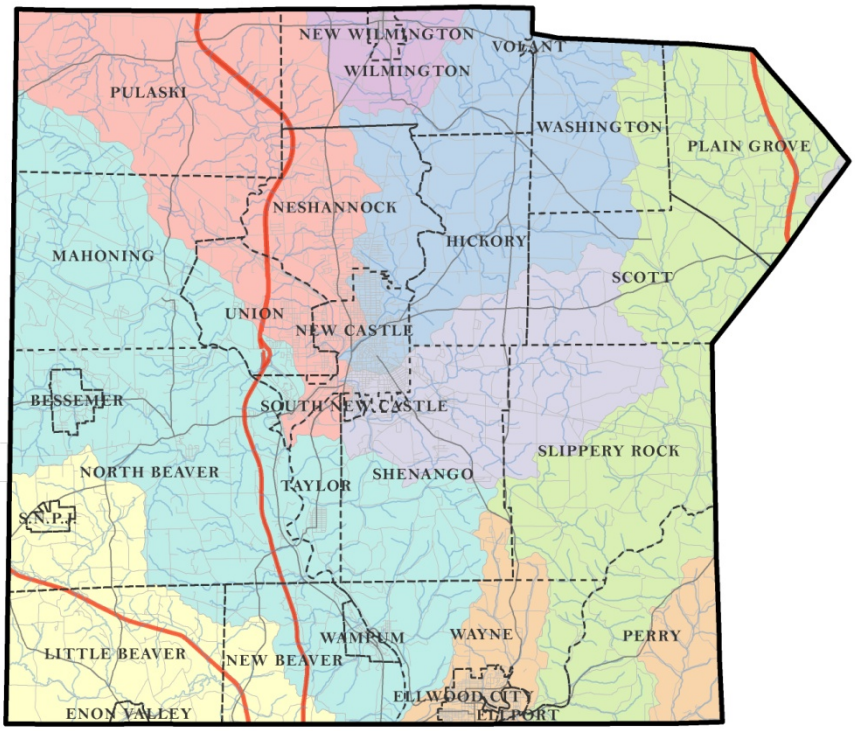
LAWRENCE COUNTY

ACT 167 PHASE 2

STORMWATER MANAGEMENT PLAN

VOLUME 1 – EXECUTIVE SUMMARY



PREPARED FOR:

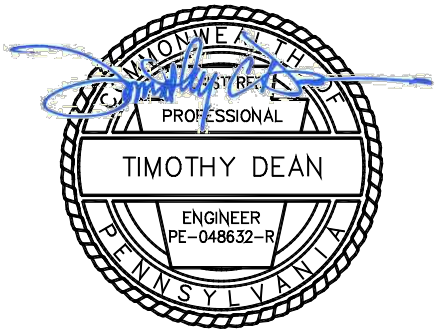
LAWRENCE COUNTY
430 Court Street
New Castle, PA 16101

PREPARED BY:

LAWRENCE COUNTY
PLANNING DEPARTMENT
430 Court Street
New Castle, PA 16101

CONSULTANT:

L.R. KIMBALL
415 Moon Clinton Road
Coraopolis, PA 15108



L.R.Kimball
ARCHITECTURE · ENGINEERING · COMMUNICATIONS TECHNOLOGY

LAWRENCE COUNTY WATERSHED PLANNING ADVISORY COMMITTEE (WPAC)

WPAC Member	Organization
Amy McKinney	Lawrence County Planning Department
Jay Russell & Megan Gahring	Lawrence County Conservation District
	Cities
Tamara Gibson	New Castle
	Boroughs
Head of Governing Body	Bessemer
Head of Governing Body	Ellport
Rohanda Zellhart	Ellwood City
Tyrone Petrich & Duane Clawson	Enon Valley
David Hairhoger	New Beaver
Fred Garret	New Wilmington
Head of Governing Body	S.N.P.J.
Head of Governing Body	South New Castle
Head of Governing Body	Volant
Head of Governing Body	Wampum
	Townships
Head of Governing Body	Hickory
Head of Governing Body	Little Beaver
Head of Governing Body	Mahoning
Head of Governing Body	Neshannock
James Gagliano, Jr.	North Beaver
Head of Governing Body	Perry
Head of Governing Body	Plain Grove
Head of Governing Body	Pulaski
Head of Governing Body	Scott
Head of Governing Body	Shenango
Head of Governing Body	Slippery Rock
Head of Governing Body	Taylor
Head of Governing Body	Union
Head of Governing Body	Washington
Dennis Hall	Wayne
Dale Elder	Wilmington

CONTENTS

SECTION I INTRODUCTION 1
SECTION II WATERSHED DESCRIPTIONS 2
SECTION III METHODOLOGY 4
SECTION IV EXEMPTIONS 6
SECTION V NPDES REGULATIONS 10
SECTION VI IMPLEMENTATION 11

PLAN FORMAT

The format of the Lawrence County Stormwater Management Plan consists of three Volumes:

Volume 1 - Executive Summary

Provides an overview of Act 167 and a summary of the standards and criteria developed for the Plan.

Volume 2 – Plan Content

Provides an overview of stormwater management, purpose of the study, data collection, all GIS maps, present conditions, projected land development patterns, calculation methodology, the Model Ordinance and implementation discussion.

Volume 3 – Appendices

Provides supporting data, watershed modeling parameters and modeling runs, peak flows, release rates, the existing municipal ordinance matrix, and obstructions inventory. Due to large volumes of data, one copy of Volume 3 will be on file at the Lawrence County Department of Planning.

SECTION I INTRODUCTION

The Lawrence County Stormwater Management Plan and Model Ordinance have been developed in accordance with the requirements of Pennsylvania Stormwater Management Act 167 of 1978. According to Act 167, each county must prepare a stormwater management Plan for each of its designated watersheds in consultation with the municipalities located within the boundaries of the watershed.

Act 167 also requires municipalities to enact or amend and implement ordinances and regulations, including zoning, subdivision and land development, building code, and erosion and sedimentation ordinances as are necessary to regulate land development in a manner consistent with the Stormwater Management Plan and the provisions of the Act. The Stormwater Management Plan includes a model ordinance that meets the applicable requirements.

SECTION II WATERSHED DESCRIPTIONS

The watershed drainage system in Lawrence County consists of three (3) primary watershed groups:

1. Slippery Rock Creek / Connoquenessing Creek

   Connoquenessing Creek, a warm-water stream, begins in northern Butler County and drains 838 square miles. The creek flows through only a small section of Lawrence County, but picks up a major tributary, Slippery Rock Creek in the process. Connoquenessing Creek is considered the second most polluted waterway in the United States, primarily due to the pollution from AK Steel. Other pollution comes from more typical sources such as agricultural runoff, sewage and siltation.

   Slippery Rock Creek starts in Butler County, drains 836 square miles and flows for forty-seven miles to Connoquenessing Creek. It is classed as a warm-water fishery. Tributaries to the creek include Wolf Creek, Muddy Creek, Skunk Run, Grindstone Run, Hell Run and Taylor Run.

   Hell Run is the only exceptional value (EV) stream in the county. It begins in Shenango Township, drains 6 square miles with a main branch length of 4.7 miles.

   The upper sections of Slippery Rock Creek are affected by acid mine drainage, but current efforts by the Slippery Rock Watershed Coalition are underway to remediate the AMD. This is helping to improve the water quality in Lawrence County. Other problems include non-point siltation and light bank erosion.

2. Shenango/Mahoning/Beaver River Watersheds

   The Mahoning River, also classified as a warm water stream, begins about 10 miles southeast of Alliance, Ohio, and flows through Pennsylvania for about 11 miles. The Mahoning River has been described as "one of the most polluted of any stream or river in Ohio" (OH EPA 1994), with the most polluted stretch located just downstream of Youngstown, Ohio. Dilution of the water makes the Pennsylvania section a little less polluted, but the sediment remains more contaminated than that found in Presque Isle Bay of Lake Erie. The Mahoning River's effects spread downstream into the Beaver River (see Beaver River description).

   Major tributaries to the Mahoning River in Lawrence County include Coffee Run flowing from the north and Hickory Run, which joins the Mahoning River near the confluence of the Mahoning River and the Shenango River.

   The Shenango River has its origin in Conneaut Township of Crawford County and flows more than 87 miles to its confluence with the Mahoning River to form the Beaver River. The drainage area is 1,062 square miles, of which 283 square miles are in Ohio (180,916 acres) and 779 square miles are in Pennsylvania (498,000 acres). The lower section from Shenango Lake to the Mahoning River confluence is considered the worse section. This section, in addition to receiving the pollutants from further upstream has effluents from industry, wastewater treatment plants and urban development.

   Major tributaries of the Shenango River in Lawrence County include Neshannock Creek, Hottenbaugh Run, Big Run and Deer Creek.

3. North Fork Little Beaver Creek

   North Fork Little Beaver Creek originates just north of New Springfield, Ohio, approximately 4.6 miles west of the Ohio-Pennsylvania border. Classed as a High quality-coldwater fishery, Little Beaver Creek flows for 30.6 miles to the Ohio River. This stream has numerous strip mines surrounding it in the upper reaches, and most of the mine drainage into the stream is alkaline. This AMD combined with the farm runoff

contributes to water that has a high hardness and conductivity. Some industrial and municipal sewage discharges also affect water quality.

Honey Creek, the only major tributary to North Fork Little Beaver Creek in Lawrence County, joins upstream of Enon Valley Borough.

Lawrence County has nine watersheds designated by the DEP under the Act 167 Program. These designated watersheds are shown in Figure II-1.

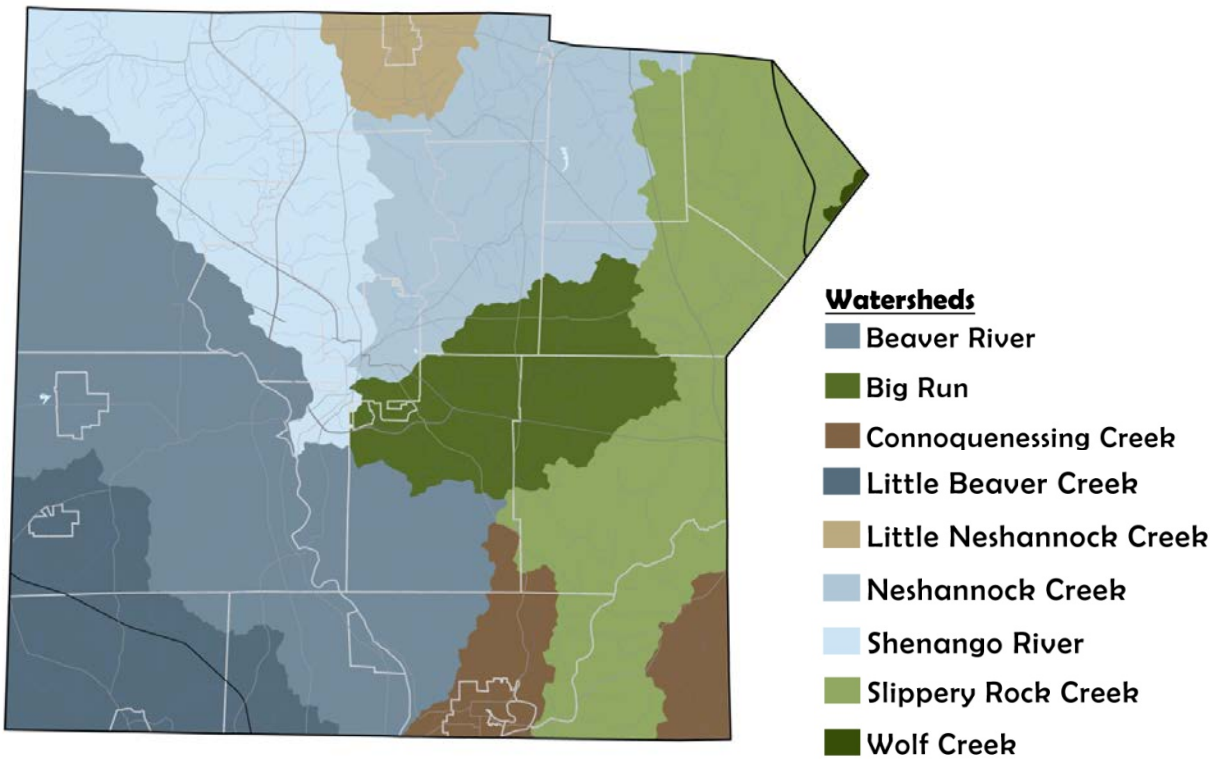


Figure II-1

SECTION III METHODOLOGY

The engineer for this planning project is L.R. Kimball. The Plan was developed from data collected on the physical features of the watershed, such as soils, wetlands, topography, floodplains, dams and reservoirs, stream dimensions, and obstructions. Information on existing problem areas was solicited from the Watershed Planning Advisory Committee (WPAC), which consisted of representatives from the twenty-seven (27) county municipalities as well as other interested parties including the County Conservation District and others. Although the Plan cannot solve all existing problems, knowing where and why these problems exist aided L.R. Kimball in developing the sub-watersheds, identifying points of interests, and understanding the hydrology of the County's watersheds as a whole. Information on existing land use and zoning was also collected. This information helped L.R. Kimball determine where and to what extent future development would take place. All of this data was compiled into a geographic information system (GIS) geodatabase.

The hydrologic model chosen for use on this plan was the U. S. Army Corps of Engineers (USACE), Hydrologic Engineering Center, Hydrologic Modeling System (HEC-HMS). The standalone HEC-HMS program was supplemented with the use of the USACE GeoHMS software package in order to take better advantage of the growing amount of countywide Geographic Information System (GIS) data available. The selection of the HEC-HMS and GeoHMS modeling software was based upon the following[1]:

- It is accepted by the Pennsylvania Department of Environmental Protection
- Provides the ability for combination modeling of the hydrology of natural watersheds as well as developed urban areas
- Provides the ability to represent engineered structures (e.g. pumps, diversions, reservoirs, etc.)
- The software places an equal value on both natural and urban watersheds (one of few software packages available that can model hydrology in watersheds with a mixture of conditions)
- The finalized model can easily be adapted for use in additional applications such as: estimating flood damage reduction, consideration of environmental restoration, future flexibility, and the ability to apply new methods that represent infiltration, new reservoir outlets, and several other components of the hydrologic cycle
- The use of the software allows for integration with other Federal, local, and private entities that are using compatible models produced from USACE software packages

While other commercially and freely developed software packages are available and possess the ability to provide similar results, HEC-HMS was chosen for the reasons outlined above as well HMS's ability to calculate flows for specific sub-watersheds along the stream/river route and then compare these flows with the overall watershed flows.

HEC-HMS has the ability to calculate runoff amounts for each specified storm or return period based on several physical, geological, and meteorological characteristics of the watershed. This flow is then generated and routed through the watershed system based on the stream's hydraulic parameters. This is one of the benefits of using the GeoHMS package in conjunction with HEC-HMS. The watershed's characteristics (listed above) are often available in GIS datasets from the County or other acceptable location. This greatly aids in streamlining the modeling process,

[1] The list is partially adapted from reference material published by the United States Army Corp of Engineers

increases the modeler's efficiency in producing the results, and helps to diminish the potential for "human error" by reducing the number of calculations that the modeler has to perform without the benefit of the software.

In essence, the amount of flow generated from any watershed is a result of the following contributing factors:

- Basin Slope
- Hydraulic Flow Parameters of Related Streams/Rivers
- Soil Type/Hydrologic Soil Conditions (used for determination of the Soil Conservation Service (SCS) soil curve number)
- Land Use within the Basin (e.g. wooded cover, grassy areas, urbanized areas, open fields, etc.)

Composite SCS curve numbers (CN) are then generated by the software using the available soils and land use information. This information, along with flow travel times, basin slopes, and available rainfall data, are the basis for the resulting watershed and sub-watershed model results.

Due to budgetary and schedule limitations, only two of the watersheds originally identified in the Phase 1 Scope of Study were modeled in Phase 2. The two watersheds modeled in this planning cycle are:

- Marshall Run
- Coffee Run

These two watersheds are located in the northwestern corner of the County and are both tributary to the Mahoning River. Both of these watersheds are located in portions of Pulaski and Mahoning Township. They flow from north to south, with their headwaters originating in Pulaski Township.

SECTION IV EXEMPTIONS

The following exemptions shall be observed for regulated activities within the jurisdiction of the Plan.

Table IV-1

0 SF ≤ new impervious area <1000 SF	**Required:** Exempt from additional requirements
1000 SF ≤ new impervious area < 2500 SF	**Required:** Small Project SWM Application[2] (See Appendix F)
2500 SF ≤ new impervious area < 5000 SF	**Required:** Volume Control (Section 304) and Small Project SWM Application (See Appendix F)
5000 SF ≤ new impervious area	**Required:** Peak Rate Control (Section 305), Volume Control (Section 304), and Stormwater Management Site Plan

All Regulated Activities must comply with the State Water Quality Requirements.

A. New Single Family Residential activities on a single lot are exempt from the requirements of Section 304 - Volume Control, Section 305 - Peak Rate Control, and from the submission of a Small Project SWM Application provided the construction:

   1. Complies with Sections 302.A, 302.B, 302.C, and
   2. Has building setbacks of at least 75 feet from downslope property lines, and
   3. Driveways:
      a. Runoff must discharge onto pervious surface with a gravel strip or other spreading device.
      b. No more than 1,000 square feet of paved surface may discharge to any one point.
      c. For each discharge point, the flow length on the pervious surface must exceed the flow length on the paved surface flow."

B. The Municipality may accept alternative stormwater management controls under this section provided that:

[2] The municipality can require the applicant to provide supplemental and additional information beyond the Small Project SWM Application if there is a threat to property, health or safety

1. The alternative controls are documented to be acceptable to PADEP (or Delegated Authority), for NPDES requirements pertaining to post construction stormwater management requirements.
2. The alternative controls comply with all other sections of this ordinance, including but not limited to Sections 301.C and 302.A-C.

C. Agricultural activities are exempt from the rate and SWM Site Plan preparation requirements of this ordinance provided the activities are performed according to the requirements of 25 Pa.Code Chapter 102.

D. Forest management and timber operations are exempt from the rate and volume control and SWM Site Plan preparation requirements of this ordinance provided the activities are performed according to the requirements of 25 Pa.Code Chapter 102. Refer to Section 309 for additional information and guidance concerning timber operations.

E. Exemptions from any provisions of this Ordinance shall not relieve the Applicant from the requirements in Sections 301.D, F, G, H, I, J and K.

F. Proposed Municipal projects are bound to the following requirements and criteria:

Table IV-2

Type of Project		Description:	Requirements:
Roadway Restoration	Alignments*	Change the roadway by either reducing or eliminating horizontal and vertical curves, or changing the roadway's superelevation.	Required: BMP implementation that uses non-structural and restoration practices such as: • Street sweeping • Impervious disconnection • Slope roughening • Pavement width reduction • Riparian buffers • Vegetative Restoration (including road-side swales)
	Pull-Offs*	New, as part of a larger project or by itself.	
	Widening*	Increase the width of the existing travel lanes (no new lanes added) and shoulders, or extension of acceleration/deceleration ramps in existing shoulder areas.	
	Intersection*	Nominal channelization of intersections and addition of turning lanes.	Required: Minor practices and BMP implementation that uses low-impact practices such as: • Preservation of existing vegetation • Minimization of soil compaction • Maintenance of Erosion
	Pavement	Replace portions, overlay, or mill and resurface the roadway's surface.	
	Shoulders	Resurface, stabilize, upgrade (dirt or gravel to paved), or widen the existing shoulders within the existing footprint.	

Table IV-2

Type of Project		Description:	Requirements:
	Other	Replace and/or repair guide rail, signs, traffic signals, and drainage systems to their original specifications; various minor safety improvements.	Control and any PCSM BMPs • Restoration and stabilization of staging areas
New Construction	Major Widening*	Addition of one or more travel lanes, including acceleration and deceleration lanes, to an existing road.	Required: Peak Rate Control (Section 305), Volume Control (Section 304), and Stormwater Management Site Plan
	New Alignment*	New roadway corridor.	
	Interchange*	Reconfiguration of ramps, lane modification within interchange area, etc.	
	Municipal Facilities	New stockpile sites, buildings, or other structures or facilities not otherwise addressed by the requirements of this section	

* - Projects falling into the noted categories and that have the potential to discharge into surface waters that have existing or designated HQ or EV uses (including EV wetlands), have impairments due to stormwater, are connected to combined sewer systems, or have the potential to have an adverse effect on threatened or endangered species, or critical habitat for such species, are subject to additional stormwater management requirements, beyond the requirements listed in the table. The additional BMP measures that must be considered and implemented for projects occurring in these areas are as follows:

Table IV-3	
Constructed wetlands / Wet ponds	Significant detention of peak flow rates is needed and the contributing drainage area is large; retrofit existing detention basins are feasible.
Permeable pavement	Parking lots only.
Manufactured products: Subsurface storage, water quality inlets, etc.	Subsurface storage products are designed to attenuate peak runoff events through infiltration and/or discharge rate reduction. Storm sewer inlet structures or inserts are designed to minimize the discharge of solids, floatables, and oil/grease pollutants. Regular maintenance of these products is necessary.

Projects occurring in the areas listed above and not previously bound to such requirements (roadway restoration projects), are also required to achieve the following targeted outcomes:

1. For project areas within a release rate district, reduce the post-construction runoff peak rate as required by the release rate district in this Ordinance. For project areas not within a release rate district, reduce the post-construction runoff peak rate to the pre-construction peak rate for the 1-year through 100-year storm events.
2. Reduce the post-construction runoff volume to the pre-construction runoff volume for the 2-year 24-hour storm event and smaller.

SECTION V NPDES REGULATIONS

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

Ellwood City and Ellport Borough, and portions of Wayne and Perry Townships are included in the Pittsburgh Urbanized Area (UA) as designated by the U.S. Census 2000. Wayne and Perry Townships were granted waivers from the MS4 permitting requirements in 2003. Each municipality owning or operating a system of stormwater conveyance (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) within the designated UA is required to comply with the National Pollutant Discharge Elimination System (NPDES) Phase II requirements for operators of municipal separate storm sewer systems (MS4s), as specified by the U.S. Environmental Protection Agency (EPA). The City of New Castle is also classified as an MS-4 community.

NPDES Phase II requires owners of these MS4s to develop, implement, and enforce a stormwater management program designed to reduce the discharge of pollutants from their MS4s to the "maximum extent possible" to protect water quality. Each stormwater management program must address the following six minimum control measures (MCMs):

1. Public Education and Outreach
2. Public Participation / Involvement
3. Illicit Discharge Detection and Elimination (IDD&E)
4. Construction Site Runoff Control
5. Post-Construction Runoff Control
6. Pollution Prevention / Good Housekeeping

SECTION VI IMPLEMENTATION

All County municipalities are encouraged to enact and implement the model ordinance in the Plan to meet the requirements of Section 11 in Act 167.

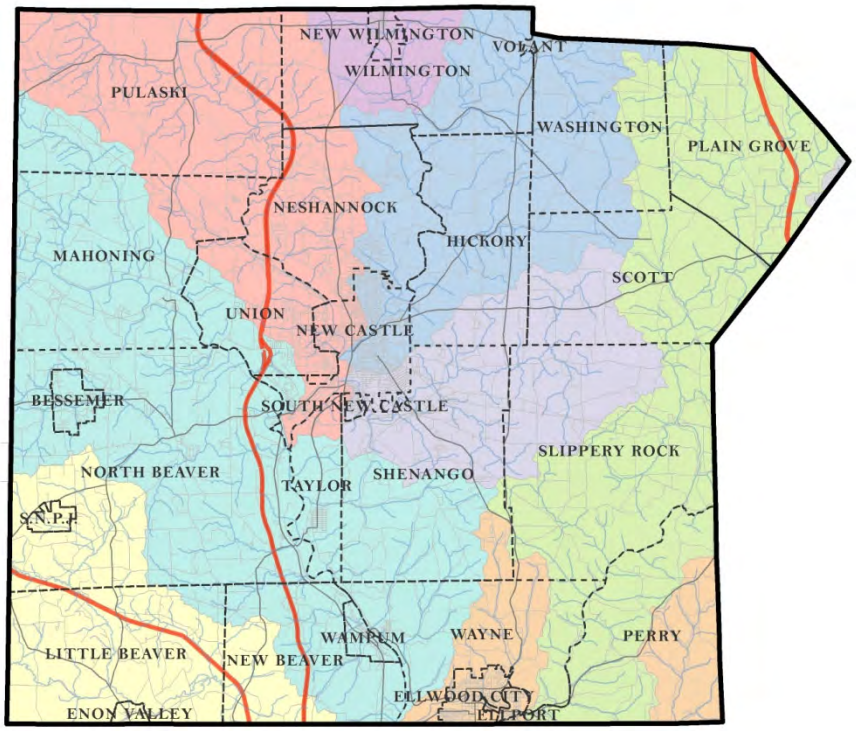
County adoption of the Plan is expected to occur in June 2010. Once this occurs, the Plan will be sent to DEP to be approved. All twenty-seven (27) of the municipalities within Lawrence County will be required to adopt the model ordinance provisions within six (6) months of DEP approval.

LAWRENCE COUNTY

ACT 167 PHASE 2

STORMWATER MANAGEMENT PLAN

VOLUME 2 – PLAN CONTENT



PREPARED FOR:

LAWRENCE COUNTY
430 Court Street
New Castle, PA 16101

PREPARED BY:

LAWRENCE COUNTY
PLANNING DEPARTMENT
430 Court Street
New Castle, PA 16101

CONSULTANT:

L.R. KIMBALL
415 Moon Clinton Road
Coraopolis, PA 15108

L.R.Kimball℠
ARCHITECTURE • ENGINEERING • COMMUNICATIONS/TECHNOLOGY

LAWRENCE COUNTY WATERSHED PLANNING ADVISORY COMMITTEE (WPAC)

WPAC Member	Organization
Amy McKinney	Lawrence County Planning Department
Jay Russell & Megan Gahring	Lawrence County Conservation District
	Cities
Tamara Gibson	New Castle
	Boroughs
Head of Governing Body	Bessemer
Head of Governing Body	Ellport
Rohanda Zellhart	Ellwood City
Tyrone Petrich & Duane Clawson	Enon Valley
David Hairhoger	New Beaver
Fred Garret	New Wilmington
Head of Governing Body	S.N.P.J.
Head of Governing Body	South New Castle
Head of Governing Body	Volant
Head of Governing Body	Wampum
	Townships
Head of Governing Body	Hickory
Head of Governing Body	Little Beaver
Head of Governing Body	Mahoning
Head of Governing Body	Neshannock
James Gagliano, Jr.	North Beaver
Head of Governing Body	Perry
Head of Governing Body	Plain Grove
Head of Governing Body	Pulaski
Head of Governing Body	Scott
Head of Governing Body	Shenango
Head of Governing Body	Slippery Rock
Head of Governing Body	Taylor
Head of Governing Body	Union
Head of Governing Body	Washington
Dennis Hall	Wayne
Dale Elcer	Wilmington

RESOLUTION

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

WHEREAS, the Lawrence County Commissioners entered into a reimbursement agreement with the Pennsylvania Department of Environmental Protection to develop a county-wide watershed Stormwater Management Plan; and

WHEREAS, the purpose of the Stormwater Management Plan is to protect public health and safety and to prevent or mitigate the adverse impacts related to the conveyance of excessive rates and volumes of stormwater runoff by providing for the management of stormwater runoff and control of erosion and sedimentation; and

WHEREAS, design criteria and standards of stormwater management systems and facilities within the County shall use the criteria and standards as found in the Stormwater Management Plan;

NOW, THEREFORE, BE IT RESOLVED that the Lawrence County Commissioners hereby adopt the Stormwater Management Plan, including all volumes, figures, appendices, and Model Ordinance, and forward the Plan to the Stormwater Management Section of the Pennsylvania Department of Environmental Protection for approval.

This Resolution is hereby adopted this _____day of _____, 2010 by:

LAWRENCE COUNTY COMMISSIONERS

Steven Craig, Chairman

Richard DeBlasio

Daniel Vogler

CONTENTS

SECTION I INTRODUCTION 1

A. Introduction 1

B. Stormwater Management 4

C. Stormwater Management Plan Objectives 4

D. Stormwater Management Plan Strategy 7

SECTION II ACT 167 9

A. Stormwater Management Act 167 9

B. Purpose of the Study 9

SECTION III GENERAL DESCRIPTION OF WATERSHEDS 10

A. General County Description 10

B. Political Jurisdictions 10

C. NPDES Phase II Involvement 12

D. Data Collection 12

E. General Development Patterns 14

F. Physiography and Geology 14

G. Climate 15

H. Soils 15

I. Water Resources 17

J. PA Chapter 93 Stream Classifications 22

K. Obstructions 22

L. Dams and Impoundments 23

M. Pollution and Stream Impairments 24

N. Stormwater Problem Areas 27

O. Land Use 33

P. Existing Development in the Flood Hazard Areas 34

SECTION IV WATERSHED TECHNICAL ANALYSIS 38

1. Watershed Modeling 38

2. Modeling Process 40

3. Calibration 41
SECTION V STANDARDS AND CRITERIA FOR STORMWATER CONTROL 48
A. Watershed Level Control Philosophy 48
B. National Pollutant Discharge Elimination System (NPDES), Phase II Requirement 48
C. Standards and Criteria 50
D. Release Rate Stormwater Management District Concept (For Overbank and Extreme Events) 69
E. Structural and Non-Structural BMPs 73
SECTION VI MUNICIPAL ORDINANCE INTRODUCTION 77
A. Supporting Information 77
B. Required Ordinance Contents 78
SECTION VII PRIORITIES FOR IMPLEMENTATION 81
A. DEP Approval of the Plan 81
B. Publishing the Final Plan 81
C. Municipal Adoption of Ordinance to Implement the Plan 81
D. Level of Government Involvement in Stormwater Management 82
E. Correction of Existing Drainage Problems 82
F. Culvert Replacement 83
G. PennVEST Funding 84
H. Landowner's/Developer's Responsibilities 85

PLAN FORMAT

The format of the Lawrence County Stormwater Management Plan consists of three Volumes:

Volume 1 - Executive Summary

Provides an overview of Act 167 and a summary of the standards and criteria developed for the plan.

Volume 2 – Plan Content

Provides an overview of stormwater management, purpose of the study, data collection, all GIS maps, present conditions, projected land development patterns, calculation methodology, the Model Ordinance and implementation discussion.

Volume 3 – Appendices

Provides supporting data, watershed modeling parameters and modeling runs, peak flows, release rates, the existing municipal ordinance matrix, and obstructions inventory. Due to large volumes of data, one copy of Volume III will be on file at the Lawrence County Department of Planning.

SECTION I INTRODUCTION

A. Introduction

The purpose of this Act 167 Stormwater Management Plan is to:

1. Encourage planning and management of storm water runoff in each watershed which is consistent with sound water and land use practices.

2. Authorize a comprehensive program of storm water management designated to preserve and restore the flood carrying capacity of Commonwealth streams; to preserve to the maximum extent practicable natural storm water runoff regimes and natural course, current and cross-section of water of the Commonwealth; and to protect and conserve ground waters and ground-water recharge areas.

3. Encourage local administration and management of storm water consistent with the Commonwealth's duty as trustee of natural resources and the people's constitutional right to the preservation of natural, economic, scenic, aesthetic, recreational and historic values of the environment.

This Countywide Plan has been prepared for Lawrence County and applies to all areas located within the boundaries of Lawrence County, as well as all designated watersheds within the County. This Plan will assist in achieving the effective and efficient stormwater management of all major watersheds within Lawrence County and provide a single technical source for stormwater management across Lawrence County.

The need for this Act 167 plan is to assist in the achievement of Lawrence County's goal to create an overall stormwater management plan document, as well as to achieve compliance with the Pennsylvania Stormwater Management Act of 1978 (Act 167). Specific County goals are identified in Section I.C below. One of the primary objectives of Lawrence County's Act 167 planning process is to provide a countywide comprehensive program to assist in the planning and management of stormwater. With coordination from the twenty- seven (27) municipalities in Lawrence County, the resulting stormwater management ordinance will address severe and ongoing stormwater related problems in critical areas throughout the County. In accordance with Section 11.(b) of the Pennsylvania Stormwater management Act of 1978 the following is required:

> *"Within six months following adoption and approval of the watershed storm water plan, each municipality shall adopt or amend, and shall implement such ordinances and regulations, including zoning, subdivision and 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 watershed drainage system in Lawrence County consists of three (3) primary watershed groups:

1. Slippery Rock Creek / Connoquenessing Creek

   Connoquenessing Creek, a cold water fishery (with a very minor portion designated as a warm water stream), begins in northern Butler County and drains 838 square miles. The creek flows through only a small section of Lawrence County, but picks up a major tributary, Slippery Rock Creek in the process. Connoquenessing Creek is considered the second most polluted waterway in the United States, primarily due to the pollution from AK Steel. Other pollution comes from more typical sources such as agricultural runoff, sewage and siltation.

   Slippery Rock Creek starts in Butler County, drains 836 square miles and flows for forty-seven miles to Connoquenessing Creek. It is classed as a cold water fishery. Tributaries to the creek include Wolf Creek, Muddy Creek, Skunk Run, Grindstone Run, Hell Run and Taylor Run.

Hell Run is the only exceptional value (EV) stream in the county. It begins in Shenango Township, drains 6 square miles with a main branch length of 4.7 miles.

The upper sections of Slippery Rock Creek are affected by acid mine drainage, but current efforts by the Slippery Rock Watershed Coalition are underway to remediate the AMD. This is helping to improve the water quality in Lawrence County. Other problems include non-point siltation and light bank erosion.

2. Shenango/Mahoning/Beaver River Watersheds

The Mahoning River, also classified as a warm water stream, begins about 10 miles southeast of Alliance, Ohio, and flows through Pennsylvania for about 11 miles. The Mahoning River has been described as "one of the most polluted of any stream or river in Ohio" (OH EPA 1994), with the most polluted stretch located just downstream of Youngstown, Ohio. Dilution of the water makes the Pennsylvania section a little less polluted, but the sediment remains more contaminated than that found in Presque Isle Bay of Lake Erie. The Mahoning River's effects spread downstream into the Beaver River (see Beaver River description).

Major tributaries to the Mahoning River in Lawrence County include Coffee Run flowing from the north and Hickory Run, which joins the Mahoning River near the confluence of the Mahoning River and the Shenango River.

The Shenango River has its origin in Conneaut Township of Crawford County and flows more than 87 miles to its confluence with the Mahoning River to form the Beaver River. The drainage area is 1,062 square miles, of which 283 square miles are in Ohio (180,916 acres) and 779 square miles are in Pennsylvania (498,000 acres). The lower section from Shenango Lake to the Mahoning River confluence is considered the worse section. This section, in addition to receiving the pollutants from further upstream has effluents from industry, wastewater treatment plants and urban development.

Major tributaries of the Shenango River in Lawrence County include Neshannock Creek, Hottenbaugh Run, Big Run and Deer Creek.

3. North Fork Little Beaver Creek

North Fork Little Beaver Creek originates just north of New Springfield, Ohio, approximately 4.6 miles west of the Ohio-Pennsylvania border. Classed as a High quality-coldwater fishery, Little Beaver Creek flows for 30.6 miles to the Ohio River. This stream has numerous strip mines surrounding it in the upper reaches, and most of the mine drainage into the stream is alkaline. This AMD combined with the farm runoff contributes to water that has a high hardness and conductivity. Some industrial and municipal sewage discharges also affect water quality.

Honey Creek, the only major tributary to North Fork Little Beaver Creek in Lawrence County, joins upstream of Enon Valley Borough.

Figure I-1 below shows the seven watersheds designated under the Act 167 Program, as well as two additional watersheds of concern in Lawrence County.

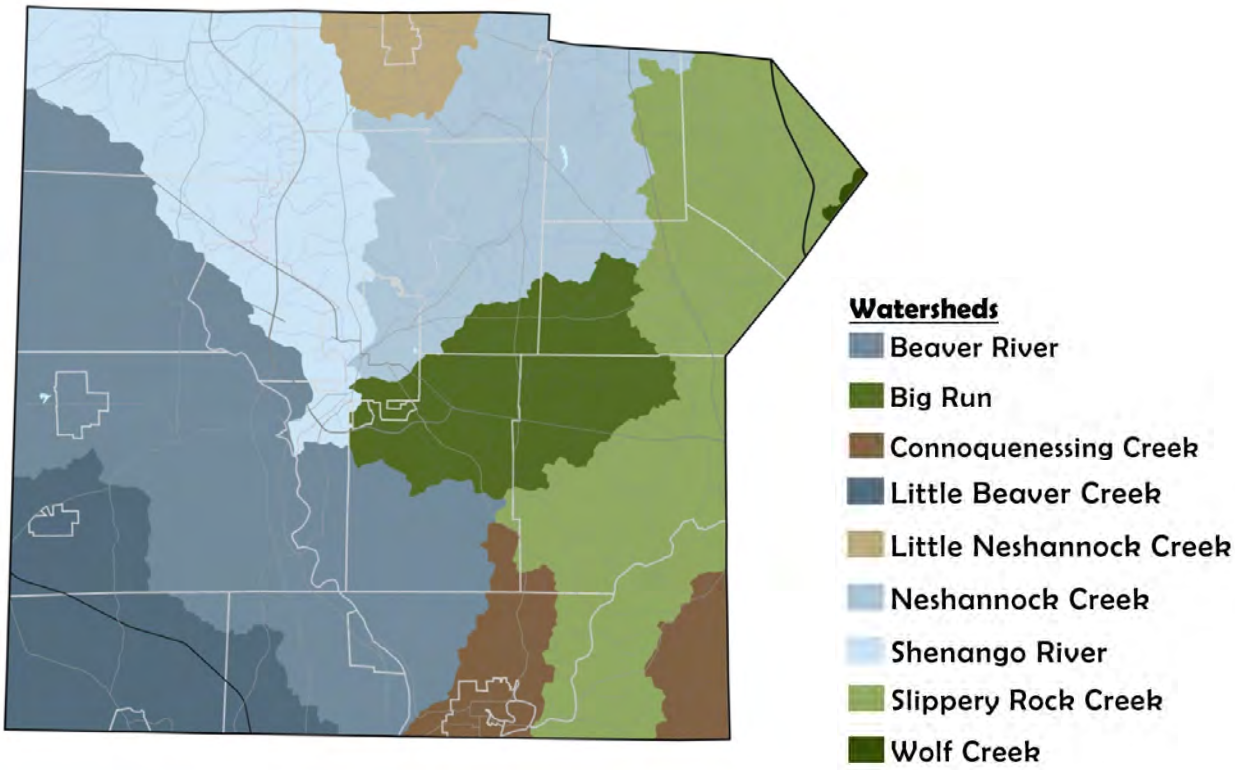


Figure I-1

As a requirement of the development of this plan, a model ordinance has been developed and is included in the Appendix section of this plan. Lawrence County and PADEP will then review and approve the final Plan document within the necessary timeframe. In accordance with Section 11.(b) of the Pennsylvania Stormwater management Act of 1978 the following is required:

> *"Within six months following adoption and approval of the watershed storm water plan, each municipality shall adopt or amend, and shall implement such ordinances and regulations, including zoning, subdivision and 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 County and municipalities must periodically review and revise the Plan at least every five years. PADEP may, for good cause shown, grant an extension of time to the County for the preparation and adoption of a watershed storm water management plan.

B. Stormwater Management

The water that runs off the land into surface waters of the Commonwealth during and immediately following a rainfall or snow/ice melt event is referred to as stormwater. In a watershed undergoing land use conversion or urban expansion, the volume of stormwater resulting from a particular rainfall event increases because of the reduction in pervious land area (i.e., natural land cover being changed to pavement, concrete, buildings, or unmanaged cropland). These surface changes can also substantially degrade stormwater runoff quality, increasing the pollutant load to the rivers and streams. The alteration of natural land cover and land contours to residential, commercial, industrial, and crop land uses results in decreased infiltration of rainfall, an increased rate and volume of runoff, and increased pollutant loadings to surface watercourses.

As the population of an area increases, land development is inevitable. As land disturbance and development increases, so does the problem of dealing with the increased quantity and decreased quality of stormwater runoff. Failure to properly manage this runoff results in greater flooding, stream channel erosion and siltation, degraded water quality, as well as reduced groundwater recharge. The cumulative effects of development in some areas of a watershed can result in flooding of natural watercourses with associated costly property damages. These impacts can be minimized if the land use and development incorporates appropriate runoff and stormwater management systems and designs.

Individual land disturbance/development projects have historically been viewed as independent or discrete events or impacts, rather than as part of a larger watershed process. This has also been the case when the individual land development projects are scattered throughout a watershed (and in many different municipalities). However, it is now being observed and verified that the cumulative nature of individual land surface changes dramatically affects runoff and flooding conditions. These cumulative effects of development and land disturbance in some areas have resulted in flooding of both small and large streams with associated property damages and even causing loss of life. Therefore, given the distributed and cumulative nature of the land alteration process, a comprehensive approach must be taken if a reasonable and practical management and implementation approach or strategy is to be successful.

C. Stormwater Management Plan Objectives

One of the County goals considered in the preparation of this plan is to produce a countywide model ordinance that will serve as a means of effectively implementing the results of the plan and providing measures that address technical, legal, and governmental issues, as well as achieving additional County-wide objectives noted below.

The final objectives for this plan were developed based on a review of the objectives within Section 3 of Act 167, a review of water quality impairments in the County, and a review of stormwater management problems identified by the WPAC and through the municipal survey process. Through analysis of the survey results, L.R. Kimball and County staff determined that the three primary stormwater problems within the County are stream corridor flooding, street flooding, and property flooding. No water quality issues or locations were identified by the WPAC or through the municipal survey process.

The original plan objectives included the following:

1. Encourage planning and management of storm water runoff in each watershed that is consistent with sound water and land use practices (Act 167, Section 3).
2. Establish a comprehensive program of storm water management policy to help preserve and restore stream flood carrying capacity, to help preserve as much as possible the natural storm water runoff regimes and natural course, current and cross-section of waters of the Commonwealth; and to protect and conserve ground waters and ground-water recharge areas (Act 167, Section 3).
3. Establish local administration and management of storm water (Act 167, Section 3).

4. Prepare detailed hydrologic analyses of the following watersheds in order to develop comprehensive approaches to stormwater management controls (as outlined in Table I-1)

Table I-1

Watershed	Rationale	Focus of Modeling Effort
Slippery Rock Creek	Bio-diversity Area threatened by development	Hell Run subwatershed
	Recurrent Flooding along Slippery Rock Creek identified in County Hazard Mitigation Plan	Lower Slippery Rock Creek in Perry and Wayne Townships
Connoquenessing Creek	Recurrent road flooding	Duck Creek subwatershed
	Recurrent road flooding	Squaw Creek subwatershed
	Recurrent road flooding	Connoquenessing Creek watershed in Ellwood City, Ellport, and Wayne Township
Little Beaver Creek	Recurrent urban flooding due to stream obstructions and development in floodplain.	Tributary in Enon Valley Borough
		Sugar Creek subwatershed
Beaver/Mahoning River	Recurrent stream corridor flooding, property damage	Hickory Run and Hickory Creek subwatersheds
	Recurrent stream corridor, property, and street flooding	Upper Mahoning River tributaries in Mahoning Township
	Recurrent street and property flooding	Lower Mahoning River tributaries in North Beaver Township
	Stream corridor flooding / obstruction(s)	Coffee Run subwatershed
	Recurrent street and property flooding, stream corridor flooding / obstruction(s)	Upper Beaver River/Jenkins Run/Edwards Run subwatersheds
	Obstructions, recurrent flooding due to increase in runoff	Unnamed tributary to Beaver River (Vinegar Valley) subwatershed in Wayne Township
	Recurrent street flooding in New Beaver Borough	Upper Eckles Run subwatershed
	Recurrent street and stream corridor flooding	Unnamed tributary to Beaver River (Possum Hollow) in New Beaver Borough

Shenango River	Growth areas, recurrent property flooding, water obstructions, urbanized areas	Select Tributaries
Big Run	Growth area, recurrent property flooding	Entire Watershed
Neshannock Creek	Growth area, urbanized areas, recurrent flooding and obstruction problems	Entire Watershed
Little Neshannock Creek	Recurrent flooding and obstruction problems in Wilmington Township	Entire Watershed

These original plan objectives were determined using the process summarized in Figure I-2.

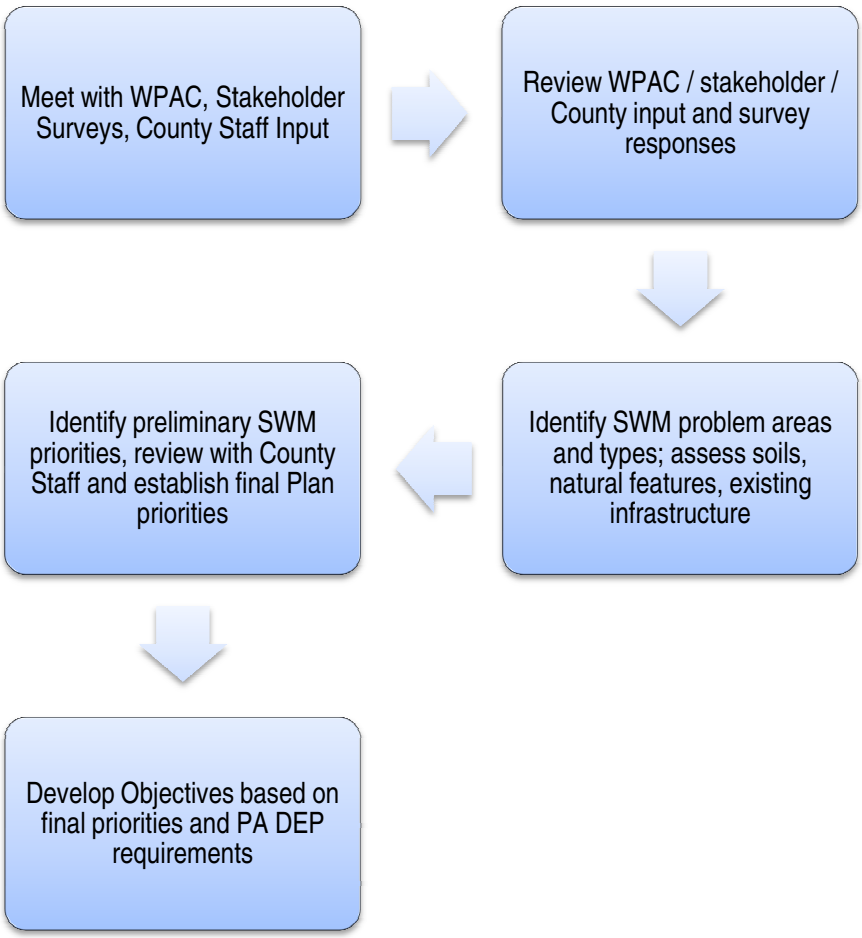


Figure I-2 Original Plan Objectives Setting Process

The final plan objectives for the current planning cycle take into account the Act 167 Program budget cuts and consequent cuts in funding for the Lawrence County Plan. These final objectives are based on the reduced funds available as well as the accelerated plan completion deadline. These changes forced a re-evaluation of the objectives for the current planning cycle, and the final plan objectives include the following:

1. Encourage planning and management of storm water runoff in each watershed that is consistent with sound water and land use practices (Act 167, Section 3).
2. Establish a comprehensive program of storm water management policy to help preserve and restore stream flood carrying capacity, to help preserve as much as possible the natural storm water runoff regimes and natural course, current and cross-section of waters of the Commonwealth; and to protect and conserve ground waters and ground-water recharge areas (Act 167, Section 3).
3. Establish local administration and management of storm water (Act 167, Section 3).
4. Prepare detailed hydrologic analyses of the following watersheds in order to evaluate more comprehensive approaches to stormwater management controls (as outlined in Table I-2):

Table I-2

Watershed	Rationale	Focus of Modeling Effort
Beaver/Mahoning River	Stream corridor flooding / obstruction(s), development pressure	Coffee Run subwatershed
	Development pressure	Marshall Run subwatershed

As noted above, these final plan objectives were determined by the County based on the amount of remaining funding available in the current state fiscal year for this planning project and based on the new plan approval deadline of June 30, 2010.

D. Stormwater Management Plan Strategy

Preferred Strategies:

1. Administrative / Policy
    a. Municipal adoption of the Model Ordinance language within this Plan.

       Municipalities may adopt a stand-alone ordinance, or may choose to incorporate the language within the Model Ordinance into their existing ordinances

    b. Municipal implementation and enforcement of the requirements of the Model Ordinance within this Plan. Specific implementation strategies are described in Section VII.
2. Technical (refer to technical discussion in Sections IV and V).
    a. Maintain groundwater recharge
    b. Maintain water quality
    c. Reduce channel erosion
    d. Manage overbank events

e. Manage extreme flood events

Alternative Strategies:

1. Administrative / Policy
    a. Municipal encouragement of clustered design practices to reduce overall development footprints
    b. Municipal or County support and funding of SWM BMP pilot projects for technical analysis as well as public education
    c. Public incentive programs related to Municipal-sponsored education activities
        i. Rain barrel programs
        ii. Public handbooks and technical guidance detailing residential BMP implementation
    d. The development of strategic partnerships between adjacent municipalities, key stakeholders and community interest groups.
2. Technical (refer to technical discussion in Sections IV and V).
    a. Correction of existing drainage problems – Individual problem corrections not addressed in the current plan due to additional technical analysis required. Refer to Section V for general discussion of non-achievable goals.
    b. Culvert retrofits – Individual retrofits not addressed in the current plan due to additional technical analysis required. Refer to Section V and the model ordinance for additional discussion of retrofits.
    c. Stormwater management basin retrofits - Individual retrofits not addressed in the current plan due to additional technical analysis required. Refer to Section V and the model ordinance for additional discussion of retrofits.
        i. Modification of outlet structures for additional outflow control
        ii. Combination of existing basin with new SWM BMPs
        iii. Addition of sediment forebays
        iv. Soil amendments for water quality
        v. Regrading/reshaping basin for more effective management and control of runoff
        vi. Incorporation of existing basins into surrounding landscaping to serve dual function of SWM practice and provide positive aesthetic and environmental habitat benefits
    d. Retrofit of existing landscaping and site design features - Individual retrofits not addressed in the current plan due to additional site investigation and technical analysis required. Refer to Section V and the model ordinance for additional discussion of retrofits.
        i. Modification of parking islands into bioretention areas
        ii. Replacement of impervious pavement/concrete with permeable paving and concrete
        iii. Modification of overflow parking areas into infiltration areas
        iv. Replacement of traditional tree planters to environmentally beneficial tree planter boxes in streetscape applications

SECTION II ACT 167

A. Stormwater Management Act 167

Recognizing the need to address the serious and growing problem of inadequate stormwater management, the Pennsylvania General Assembly enacted Act 167 of 1978. The statement of legislative findings at the beginning of the Pennsylvania Storm Water Management Act (Act 167) sums up the critical interrelationship among land development, accelerated runoff, and floodplain management. Specifically, this statement of legislative findings points out that:

1. Inadequate management of accelerated runoff of stormwater resulting from development throughout a watershed increases flood flows and velocity, contributes to erosion and sedimentation, overtaxes the carrying capacity of streams and storm sewers, greatly increases the cost of public facilities to carry and control stormwater, undermines floodplain management and floodplain control efforts in downstream communities, reduces groundwater recharge, and threatens public health and safety.
2. A comprehensive program of stormwater management, including reasonable regulation of development and activities causing accelerated runoff, is fundamental to the public health, safety, and welfare and the protection of the people of the Commonwealth, their resources, and their environment.

Until the enactment of Act 167, stormwater management had been oriented primarily towards addressing the increase in peak runoff rates discharging from individual land development sites to protect property immediately downstream. Management of stormwater throughout the state paid minimal attention to the effects on locations further downstream (frequently because they were located in another municipality) or to designing stormwater controls within the context of the entire watershed.

B. Purpose of the Study

Stormwater management has typically been regulated at the municipal level, with little or no design consistency (concerning the types or degree of storm runoff control to be practiced) between adjoining municipalities in the same watershed. Act 167 changed this approach by instituting a comprehensive program of watershed stormwater management planning. The Act requires Pennsylvania counties to prepare and adopt stormwater management plans for each designated watershed within the County. The County shall establish, in conjunction with each watershed storm water planning program, a watershed plan advisory committee composed of at least one representative from each municipality within the watershed, the County soil and water conservation district and such other agencies or groups as are necessary and proper to carry out the purposes of the committee. The plans are to provide uniform technical standards and criteria throughout the County's watersheds for the management of stormwater runoff, volume, and quality from new land development sites.

There also exists the opportunity for municipalities to retrofit existing sites to improve existing water quality impairments or existing sources of flooding problems. The types and degree of controls that are prescribed in the stormwater management plan must be based on the expected development pattern and hydrologic characteristics of each individual watershed. The standards and criteria contained within the plan are to be developed from the technical evaluations performed in the planning process in order to respond to the "cause and effect" nature of existing and potential storm runoff impacts in the watershed. The final product of the Act 167 watershed planning process is to be a comprehensive and practical implementation plan, developed with a firm sensitivity to the overall needs (e.g., financial, legal, political, technical, etc.) of the municipalities within Lawrence County.

SECTION III GENERAL DESCRIPTION OF WATERSHEDS

A. General County Description

Lawrence County covers 362 square miles and, according to the 2000 census, is ranked 29th out of the sixty-seven counties in Pennsylvania with a population of 94,643. The largest municipality in Lawrence County is the City of New Castle with a population of 28,334. Two townships in the New Castle vicinity follow with 8,373 people in Neshannock Township and 7,187 people in Shenango Township.

B. Political Jurisdictions

The County is comprised of twenty-seven municipalities. The political jurisdictions include sixteen townships, ten boroughs, and one city.

Table III-1

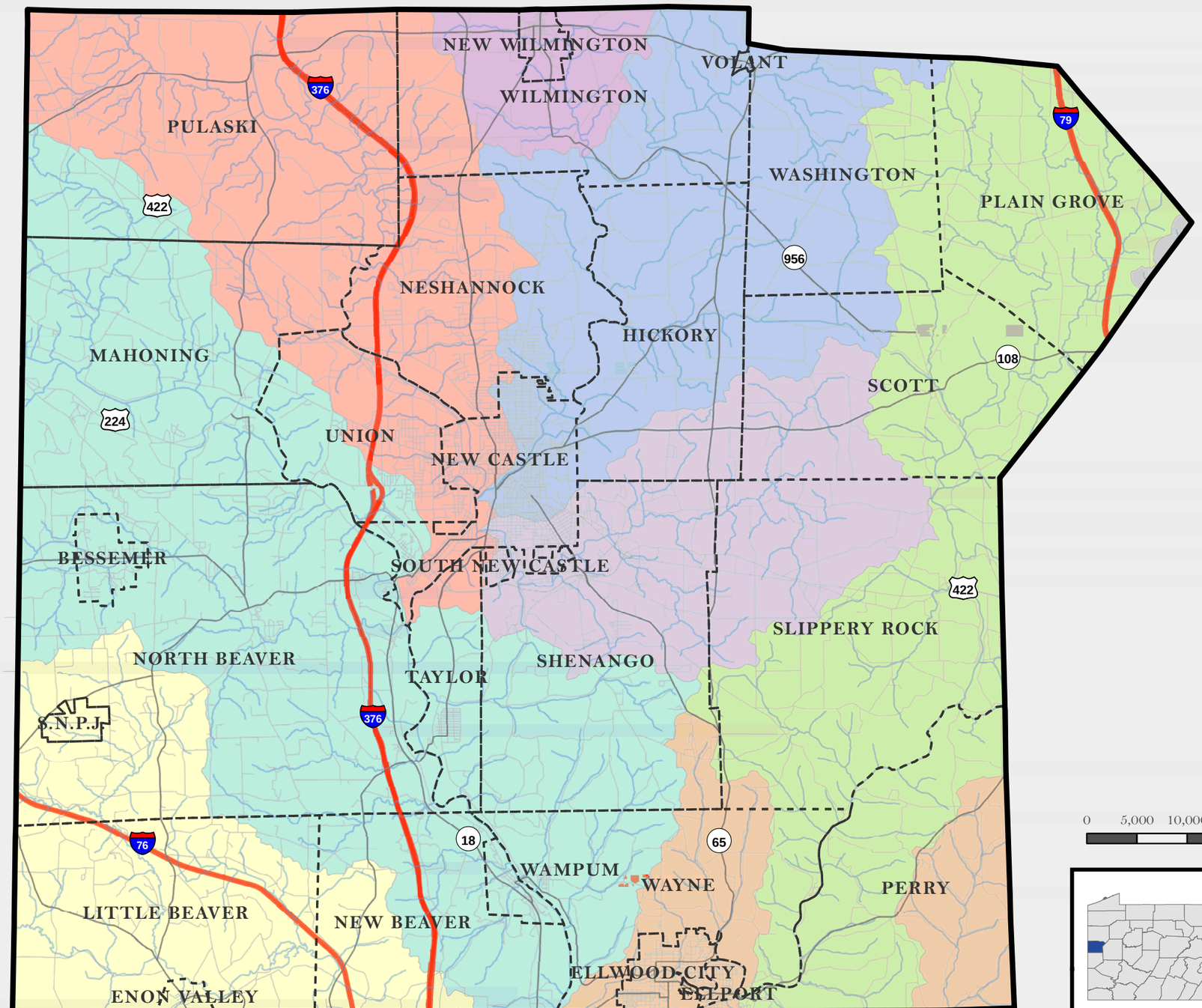
County Political Jurisdictions

Townships		Boroughs	Cities
Hickory	Taylor	Bessemer	New Castle
Little Beaver	Union	Ellport	
Mahoning	Washington	Ellwood City	
Neshannock	Wayne	Enon Valley	
North Beaver	Wilmington	New Beaver	
Perry		New Wilmington	
Plain Grove		S.N.P.J.	
Pulaski		South New Castle	
Scott		Volant	
Shenango		Wampum	
Slippery Rock			

Refer to Figure III-1 for a Base Map of Lawrence County.

Lawrence County
Stormwater Management Plan
Phase 2 Plan

FIGURE III-1
Base Map



- Lawrence County
- Municipal Boundary
- Stream

Other Features

- Interstate
- PA & US HWY
- Local Road

Watersheds

- Beaver River
- Big Run
- Connoquenessing Creek
- Little Beaver Creek
- Little Neshannock Creek
- Neshannock Creek
- Shenango River
- Slippery Rock Creek
- Wolf Creek

N W E S

0 5,000 10,000 20,000 Feet

Location of Lawrence County within the state of Pennsylvania.

DISCLAIMER

No part of this document may be reproduced, stored in a retrieval system or transmitted in any form of by any means, electronic, mechanical, photocopying, recording or otherwise, except as expressly permitted by the Lawrence County, PA.

This map was digitally compiled for internal maintenence and developmental use by Lawrence County, PA for reference purposes. Lawrence County, PA makes no claims as to the completeness, accuracy or content of any data contained hereon, and makes no representation of any kind, including, but not limited to, the warranties of merchantability or fitness for a particular use, nor are any such warranties to be implied or inferred, with respect to the information or data furnished herein.

L.R.Kimball℠
ARCHITECTURE • ENGINEERING • COMMUNICATIONS TECHNOLOGY

415 Moon Clinton Road Coraopolis, PA 15108-3886

Prepared by: GLF **Date: 04/16/2010**

Project Number: 08-1300-0135

File Location: G:\2008\Lawrence_County\ArcProjects\Phase 2_Figure III-1_BaseMap.mxd

C. NPDES Phase II Involvement

Ellwood City and Ellport Borough, and portions of Wayne and Perry Townships are included in the Pittsburgh Urbanized Area (UA) as designated by the U.S. Census 2000. Wayne and Perry Townships were granted waivers from the MS4 permitting requirements in 2003. Each municipality owning or operating a system of stormwater conveyance (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) within the designated UA is required to comply with the National Pollutant Discharge Elimination System (NPDES) Phase II requirements for operators of municipal separate storm sewer systems (MS4s), as specified by the U.S. Environmental Protection Agency (EPA). The City of New Castle is also classified as an MS-4 community.

NPDES Phase II requires owners of these MS4s to develop, implement, and enforce a stormwater management program designed to reduce the discharge of pollutants from their MS4s to the "maximum extent possible" to protect water quality. Each stormwater management program must address the following six minimum control measures (MCMs):

1. Public Education and Outreach
2. Public Participation / Involvement
3. Illicit Discharge Detection and Elimination (IDD&E)
4. Construction Site Runoff Control
5. Post-Construction Runoff Control
6. Pollution Prevention / Good Housekeeping

D. Data Collection

In order to evaluate hydrologic responses of the watersheds, data was collected on the physical features of the watersheds. Data collection varied depending on whether a hydrologic a detailed watershed model was to be developed and analyzed for a particular watershed.

1. Base Map: The base map was created using data from a variety of sources:

Data	Source
Designated watershed boundaries	PA DEP
USGS 1:24,000 Quadrangle Maps	USGS
Roads	The Pennsylvania Department of Transportation
Municipal and County Boundaries	The Pennsylvania Department of Transportation
Networked Streams	The Pennsylvania State University / Environmental Resources Research Institute

Data were reviewed against available aerial mapping and each other to check for consistency. Other various datasets were used for compilation of the GIS and stormwater models for analysis. A list of this additional information includes:

2. Topography: USGS digital raster graphic (DRG) formatted topographic maps (1:24,000, 7.5 minute quadrangles) were used to create a watershed-wide DRG. Corresponding 7.5-minute digital elevation models (DEM) were used to create a watershed-wide digital elevation model. Subwatersheds or subareas used in the watershed modeling process were derived from the watershed DEM using HEC-GeoHMS. Subareas, drainage courses, land slopes and lengths, and drainage element lengths and slopes were determined and calculated from the DEM using HEC-GeoHMS.
3. Soils: All soil data was obtained from the United States Department of Agriculture, Natural Resources Conservation Service (NRCS) in digital format. Generalized soils were obtained from the State Soil Geographic Database (STATSGO). STATSGO maps are statewide soil maps made by generalizing the detailed soil survey data. Soil mapping units with similar characteristics are grouped together. Data on hydrologic soil groups (HSG) was derived from the detailed Soil Survey Geographic Database (SSURGO) data. The spatial component of SSURGO data (the soil map) is provided as a GIS data layer. The attribute data (soil information) is provided as a relational Access database. Together the spatial data and relational database are referred to as National Soil Information System (NASIS) data. The NASIS data were processed to extract HSG classifications for the surface horizon of the soil-mapping units within the watershed.
4. Geology: The geology for the watershed was extracted from the statewide bedrock geology coverage produced by Pennsylvania Bureau of Topographic and Geologic Survey, Department of Conservation and Natural Resources (DCNR). The dataset obtained from the DCNR are not intended to be used at any scale finer than 1:250,000. The geology data are displayed for the watershed at a scale larger than 1:250,000. The geology information is provided for illustrative and general information only.
5. Land Cover: The land cover data was derived from the USGS National Land Cover Dataset. The National Land Cover Dataset (NLDC) was compiled from Landsat satellite TM imagery (circa 1992) with a spatial resolution of 30 meters and supplemented by various ancillary data (where available). The NLCD represents conditions in the early 1990s. This data is intended to provide a general overview of the watershed and to model stormwater runoff characteristics.
6. Wetlands: Wetlands were obtained from the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) in digital format and incorporated into the overall GIS. NWI maps are compiled from photo interpreted aerial photography from the National Aerial Photography Program (NAPP) 1:40,000 Scale, and the National High Altitude Photography Program (NHAP) 1:58,000 or 1:80,000 Scale. Sources dates range from the 1970's to the present. The minimum mapping unit for treeless areas is 1/4 acres, 1 to 3 acres in general. The wetlands data is provided for illustrative purposes. Other wetland areas likely exist in the watershed that is not depicted on NWI maps.
7. Development in Floodplains: 100-year floodplain data, or special flood hazard areas, for Lawrence County was derived from the September 1996 Federal Emergency Management Agency (FEMA) National Flood Insurance Program Q3 Flood Data. The existing land cover was then clipped to these areas to depict the development in floodplains.
8. Obstructions: Bridges, culverts and pipes that convey streams and tributaries under roads, railroads and other similar infrastructure are referred to as obstructions. The obstruction locations and attribute information (size and shape) were determined during field investigations of the county and from Stakeholder Survey information.
9. Problem Areas: Stormwater problems include flooding, erosion, sedimentation, landslides, groundwater impacts, pollution and other potential issues. Data on the location of these problems in the watershed were collected from surveys sent to each municipality within the watersheds and incorporated into the watershed geodatabase. The municipalities were provided a topographic map of their township or borough and a collection of forms. They identified and plotted the locations of the known problem areas on paper maps or in digital format and completed the forms that describe the problems at each location

10. Stormwater Management Facilities: Stormwater management facilities may include detention/retention basins, underground storage and constructed wetlands. These types of facilities were also identified, plotted and described on forms by the municipalities.
11. Stormwater Sewer System Outfalls: Municipalities in urban areas (as defined by the US Census Bureau) are required to map the location of storm sewer outfalls as part of the PA DEP Municipal Separate Storm Sewer System (MS4) program. Based on budget and schedule restraints, appropriate outfall location information was not provided nor collected for Lawrence County. This data should be included in the next planning cycle.

E. General Development Patterns

The top ten municipalities in terms of subdivision activity over the twenty (20) year period studied for the latest Comprehensive Plan update are as follows:

1. Neshannock Township - 313 new lots
2. Slippery Rock Township - 235 new lots
3. Shenango Township - 201 new lots
4. North Beaver Township – 171 new lots
5. Wilmington Township - 158 new lots
6. Scott Township – 136 new lots
7. Pulaski Township – 130 new lots
8. Perry Township – 98 new lots
9. Hickory Township – 97 new lots
10. Mahoning Township – 93 new lots

Primary growth areas consist of those municipalities listed above, and include a new 1200-acre industrial park being planned for Neshannock Township. Major subdivisions are occurring in Union, Shenango, and Wayne townships.

Public water and sewer improvements are underway in Pulaski Township. The new infrastructure could induce development pressure, especially since this township is about equidistant from both Sharon and New Castle.

F. Physiography and Geology

Most of Lawrence County consists of undulating and rolling uplands, many poorly drained lowlands, rounded hills, and some steep ridges near the major streams. The southeast corner of Lawrence County consists primarily of rolling and hilly uplands and many narrow, steep-sided valleys. Here, the level and undulating areas are mainly on the broad ridge tops and in river valleys.

Elevations in the county range from a high of 1,440 feet just to the west of Slippery Rock Creek in Slippery Rock Township to a low of 740 feet at Rock Point where the Beaver River flows south out of the county in Wayne Township. Variations in aspect, slope, and elevation combine to create a number of different microenvironments throughout the county. Numerous soil types influenced by weathering of underlying bedrock, slope, organic material and climate and sometimes the bedrock itself create the ecological foundation for Lawrence County.

Lawrence County is divided into two geologic provinces. The Pittsburgh glaciated plateau prominently covers about 4/5 of the county. The un-glaciated Pittsburgh Plateau covers the rest of the county in the southeast delineated roughly by Slippery Rock Creek and Connoquenessing Creek. The underlying bedrock of the county is divided into four groups: the Pocono group underlies the steep slopes of the upper Mahoning and Shenango Rivers, and the Pottsville Group, Allegheny Group, and the Conemaugh Formation underlie the rest of the county.

Refer to Figure III-2 for a general geology map of Lawrence County.

G. Climate

Winters are cold and snowy at high elevations in the County. It is also frequently cold in the valleys, but intermittent thaws preclude a long-lasting snow cover. Summers are fairly warm on mountain slopes and very warm with occasional very hot days in the valleys. Rainfall is evenly distributed throughout the year, but it is appreciably heavier on the windward, west- facing slopes than in the valleys. Normal annual precipitation is adequate for all crops, although summer temperature and growing season length, particularly at higher elevations, may be inadequate.

In winter, the average temperature is 30 degrees F, and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred at New Castle on January 29, 1963, is -23 degrees. In summer, the average temperature is 70 degrees, and the average daily maximum temperature is 80 degrees. The highest recorded temperature, which occurred at New Castle on September 2, 1953, is 100 degrees.

The total annual precipitation is 38 inches. Of this, 22 inches, or 60 percent, usually falls in April through September, but in 2 years out of 10, the rainfall in April through September is less than 17 inches. The heaviest 1-day rainfall during the period of record was 3.70 inches at New Castle on October 16, 1954. Thunderstorms occur on about 36 days each year, and most occur in summer. Heavy rains, which occur at any time of the year, and severe thunderstorms in summer sometimes cause flash flooding, particularly in narrow valleys.

Average seasonal snowfall is 38 inches. The greatest snow depth at any one time during the period of record was 19 inches. On an average of 24 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in mid-afternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 60 percent of the time possible in summer and 35 percent in winter. The prevailing wind is from the southwest. Average wind- speed of 12 miles per hour is highest in winter.

H. Soils

Soil properties influence the runoff generation process. The USDA, Natural Resources Conservation Service (NRCS) has established a criterion determining how soils will affect runoff by placing all surface horizon soils into four Hydrologic Soil Groups (HSGs) – A through D, based on infiltration rate and depth. Hydrologic soil group A characteristics, which have a high infiltration rate and therefore low runoff potential, are found sporadically throughout Lawrence County. The majority of the surface horizon soils in the watershed fall in Group B and C. Group B is characterized as having moderate infiltration rates, and it consists primarily of moderately deep to deep, moderately well to well drained soils that exhibit a moderate rate of water transmission. Group C soils have slow infiltration rates when thoroughly wetted and contain fragipans, a layer that impedes downward movement of water and produces a

slow rate of water transmission. Found throughout the watershed, D soils are tight, low permeable soils with high runoff potential and are typically clay soils.

Soils in the Pittsburgh Plateau section of Lawrence County are part of the Gilpin-Wharton-Wiekert Association. These level to steep soils, are well drained and formed in the residual material from acid shale, siltstone and sandstone.

Many different associations cover the glaciated part of the county. The Conotton-Chili-Holly association underlies the major rivers and streams, such as the Beaver, Shenango and Mahoning Rivers and North Fork Little Beaver and Slippery Rock Creeks. These soils formed from glacial outwash and alluvium and range from level to very steep, and from excessively drained to poorly drained.

The Ravenna-Canfield-Frenchtown and Canfield-Ravenna-Loudonville associations underlie the uplands. Both of these soils associations are formed in glacial till and range from level to very steep, and well drained to poorly drained. Plain Grove Township contains a small area of the Candice-Frenchtown-Holly Association formed from glacial lake sediment.

More descriptive breakdowns of each soil in the series can be found below. See soil map for additional information and location on the soils types.

Canadice Series: Soils of the Canadice Series are fine illitic, mesic type Ochraqualfs. They are deep and poorly drained and can be found on lake plains and along stream valleys. They were formed in glacial lake settlements. They range in slope between 0 and 3 percent. They have very slow permeability.

Conotton Series: Soils of the Conotton series are loamy skeletal mixed mesic type Hapludults. They are deep well drained, and somewhat excessively drained soils. The slope range is 3 to 50 percent. The saturated hydraulic conductivity is high is the mineral surface and high to very high in the subsoil and substratum.

Chili Series: Soils of the chili series are fine-loamy, mixed, mesic typic hapludalfs. They are deep and well-drained soils. The slope range is between 3 and 15 percent. The permeability is moderately rapid in the subsoil and rapid in the substratum.

Canfield Series: The Canfield series is made up of fine-loamy mixed mesic Aquic fragidaulfs. They are deep, moderately well drained soils and knolls and rides that were formed in glacial till material. The slope range is 3 to 25 percent. The permeability is moderate above the fragipan and slow within the fragipan.

Gilpin Series: Soils of the Gilpin series are fine-loamy mixed mesic typic Hapludults. They are moderately deep, well-drained soils on ridges and hillsides formed in residual material formed from acid shale and siltstone and they have a slope range of 3 to 70 percent. It has moderate permeability.

Frenchtown Series: Soils of the Frenchtown series are fine-loamy mixed mesic typic Fragiqualfs. They are deep, poorly drained soils on till plains and in minor drainageways and were formed in glacial till material. The slope range is 0 to 8 percent. The have moderate permeability above the fragipan and slow or very slow permeability within the fragipan.

Holly Series: Soils of the Holly series are fine-loamy, mixed non-acid, mesic type fluvaquents. They are deep, poorly drained soils on flood plains formed in alluvial material derived from glaciated uplands. Their slope range is between 0 and 3 percent.

Ravenna Series: Soils of the Ravenna series are fine-loamy mixed mesic aeric fragiqualfs. They are deep, somewhat poorly drained, nearly level and undulating soils on till plains formed in glacial till material. The slope range is 0 to 15 percent. The permeability is moderate above the fragipan and slow within the fragipan.

Loudonville Series: Soils of the Loudonville series are fine-loamy mixed mesic Ultic Hapludalfs. They are moderately deep and well drained soils that were formed in glacial till and in material from siltstone or shale bedrock. They have moderate permeability.

Wharton Series: Soils of the Wharton series are fine-loamy, mixed mesic Aquic Hapludults. They are deep and moderately well drained soils. They are found on broad ridge tops and side slopes. They were formed in residual material from interbedded acid shale and siltstone. The slope range is 0 to 25 percent. The permeability is slow to moderately slow.

Weikert Series: Soils of the Weikert Series are loamy-skeletal, mixed, mesic Lithic Dystrochrepts. They are shallow, well-drained soils on ridges and hillsides and were formed in residual material from interbedded acid shale, siltstone and some sandstone. The slope range is 3 to 80 percent. They have moderately rapid permeability.

County soils are shown in Figure III-3.

I. Water Resources

Various river and stream valleys cut through the landscape of Lawrence County. All of these either form or are tributaries to the Beaver River except for North Fork Little Beaver Creek, which flows directly to the Ohio River.

See Figure III-4 for watershed locations.

Slippery Rock Creek/Conoquenessing Creek Watersheds:

Connoquenessing Creek, a cold water fishery (with a very minor portion classified as a warm water stream), begins in northern Butler County and drains 838 square miles. The creek flows through only a small section of Lawrence County, but picks up a major tributary, Slippery Rock Creek in the process. Connoquenessing Creek is considered the second most polluted waterway in the United States, primarily due to the pollution from AK Steel. Other pollution comes from more typical sources such as agricultural runoff, sewage and siltation.

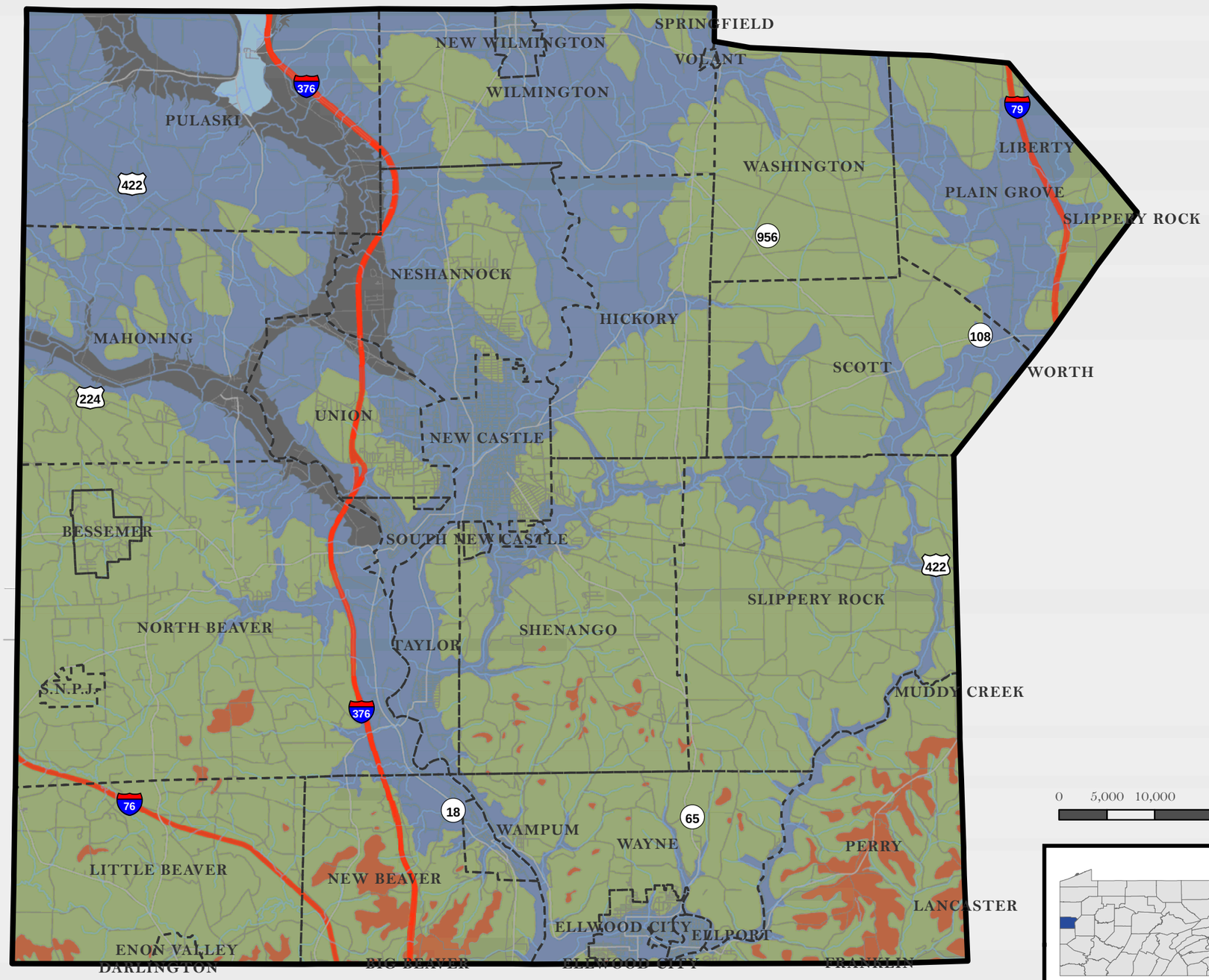
Slippery Rock Creek starts in Butler County, drains 836 square miles and flows for forty-seven miles to Connoquenessing Creek. It is classed as a cold-water fishery. Tributaries to the creek include Wolf Creek, Muddy Creek, Skunk Run, Grindstone Run, Hell Run and Taylor Run.

Hell Run is the only exceptional value (EV) stream in the county. It begins in Shenango Township, drains 6 square miles and has a main branch length of 4.7 miles.

The upper sections of Slippery Rock Creek are affected by acid mine drainage (AMD), but current efforts by the Slippery Rock Watershed Coalition are underway to remediate the AMD. This is helping to improve the water quality in Lawrence County. Other problems include non-point siltation and light bank erosion.

Lawrence County
Stormwater Management Plan
Phase 2 Plan

FIGURE III-2
Geology



Lawrence County
Municipal Boundary
Stream

Other Features

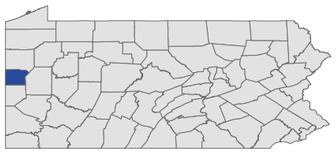
Interstate
PA & US HWY
Local Road

Bedrock

Glenshaw Formation
Allegheny Formation
Pottsville Formation
Cuyahoga Group
Shenango Formation

N W E S

0 5,000 10,000 20,000 Feet



Location of Lawrence County within the state of Pennsylvania.

DISCLAIMER

No part of this document may be reproduced, stored in a retrieval system or transmitted in any form of by any means, electronic, mechanical, photocopying, recording or otherwise, except as expressly permitted by the Lawrence County, PA.

This map was digitally compiled for internal maintenence and developmental use by Lawrence County, PA for reference purposes. Lawrence County, PA makes no claims as to the completeness, accuracy or content of any data contained hereon, and makes no representation of any kind, including, but not limited to, the warranties of merchantability or fitness for a particular use, nor are any such warranties to be implied or inferred, with respect to the information or data furnished herein.

L.R. Kimball
ARCHITECTURE · ENGINEERING · COMMUNICATIONS TECHNOLOGY
415 Moon Clinton Road Coraopolis, PA 15108-3886

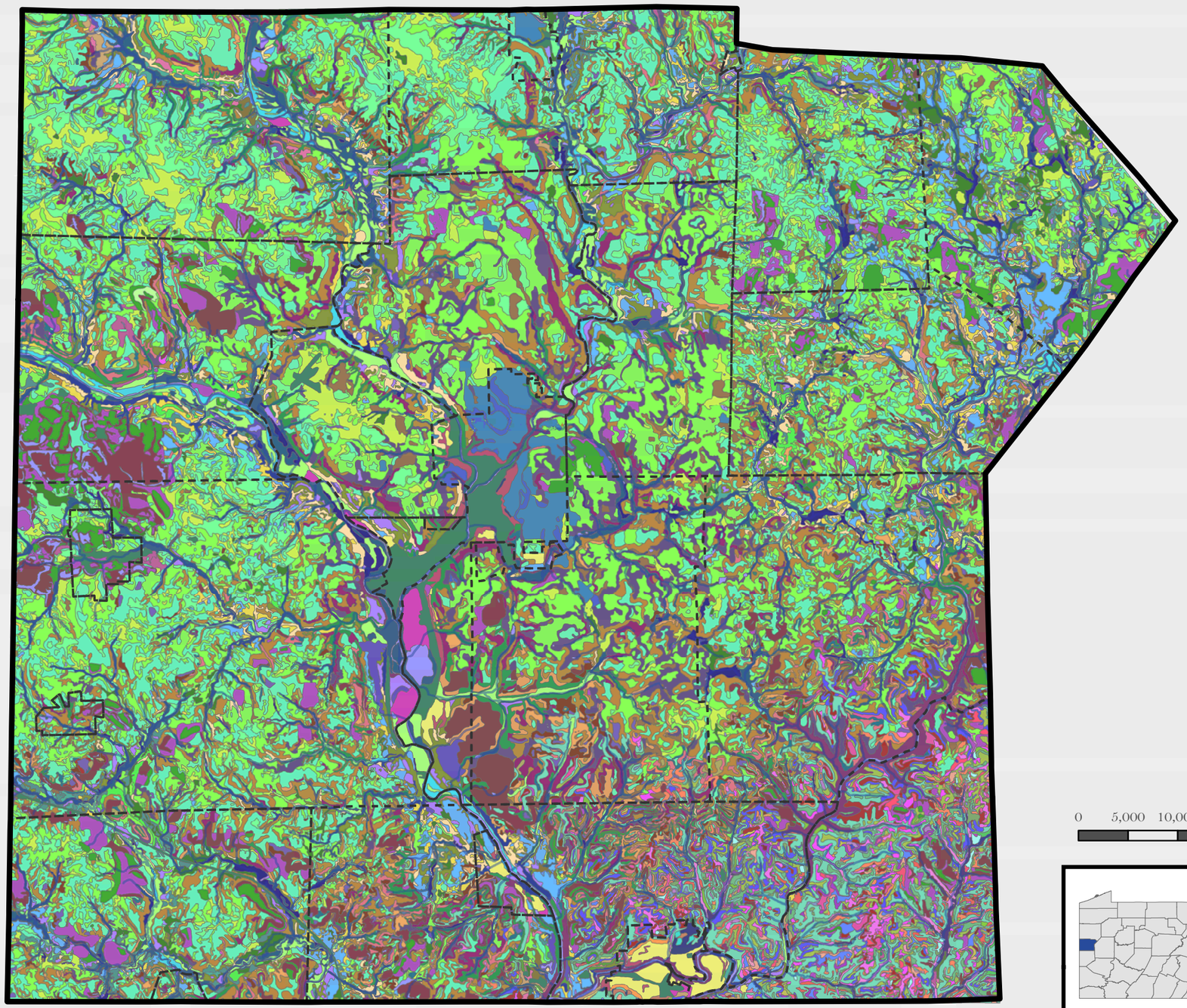
Prepared by: GLF **Date: 04/16/10**

Project Number: 08-1300-0135

File Location: G:\2008\Lawrence_County\ArcProjects\Phase 2_Figure III-2_Geology.mxd

Lawrence County
Stormwater Management Plan
Phase 2 Plan

FIGURE III-3
County Soils



AgB	ChC	FnA	Lb	TsB	UwB
AgC	CmB	FnB	LoB	TsC	UwD
At	CmC	GnB	LoC	TyA	W
BcB	CmD	GnC	LoD	TyB	WeF
BcC	CoB	GnD	LoF	UAD	WhA
BkB	CoC	GsB	MoA	UaB	WhB
BkC	CoD	GsC	MoB	UaD	WhC
Ca	CoF	GsD	MoC	UaE	WnD
CdB	CuB	GsF	Ph	Ub	WoB
CdC	CuC	GtB	Pn	UcB	WoC
CdD	CuD	GtC	Po	UcD	WoD
CeB	Du	GvC	RaA	UfB	
CeC	ErB	HaB	RaB	UfD	
CeD	ErC	HaC	RaC	UgB	
Cg	ErD	HaD	ReB	UgD	
ChB	EsD	Ho	Sn	UnK	

N
W E
S

0 5,000 10,000 20,000
Feet

Location of Lawrence County within the state of Pennsylvania.

DISCLAIMER

No part of this document may be reproduced, stored in a retrieval system or transmitted in any form of by any means, electronic, mechanical, photocopying, recording or otherwise, except as expressly permitted by the Lawrence County, PA.

This map was digitally compiled for internal maintenence and developmental use by Lawrence County, PA for reference purposes. Lawrence County, PA makes no claims as to the completeness, accuracy or content of any data contained hereon, and makes no representation of any kind, including, but not limited to, the warranties of merchantability or fitness for a particular use, nor are any such warranties to be implied or inferred, with respect to the information or data furnished herein.

L.R.Kimball℠
ARCHITECTURE • ENGINEERING • COMMUNICATIONS TECHNOLOGY

415 Moon Clinton Road Coraopolis, PA 15108-3886

Prepared by: GLF **Date: 04/16/10**

Project Number: 08-1300-0135

File Location: G:\2008\Lawrence_County\ArcProjects\Phase 2_Figure III-3_Soils.mxd

Shenango/Mahoning/Beaver River Watersheds:

The Mahoning River, also classified as a warm water stream, begins about 10 miles southeast of Alliance, Ohio, and flows through Pennsylvania for about 11 miles. The Mahoning River has been described as "one of the most polluted of any stream or river in Ohio" (OH EPA 1994), with the most polluted stretch located just downstream of Youngstown, Ohio. Dilution of the water makes the Pennsylvania section a little less polluted, but the sediment remains more contaminated than that found in Presque Isle Bay of Lake Erie. The Mahoning River's effects spread downstream into the Beaver River (see Beaver River description).

Major tributaries to the Mahoning River in Lawrence County include Coffee Run flowing from the north and Hickory Run, which joins the Mahoning River near the confluence of the Mahoning River and the Shenango River.

The Shenango River has its origin in Conneaut Township of Crawford County and flows more than 87 miles to its confluence with the Mahoning River to form the Beaver River. The drainage area is 1,062 square miles, of which 283 square miles are in Ohio (180,916 acres) and 779 square miles are in Pennsylvania (498,000 acres). The lower section from Shenango Lake to the Mahoning River confluence is considered the worse section. This section, in addition to receiving the pollutants from further upstream has effluents from industry, wastewater treatment plants and urban development.

Major tributaries of the Shenango River in Lawrence County include Neshannock Creek, Hottenbaugh Run, Big Run and Deer Creek. Neshannock Creek is discussed in its own section because of its size.

North Fork Little Beaver Creek:

North Fork Little Beaver Creek originates just north of New Springfield, Ohio, approximately 4.6 miles west of the Ohio-Pennsylvania border. Classed as a High quality-coldwater fishery, Little Beaver Creek flows for 30.6 miles to the Ohio River. This stream has numerous strip mines surrounding it in the upper reaches, and most of the mine drainage into the stream is alkaline. This AMD combined with the farm runoff contributes to water that has a high hardness and conductivity. Some industrial and municipal sewage discharges also affect water quality.

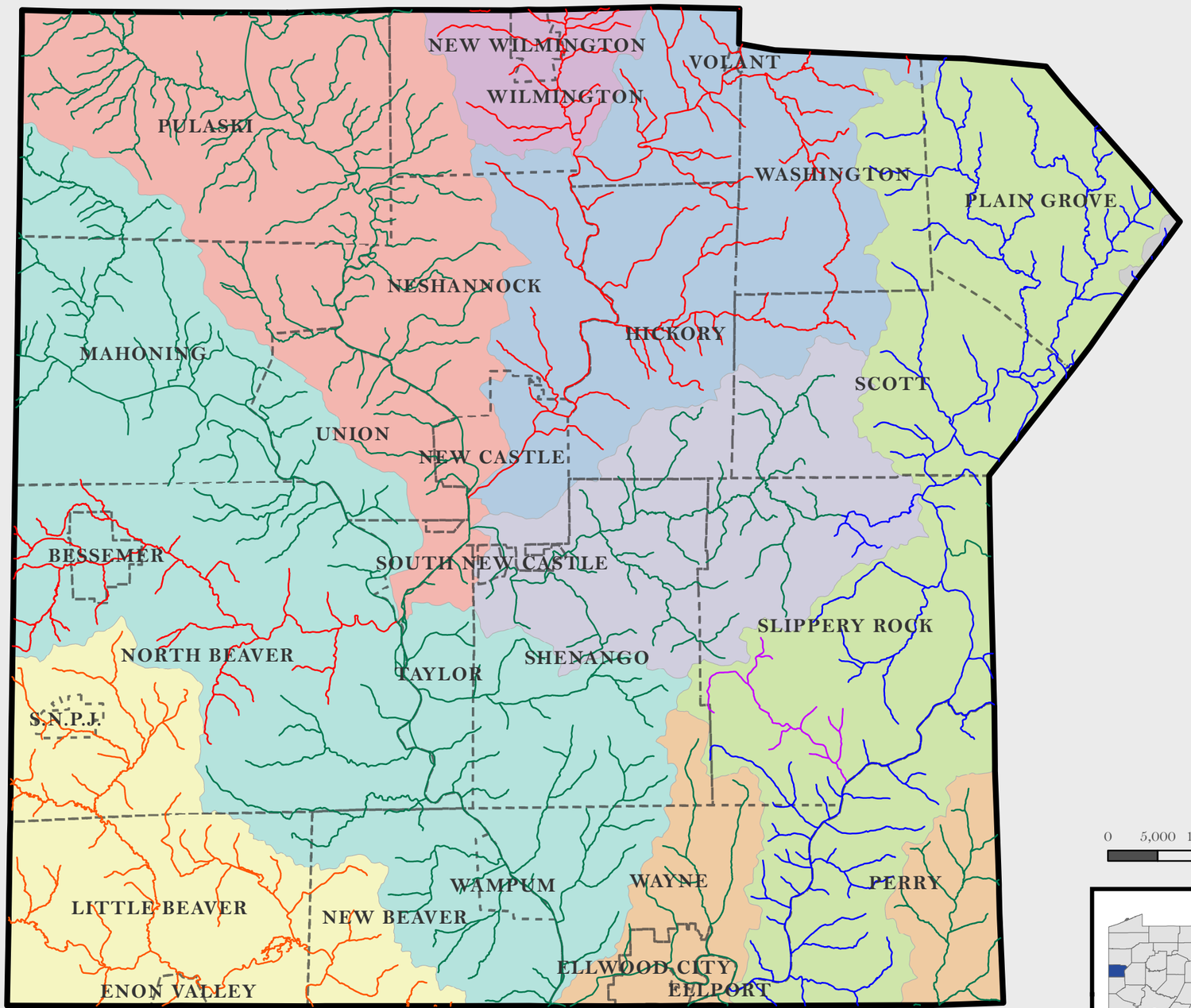
Honey Creek, the only major tributary to North Fork Little Beaver Creek in Lawrence County, joins upstream of Enon Valley Borough.

Designated Act 167 watersheds in Lawrence County include:

Beaver/Mahoning River
Shenango River
Little Beaver Creek
Conoquenessing Creek
Slippery Rock Creek
Neshannock Creek
Little Neshannock Creek

Lawrence County
Stormwater Management Plan
Phase 2 Plan

FIGURE III-4
Hydrology



- Cold Water Fishes
- Exceptional Value
- High Quality Cold Water Fishes
- Trout Stocking
- Warm Water Fishes
- Lawrence County
- Municipal Boundary

Act 167 Watersheds

- Beaver River
- Big Run
- Connoquenessing Creek
- Little Beaver Creek
- Little Neshannock Creek
- Neshannock Creek
- Shenango River
- Slippery Rock Creek
- Wolf Creek

N W E S

0 5,000 10,000 20,000 Feet

Location of Lawrence County within the state of Pennsylvania.

DISCLAIMER

No part of this document may be reproduced, stored in a retrieval system or transmitted in any form of by any means, electronic, mechanical, photocopying, recording or otherwise, except as expressly permitted by the Lawrence County, PA.

This map was digitally compiled for internal maintenence and developmental use by Lawrence County, PA for reference purposes. Lawrence County, PA makes no claims as to the completeness, accuracy or content of any data contained hereon, and makes no representation of any kind, including, but not limited to, the warranties of merchantability or fitness for a particular use, nor are any such warranties to be implied or inferred, with respect to the information or data furnished herein.

L.R.Kimball℠
ARCHITECTURE · ENGINEERING · COMMUNICATIONS TECHNOLOGY

415 Moon Clinton Road Coraopolis, PA 15108-3886

Prepared by: GLF **Date: 04/16/2010**

Project Number: 08-1300-0135

File Location: G:\2008\Lawrence_County\ArcProjects\Phase 2_Figure-4_Hydrology.mxd

J. PA Chapter 93 Stream Classifications

Current (2008) PA Chapter 93 stream water quality classifications are shown on Figure III-4. A summary table of the streams in Lawrence County based on this data is presented below:

Table III-2

County Chapter 93 Stream Classification Summary

Classification	County Stream Miles	Percentage of Overall
Exceptional Value (EV)	8.99	1.3%
High Quality (HQ) Cold Water Fishery (CWF)	66.87	9.9%
Cold Water Fishery (CWF)	115.96	17.2%
Warm Water Fishery (WWF)	350.97	52.1%
Trout Stocking Fishery (TSF)	130.35	19.4%

K. Obstructions

Locations of significant waterway obstructions (i.e., culverts, bridges, etc.) were obtained by a number of methods. Methods used to properly verify the presence and to further address the integrity of the obstructions included:

1. Inspection of the United States Geologic Survey (USGS) topographic base mapping
2. Data from the Pennsylvania Department of Transportation (PADOT)
3. FEMA Flood Insurance Studies
4. Phase 1 Stormwater Problem Area survey results
5. Field verification work

The field verification portion of the project was completed by County Planning and the engineering Consultant. Using GIS data from the above sources, mapping was created from the direct intersection of roadway data and stream data. These intersections would indicate the likely location of a culvert or bridge structure. Field crews were then assigned to visually inspect and assess as many of the known structures as possible, as well as additional unknown structures that were discovered during the fieldwork. The type of information that was obtained through the field investigations were:

1. Verification that the structure is present
2. Type of structure
3. Physical characteristics and dimensions of structure
    a. Diameter/opening width
    b. Depth from thalweg of channel to top of opening or crown of pipe
    c. Depth from pipe crown or top of opening to approximate crown of road above
    d. Bridge piers and abutments
    e. Pipe/bridge material

4. Structural condition of structure
5. Observed deficiencies with the structure
    a. Damaged pipe or bridge
    b. Siltation/sedimentation
    c. Evidence of insufficient capacity (visual evidence of overtopping)
6. Photographs documenting structure

The field data that was collected at each structure was recorded on field survey forms that can be found in Volume III of the Plan.

The most common deficiencies discovered during field investigations were structural problems with the pipe/bridge and sedimentation at pipes and bridges. A significant number of structures have some form of structural damage. Damages most often included corroded or missing portions of pipe barrels, partially or near complete crushing of pipe barrels, occasional occurrences of spalling at bridges, reduced flow area (e.g. due to debris within pipe or opening) and damaged appurtenances (e.g. damaged or missing head/end walls). Sedimentation problems were also identified in a number of areas.

Any structure determined to be less than 18 inches in diameter was excluded from the field survey operations. Such structures were omitted from field collection activities due to the time constraints required to determine their locations and assess their physical and flow conveyance capabilities.

Based upon the limitations of the project due to the reduction in scope and schedule, obstruction hydraulic capacity calculations were not performed. Consequently, capacity calculations for the obstructions are not included as part of this plan. Plan updates should address capacity issues based upon the included field data in the appendix.

L. Dams and Impoundments

Existing dam locations are shown on Figure III-5 and are listed below. This list includes permitted PADEP dams, a United State Army Corps of Engineers dam, and two PA Fish and Boat Commission run-of-river dams.

Table III-3

Dams and Impoundments

Dam Number	Dam Name	Stream Name	Municipality
37-004	McConnell	Hettenbaugh Run	Hickory Township
37-011	Upper	Big Run	Shenango Township
37-012	Lower	Big Run	Shenango Township
37-016	Unnamed	Big Run	Shenango Township
37-019	McConnells Mill	Slippery Rock Creek	Slippery Rock Township
37-020	Kennedy Mill	Slippery Rock Creek	Slippery Rock Township
37-022	Volant Mill	Neshannock Creek	Washington Township
37-028	Boyer Dam	Eckles Run	Wayne Township
37-031	Fairless Murray	Slippery Rock Creek	Wayne Township

Table III-3

Dams and Impoundments

Dam Number	Dam Name	Stream Name	Municipality
37-032	Sarah Heinz House	Slippery Rock Creek	Wayne Township
37-039	Castleview Lower	Tr Shenango River	Neshannock Township
37-051	Unnamed Dam	Beaver River	Taylor Township
37-053	Mohawk Trails	Tr Mahoning River	Mahoning Township
37-054	Slippery Rock Dam - Wortemburg Pump	Slippery Rock Creek	Perry Township
37-055	Slovene Camp Dam	Tr Sugar Creek	North Beaver Township
37-056	Detention Basin No 1 (Section 43)	Tr Beaver River	North Beaver Township
37-057	Detention Basin No 3 (Section 43)	Tr Wampum Run	New Beaver Borough
37-058	Detention Basin No 4 (Section 43)	Tr Eckles Run	New Beaver Borough
37-059	Detention Basin No 8 (Section 43)	Tr Eckles Run	New Beaver Borough
37-060	Detention Basin No 6 (Section 44)	Tr Mahoning River	North Beaver Township
37-061	Fisher	Tr Hottenbaugh Run	Hickory Township
37-062	Reeher	Tr Neshannock Creek	Hickory Township
37-063	Unnamed	Tr Shenago River	Neshannock Township
37-064	Castleview Upper	Tr Shenango River	Neshannock Township
37-065	Castleview Middle	Tr Shenango River	Neshannock Township

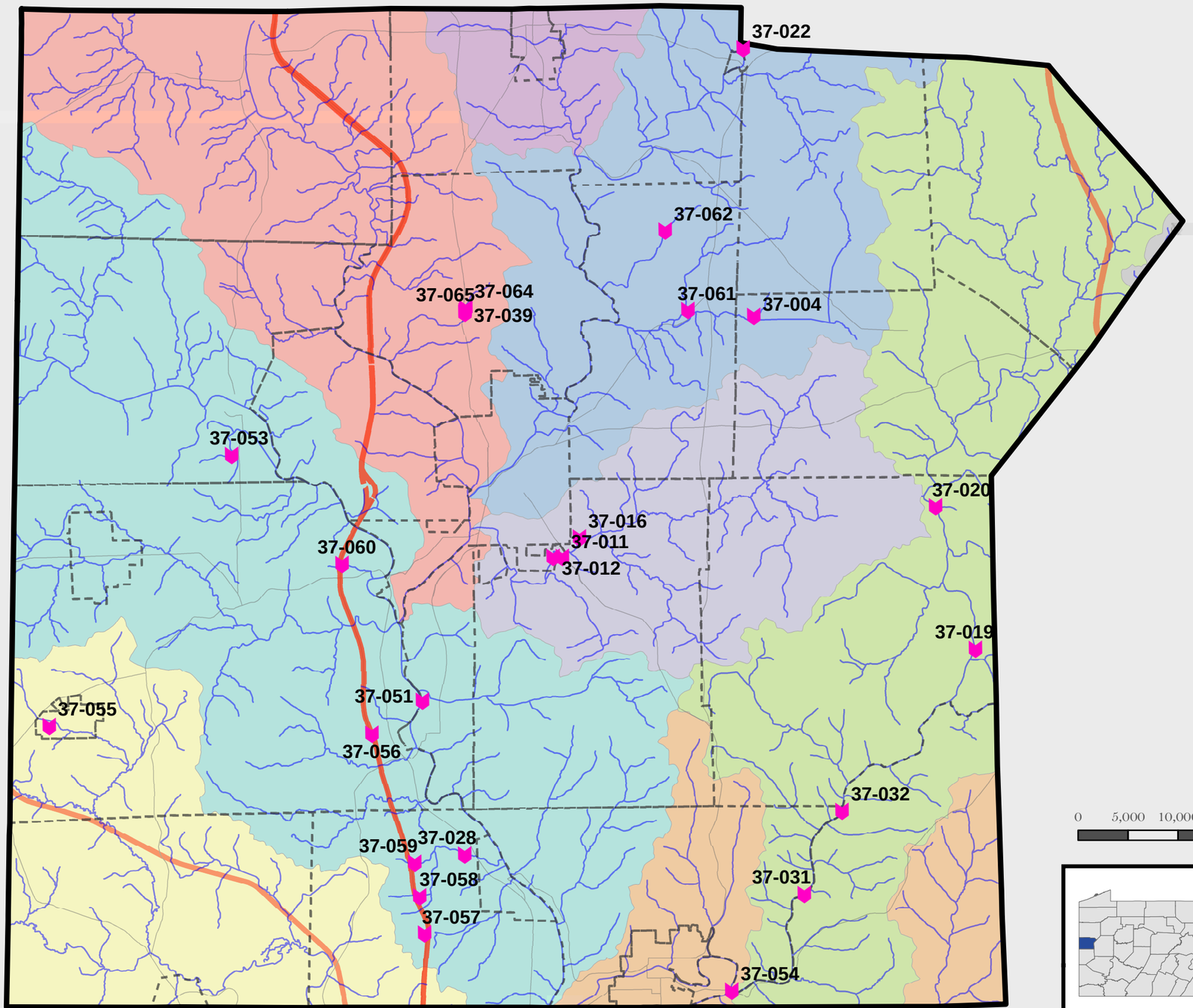
M. Pollution and Stream Impairments

Table III-4 shows a summary of non-attaining segments of the Streams Integrated List representing stream assessments for the Clean Water Act Section 305(b) reporting and Section 303(d) listing.[1] PA DEP protects four (4) stream water uses: aquatic life, fish consumption, potable water supply, and recreation. If a stream segment is not attaining any one of its four uses, it is considered impaired. Based on the 303(d) data, the total number of impaired stream miles in Lawrence County caused by stormwater or urban runoff is approximately 62 miles.

[1] PA DEP Office of Water Management, Bureau of Water Supply & Wastewater Management, Water Quality Assessment and Standards Division, 2010

Lawrence County
Stormwater Management Plan
Phase 2 Plan

FIGURE III-5
Dams



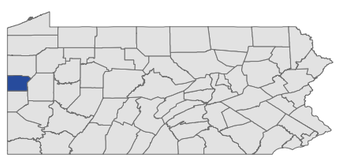
- Dams
- Lawrence County
- Municipal Boundary
- Stream

Watersheds

- Beaver River
- Big Run
- Connoquenessing Creek
- Little Beaver Creek
- Little Neshannock Creek
- Neshannock Creek
- Shenango River
- Slippery Rock Creek
- Wolf Creek

N W E S

0 5,000 10,000 20,000 Feet



Location of Lawrence County within the state of Pennsylvania.

DISCLAIMER

No part of this document may be reproduced, stored in a retrieval system or transmitted in any form of by any means, electronic, mechanical, photocopying, recording or otherwise, except as expressly permitted by the Lawrence County, PA.

This map was digitally compiled for internal maintenence and developmental use by Lawrence County, PA for reference purposes. Lawrence County, PA makes no claims as to the completeness, accuracy or content of any data contained hereon, and makes no representation of any kind, including, but not limited to, the warranties of merchantability or fitness for a particular use, nor are any such warranties to be implied or inferred, with respect to the information or data furnished herein.

L.R.Kimball℠
ARCHITECTURE · ENGINEERING · COMMUNICATIONS TECHNOLOGY

415 Moon Clinton Road Coraopolis, PA 15108-3886

Prepared by: GLF **Date: 04/16/2010**

Project Number: 08-1300-0135

File Location: G:\2008\Lawrence_County\ArcProjects\Phase 2_Figure-5_Dams.mxd

Table III-4

Non-attaining Impaired Stream Lengths

Impairment Source - Impairment Cause	Total (miles)
Abandoned Mine Drainage - Metals	16.17
Abandoned Mine Drainage - Metals ; Abandoned Mine Drainage - pH	0.61
Abandoned Mine Drainage - Metals ; Agriculture - Nutrients	12.66
Abandoned Mine Drainage - Metals ; Agriculture - Siltation	16.39
Abandoned Mine Drainage - Metals ; Road Runoff - Siltation	0.71
Abandoned Mine Drainage - Metals ; Urban Runoff/Storm Sewers - Siltation	2.51
Agriculture - Nutrients	3.08
Agriculture - Nutrients ; Abandoned Mine Drainage - Metals	5.44
Agriculture - Pathogens	2.99
Agriculture - Siltation	3.07
Agriculture - Siltation ; Agriculture - Nutrients	5.64
Channelization - Flow Alterations ; Road Runoff - Water/Flow Variability	2.60
Erosion from Derelict Land - Siltation	0.99
Grazing Related Agric - Siltation ; Animal Feeding Agric - Nutrients	1.18
Other - Nutrients ; Other - Metals	12.85
Package Plants - Nutrients	2.68
Package Plants - Unionized Ammonia	1.58
Road Runoff - Siltation	3.90
Road Runoff - Siltation ; Road Runoff - Metals	2.22
Source Unknown - Cause Unknown	24.99
Source Unknown - Pathogens	9.77
Source Unknown - PCB	20.74
Source Unknown - PCB ; Source Unknown - Chlordane	17.26
Surface Mining - Siltation	0.95
Urban Runoff/Storm Sewers - Cause Unknown	5.78
Urban Runoff/Storm Sewers - Nutrients	2.88
Urban Runoff/Storm Sewers - Siltation	1.60
Urban Runoff/Storm Sewers - Siltation ; Abandoned Mine Drainage - Metals	11.48
Urban Runoff/Storm Sewers - Siltation ; Urban Runoff/Storm Sewers - Nutrients	0.84
Total Impaired Stream Miles:	**193.57**

Additional discussion and detailed information pertaining to pollution and stream impairments are discussed in the water quality portions of the Plan.

N. Stormwater Problem Areas

Through analysis of survey results received from the County municipalities, it was determined that the three primary stormwater problem types are street flooding, property flooding, and stream corridor flooding.

More detailed information pertaining to problem areas and possible solution strategies are discussed later in this plan. While it is the initial intent of the Plan to focus on the primary stormwater problems identified above, the planning effort will also include further refinement and prioritization of stormwater problem solutions and strategies. Existing and potential problems caused by excessive stormwater runoff or pollution issues are indentified and addressed throughout the Plan. The Plan provides solutions and techniques to help better manage and mitigate existing problems and prevent future problems through proper management techniques and technologies. The problems identified in this section were further combined with other known issues within the County and then used to form the technological approach (discussed later in the Plan) for addressing the specific types of problems the County encounters.

The causes for the problems described above and listed on Figure III-6 range from increases in stormwater volume and velocity, inadequate infrastructure, obstructed waterways, AMD, excessive floodplain development, and illicit discharges. Refer to Figure III-7 for the location of problem causes.

A summary of the survey results indicating the types, frequency, and related severity of damage related to stormwater problems are shown in the table below:

Table III-5

Stormwater Management Problem Areas Identified in Survey

ID	Municipality	Problem Type	Problem Cause	Problem Frequency	Damage Type	Description / Comments
1	Ellwood City	8	1	2	3	Open storm culvert causing erosion
2	Ellwood City	8	1	2	3	Bank and yard erosion with debris accumulation. Possible AMD
3	Ellwood City	5	1	1	2	Ewing Park combined sewer system that is old
4	Ellwood City	8	1	2	3	Barry's run
5	Ellwood City	8	1	2	3	Bridge St. Run. Also possible AMD from Wayne TWP.
6	Ellwood City	5	-	-	2	WWTP storm steps. Old stormwater outfall is deteriorating.
55	Mahoning	1,2	-	-	-	Flooding in Edinburg, Coffee Run prior to entering Mahoning
37	New Beaver	3	1,6	1	-	Private road-Freed's camp
38	New Beaver	2	1	1	-	Haggerty Road

Table III-5

Stormwater Management Problem Areas Identified in Survey

ID	Municipality	Problem Type	Problem Cause	Problem Frequency	Damage Type	Description / Comments
39	New Beaver	2	1	1	-	Glenkirk Rd.
40	New Beaver	3,8	1	1	-	McBride Rd
41	New Beaver	2	1	1	-	Mallory Rd.
42	New Beaver	1,2	1	1	-	Possum Hollow Run
32	New Castle	8	1	1	2	-
33	New Castle	13	1,5	3	2	-
34	New Castle	2,3	1	4	2	-
35	New Castle	2,3	1	3	2	-
36	New Castle	8,2	1	1	2	-
11	North Beaver	1	1	-	2	Mallory/Halltown Rd.
14	North Beaver	1	1	-	2	Galilec/Wampum Rd.
15	North Beaver	1	1	-	2	Willow Grove
16	North Beaver	3	3	-	2	Jackson Knolls
17	North Beaver	1,3	1,3	-	2	Hickory View
18	North Beaver	3	1	-	2	Westfield Rd/Pond overflow
19	North Beaver	1	1	-	2	Moravia Rd.
20	North Beaver	1	1	-	2	Moravia Rd.
21	North Beaver	1	1	-	2	Moravia/Musser Rd
22	North Beaver	1	1	-	2	McClain Rd
25	North Beaver	1	1	-	2	Enon Rd./culvert
26	North Beaver	1	1	-	2	Smalls Ferry Rd
27	North Beaver	2,3	1,3	-	2	Smalls Ferry/Columbiana Rd.
28	North Beaver	1,3	1	-	2	East Beechwood Rd
29	North Beaver	1,3	1,5	-	2	Len Ann Dr.
30	North Beaver	2,3	1	-	2	Covert Rd./run off from Rt. 60 overpass

Table III-5

Stormwater Management Problem Areas Identified in Survey

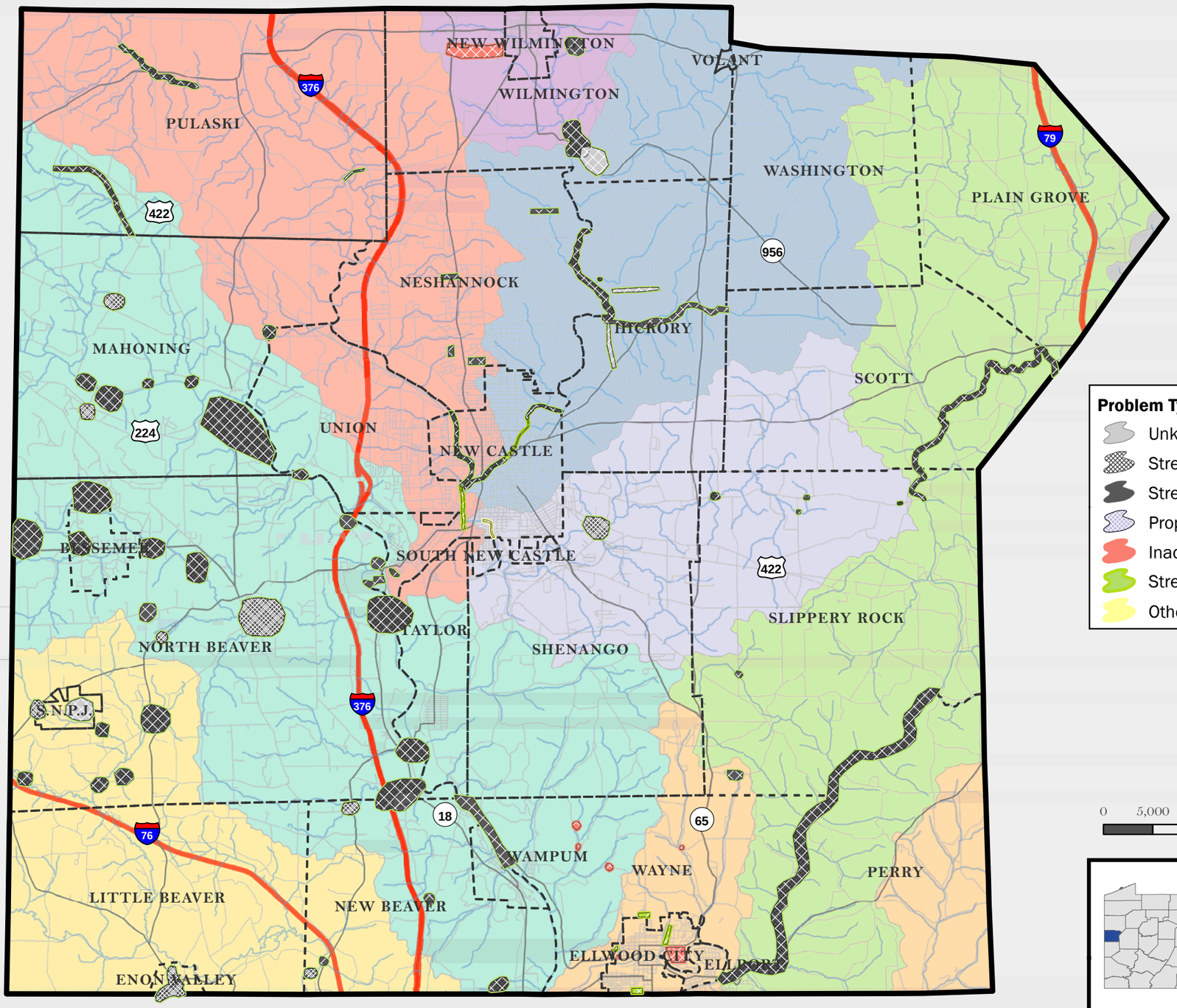
ID	Municipality	Problem Type	Problem Cause	Problem Frequency	Damage Type	Description / Comments
31	North Beaver	2	1,3	-	2	Mt. Jackson Rd./Mahoning Town swamp overflow
43	Pulaski	2	-	-	-	Prone to flooding
44	Pulaski	1	-	-	-	Prone to flooding
23	SNPJ	-	1	-	2	SNPJ surface water washed out culverts
24	SNPJ	3	1	-	2	SNPJ lake overflow
45	Wayne	5	3	1	-	Friday Hill Rd
46	Wayne	5	1	1	-	Smiley Stop
47	Wayne	5	1	4	-	Green House Rd
48	Wayne	5	1	4	-	Green House Rd
49	Wilmington	1	-	4	3	Little Neshannock Creek floods when we get lots of rain
50	Wilmington	2	1	1	-	Riding stable area, floods road and basements
51	Wilmington	-	-	-	-	Big Neshannock Creek
52	Wilmington	5	5	4	-	Beechwood Rd. 3ft culvert plugs up and needs replaced

Description Codes

Problem Type:	Description:	Problem Frequency:	Description:
1	Stream corridor flooding	1	Occurs > 1 per year
2	Street flooding	2	Occurs every 1 to 3 years
3	Property flooding	3	Occurs every 4 to 8 years
4	Surface water pollution	4	Occurs during flood events
5	Inadequate infrastructure		
6	Accelerated soil erosion		
7	Sediment in streams		
8	Stream bed/bank erosion		
9	Storm sewer outfall erosion		
10	Habitat/water resources loss or damage		
11	Other		
Problem Cause:	**Description:**	**Damage Type:**	**Description**
1	Increase in the amount of stormwater (volume)	1	Loss of life
2	Velocity of stormwater	2	Loss of vital services
3	Poor drainage	3	Property damage
4	Discharge location (direction of flow)		
5	Water obstructions		
6	Floodplain development		
7	Other		

Lawrence County
Stormwater Management Plan
Phase 2 Plan

FIGURE III-6
Problem Areas: Problem Types



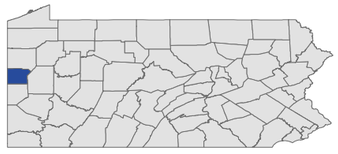
Problem Type
- Unknown
- Stream Corridor flooding
- Street flooding
- Property flooding
- Inadequate infrastructure
- Stream bed/bank erosion
- Other

Watersheds
- Beaver River
- Big Run
- Connoquenessing Creek
- Little Beaver Creek
- Little Neshannock Creek
- Neshannock Creek
- Shenango River
- Slippery Rock Creek
- Wolf Creek

Other Features
- Interstate
- PA & US HWY
- Local Road
- Stream
- Municipal Boundary
- Lawrence County

N W E S

0 5,000 10,000 20,000 Feet



Location of Lawrence County within the state of Pennsylvania.

DISCLAIMER

No part of this document may be reproduced, stored in a retrieval system or transmitted in any form of by any means, electronic, mechanical, photocopying, recording or otherwise, except as expressly permitted by the Lawrence County, PA.

This map was digitally compiled for internal maintenence and developmental use by Lawrence County, PA for reference purposes. Lawrence County, PA makes no claims as to the completeness, accuracy or content of any data contained hereon, and makes no representation of any kind, including, but not limited to, the warranties of merchantability or fitness for a particular use, nor are any such warranties to be implied or inferred, with respect to the information or data furnished herein.

L.R.Kimball℠
ARCHITECTURE · ENGINEERING · COMMUNICATIONS TECHNOLOGY
415 Moon Clinton Road Coraopolis, PA 15108-3886

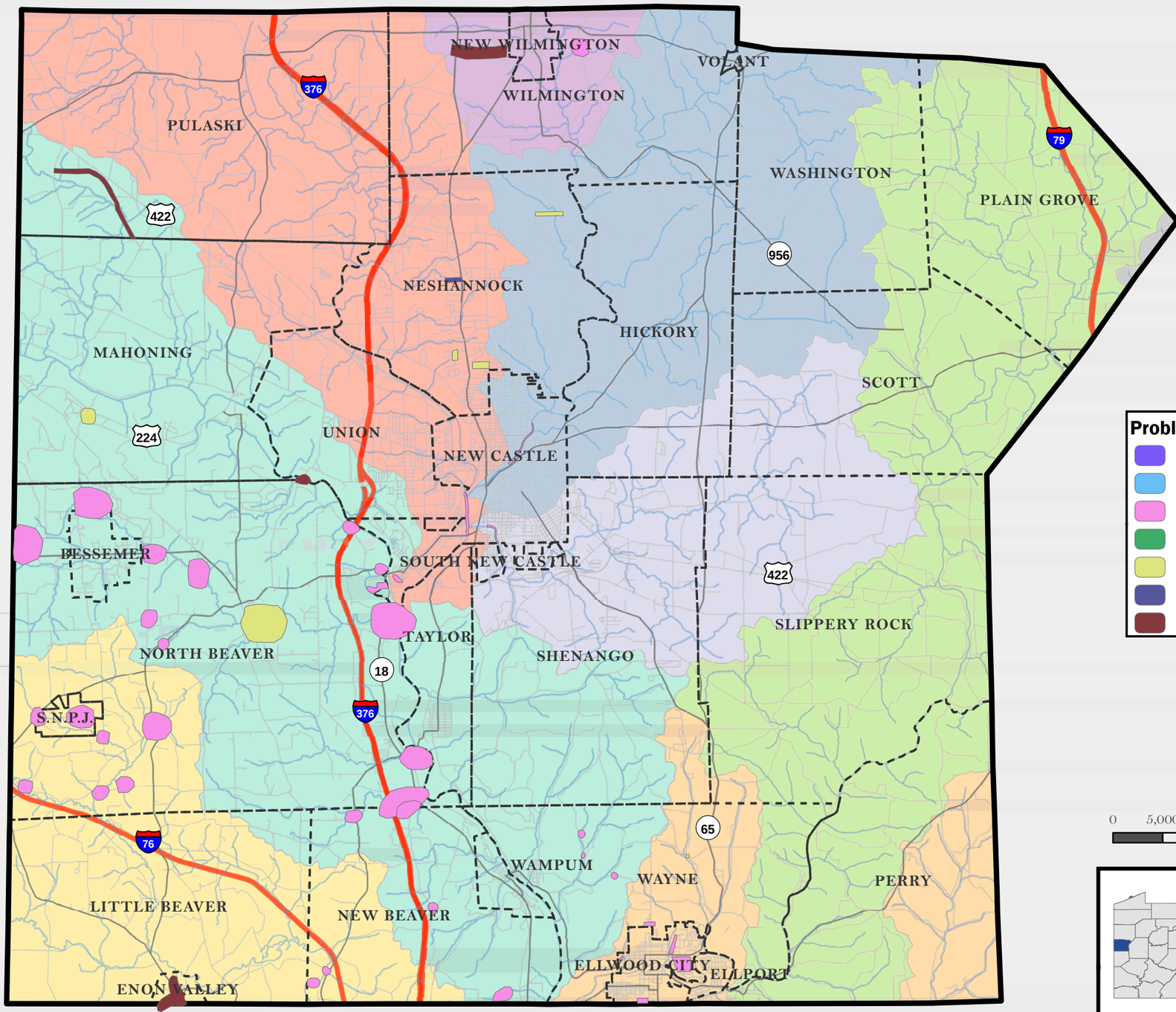
Prepared by: GLF **Date: 04/16/2010**

Project Number: 08-1300-0135

File Location: G:\2008\Lawrence_County\ArcProjects\Phase 2_Figure III-6_Problem Areas.mxd

Lawrence County
Stormwater Management Plan
Phase 2 Plan

FIGURE III-7
Problem Areas: Problem Causes



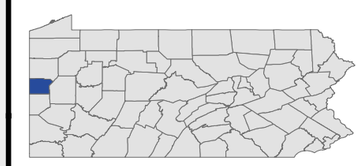
Problem Cause
- Discharge location.
- Floodplain development
- Increase in SW Volume
- Other.
- Poor drainage.
- Velocity of stormwater.
- Water obstruction.

Watersheds
- Beaver River
- Big Run
- Connoquenessing Creek
- Little Beaver Creek
- Little Neshannock Creek
- Neshannock Creek
- Shenango River
- Slippery Rock Creek
- Wolf Creek

Other Features
- Interstate
- PA & US HWY
- Local Road
- Stream
- Municipal Boundary
- Lawrence County

N W E S

0 5,000 10,000 20,000 Feet



Location of Lawrence County within the state of Pennsylvania.

DISCLAIMER

No part of this document may be reproduced, stored in a retrieval system or transmitted in any form of by any means, electronic, mechanical, photocopying, recording or otherwise, except as expressly permitted by the Lawrence County, PA.

This map was digitally compiled for internal maintenence and developmental use by Lawrence County, PA for reference purposes. Lawrence County, PA makes no claims as to the completeness, accuracy or content of any data contained hereon, and makes no representation of any kind, including, but not limited to, the warranties of merchantability or fitness for a particular use, nor are any such warranties to be implied or inferred, with respect to the information or data furnished herein.

L.R.Kimball℠
ARCHITECTURE · ENGINEERING · COMMUNICATIONS TECHNOLOGY

415 Moon Clinton Road Coraopolis, PA 15108-3886

Prepared by: GLF **Date: 04/16/2010**

Project Number: 08-1300-0135

File Location: G:\2008\Lawrence_County\ArcProjects\Phase 2_Figure III-7_Problem Causes.mxd

O. Land Use

Lawrence County contains three major watersheds: Slippery Rock Creek/ Connoquenessing Creek, the Shenango/Mahoning/Beaver River watershed complex, and North Fork Little Beaver Creek.

Slippery Rock Creek / Connoquenessing Creek: Land uses in these watersheds include the urban areas of Ellwood City, Ellport and Wayne Township, as well as agricultural, forestry, industrial and light residential land uses in the Slippery Rock Creek watershed.

Shenango/Mahoning/Beaver River Watersheds: Land uses in these watersheds include the heavily urbanized and industrial areas around New Castle, strip mining and gravel quarries in floodplain areas, agricultural, low density and medium density residential, and natural areas.

North Fork Little Beaver Creek: Land uses in this watershed include agriculture, rural residential and strip mine uses.

The factors which influence the growth and development of communities, are very complex and interrelated. These factors are variable in nature and include such items as economy, cultural rate of growth, and technology. Furthermore, these factors are beyond the control of governmental agencies responsible for land use regulations. Local government can however, stimulate, retard, control, and guide development patterns to productively enhance those variables: growth, cultural enhancement, economy.

It is not the intent of this plan to analyze land use from a growth impact standpoint, but to consider existing and potential future land use to properly analyze the impacts land use has on the existing hydrology of the County. It is also necessary to identify those areas which currently are adversely impacted by stormwater. The hydrologic modeling done within the County takes into account the existing land uses to accomplish this.

Land uses are identified and grouped below:

Table III-6

Land Use

Land Use	Overall Area (Acres)	Overall Area (Square Miles)	Percentage of County[2]
Commercial and industrial areas	4,424.21	6.913	1.91%
Rangeland Areas[3]	27,071.89	3.1804	0.88%
Forested Areas[4]	94,598.21	147.81	40.74%
Row crops, pastures, golf courses	90,557.97	141.49	39.00%
Reservoirs/water	4,467.56	6.98	1.92%
Residential	16,164.68	25.25	6.96%
Strip Mines, Quarries and Gravel Pits	14,481.06	23.189	6.39%
Transportation, Communications and Services	5,106.67	7.97	2.20%
Totals:	**533,118**	**362.78**	**100%**

[2] Based on approximately 362.78 square miles

[3] Includes areas classified as croplands, pastures, and shrub-brush land

[4] Includes areas classified as deciduous, evergreen, mixed forest, and forested wetlands

Refer to Figure III-8 for Lawrence County Land Uses.

P. Existing Development in the Flood Hazard Areas

The U.S. Department of Housing and Urban Development, Federal Insurance Administration, and Federal Emergency Management Agency (FEMA) prepare Flood Insurance Studies (FISs) and floodplain mapping for the municipalities in Lawrence County. This activity is now a responsibility of the U.S. Department of Homeland Security. Municipalities and the Pennsylvania Department of Community and Economic Development (PADCED) should be contacted as to the latest FIS studies before use.

There are two types of studies conducted in the FIS program: detailed and approximate. Detailed methods included hydrologic computations and detailed HEC-2 or HEC-RAS backwater computations. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction. Areas studied by the approximate methods were areas having low development potential or minimal flood hazards. Map III-9 shows the 100-year floodplains classified as detailed and approximate as taken from the FEMA mapping for the entirety of Lawrence County.

Encroachments of residential, industrial, urban, transitional, transportation infrastructure, and commercial land covers are shown by overlaying these areas on the floodplain in the GIS.

Approximately 55,955 acres (24%) of the County are within floodplains.

The following table provides a summary of the total amount of developed floodplain area.

Table III-7

Floodplain Land Use

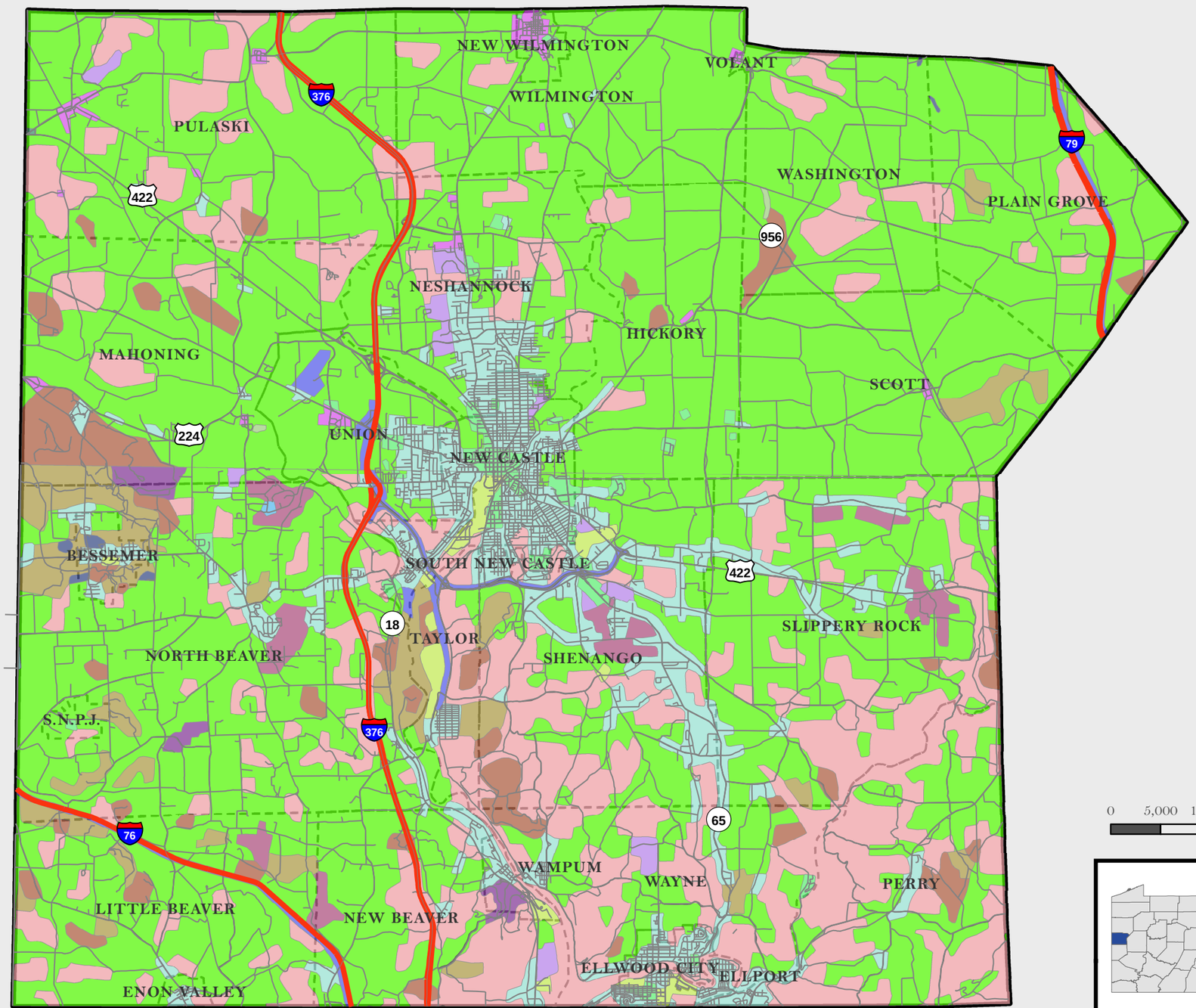
Land Use	Area (Acres)	Area (Square Miles)
Residential Areas	2,617	4.09
Forested Areas	37,667	58.86
Industrial	1,334	2.08
Mines, Quarries and Gravel Pits	2,698	4.21
Row Crops, Pastures, Golf Courses	11,639	18.27
Totals:	**55,955**	**87.51**

Refer to Figure III-10 for mapping that overlays the existing, 100-year flood plain locations with the Lawrence County Land Uses. This map will show the degree to which urbanized development has occurred within the flood plain boundaries.

The evaluation of the returned municipal questionnaires shows occurrences of stream flooding throughout several of the more urbanized areas of the County during major storm events, resulting in property damages. Urbanized development of any kind within delineated flood plain areas is highly discouraged by this Plan. Restoration of existing flood plains and their eventual return to their natural occurring conditions is key to improving the overall County stream conditions and flood-flow capacities.

Lawrence County
Stormwater Management Plan
Phase 2 Plan

FIGURE III-8
Existing Land Use

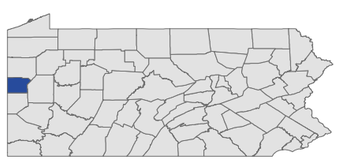


Existing Land Use

- Commercial and Services
- Confined feeding operations
- Cropland and pasture
- Deciduous forest land
- Evergreen forest land
- Industrial
- Lakes
- Mixed forest land
- Mixed urban or built-up land
- Orchards, groves, vineyards, nurseries..
- Other urban or built-up land
- Reservoirs
- Residential
- Strip mines, quarries and gravel pits
- Transitional areas
- Transportation, communications and services
- Municipal Boundary
- Lawrence County
- StateRoads

N W E S

0 5,000 10,000 20,000 Feet



Location of Lawrence County within the state of Pennsylvania.

DISCLAIMER

No part of this document may be reproduced, stored in a retrieval system or transmitted in any form of by any means, electronic, mechanical, photocopying, recording or otherwise, except as expressly permitted by the Lawrence County, PA.

This map was digitally compiled for internal maintenence and developmental use by Lawrence County, PA for reference purposes. Lawrence County, PA makes no claims as to the completeness, accuracy or content of any data contained hereon, and makes no representation of any kind, including, but not limited to, the warranties of merchantability or fitness for a particular use, nor are any such warranties to be implied or inferred, with respect to the information or data furnished herein.

L.R.Kimball℠
ARCHITECTURE · ENGINEERING · COMMUNICATIONS TECHNOLOGY

415 Moon Clinton Road Coraopolis, PA 15108-3886

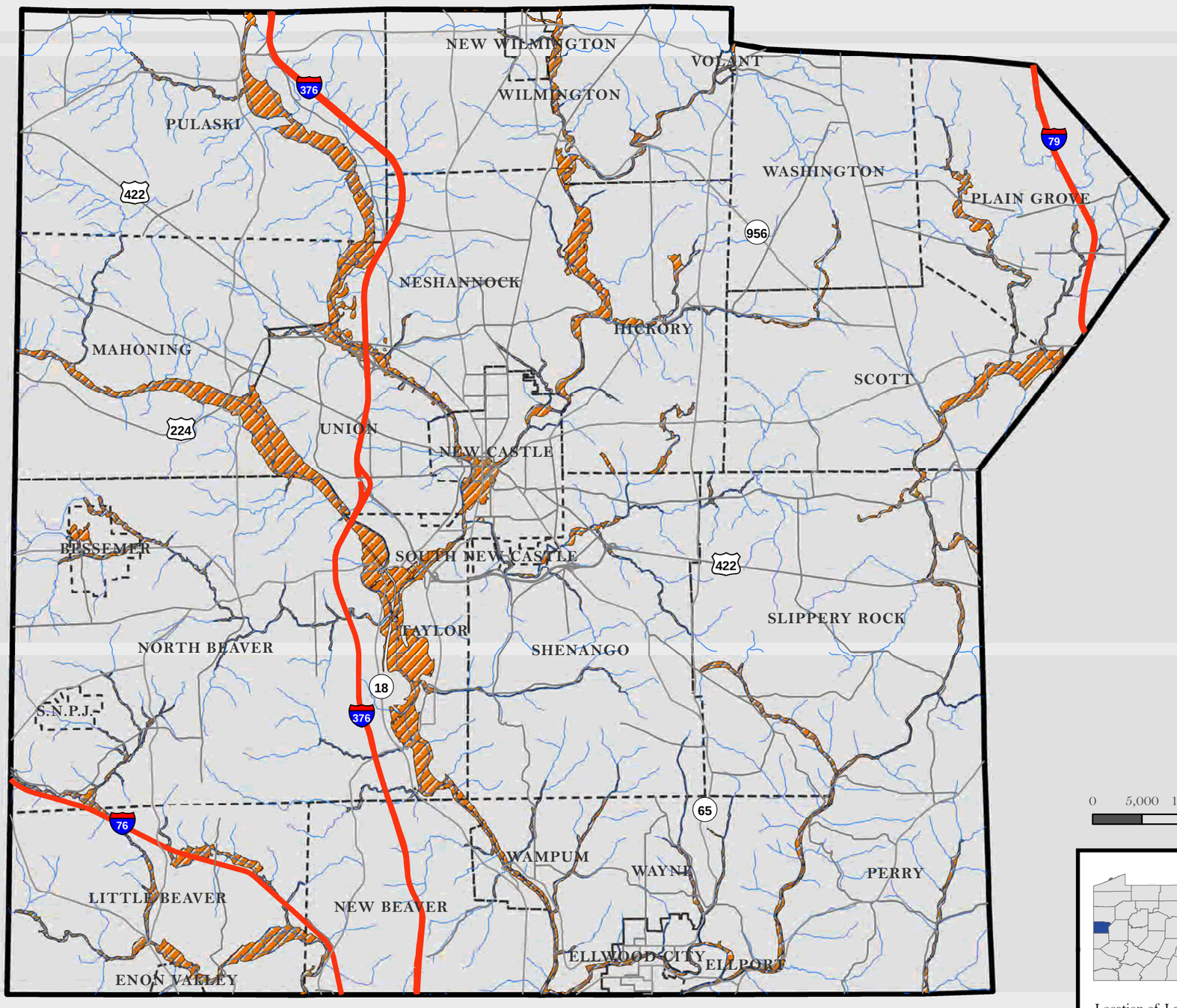
Prepared by: GLF **Date: 04/16/2010**

Project Number: 08-1300-0135

File Location: G:\2008\Lawrence_County\ArcProjects\Phase 2_Figure III-8_Land Uses.mxd

Lawrence County
Stormwater Management Plan
Phase 2 Plan

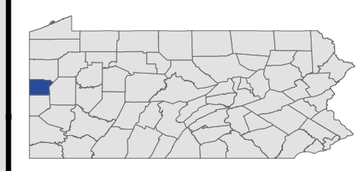
FIGURE III-9
100-Year Flood Plains



100-Year Flood Plain
Streams
Municipal Boundary
Lawrence County
State Roads

N
W E
S

0 5,000 10,000 20,000
Feet



Location of Lawrence County within the state of Pennsylvania.

DISCLAIMER

No part of this document may be reproduced, stored in a retrieval system or transmitted in any form of by any means, electronic, mechanical, photocopying, recording or otherwise, except as expressly permitted by the Lawrence County, PA.

This map was digitally compiled for internal maintenence and developmental use by Lawrence County, PA for reference purposes. Lawrence County, PA makes no claims as to the completeness, accuracy or content of any data contained hereon, and makes no representation of any kind, including, but not limited to, the warranties of merchantability or fitness for a particular use, nor are any such warranties to be implied or inferred, with respect to the information or data furnished herein.

L.R.Kimball℠
ARCHITECTURE • ENGINEERING • COMMUNICATIONS TECHNOLOGY
415 Moon Clinton Road Coraopolis, PA 15108-3886

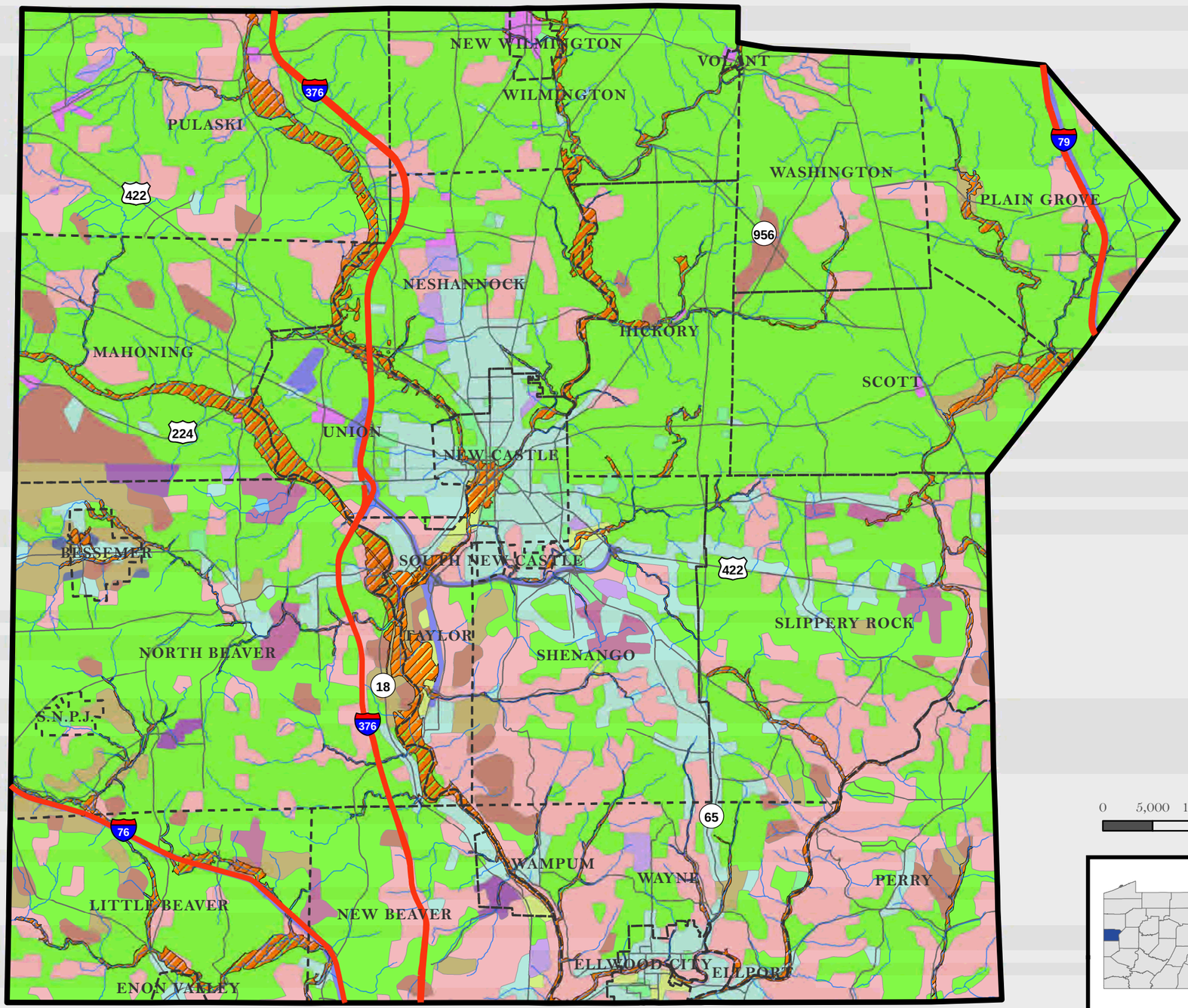
Prepared by: GLF **Date: 04/16/2010**

Project Number: 08-1300-0135

File Location: G:\2008\Lawrence_County\ArcProjects\Phase 2_Figure III-9_Flood Plains.mxd

Lawrence County
Stormwater Management Plan
Phase 2 Plan

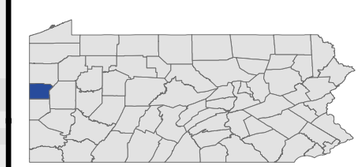
FIGURE III-10
Existing Land Use and 100-Year Flood Plains



Lawrence County
Municipal Boundary
Streams
State Roads
100-Year Flood Plain
Commercial and Services
Confined feeding operations
Cropland and pasture
Deciduous forest land
Evergreen forest land
Industrial
Lakes
Mixed forest land
Mixed urban or built-up land
Orchards, groves, vineyards, nurseries..
Other urban or built-up land
Reservoirs
Residential
Strip mines, quarries and gravel pits
Transitional areas
Transportation, communications and services

N W E S

0 5,000 10,000 20,000 Feet



Location of Lawrence County within the state of Pennsylvania.

DISCLAIMER

No part of this document may be reproduced, stored in a retrieval system or transmitted in any form of by any means, electronic, mechanical, photocopying, recording or otherwise, except as expressly permitted by the Lawrence County, PA.

This map was digitally compiled for internal maintenence and developmental use by Lawrence County, PA for reference purposes. Lawrence County, PA makes no claims as to the completeness, accuracy or content of any data contained hereon, and makes no representation of any kind, including, but not limited to, the warranties of merchantability or fitness for a particular use, nor are any such warranties to be implied or inferred, with respect to the information or data furnished herein.

L.R.Kimball℠
ARCHITECTURE · ENGINEERING · COMMUNICATIONS TECHNOLOGY

415 Moon Clinton Road Coraopolis, PA 15108-3886

Prepared by: GLF Date: 04/16/2010

Project Number: 08-1300-0135

File Location: G:\2008\Lawrence_County\ArcProjects\Phase 2_Figure III-9_Land Uses and Flood Plains.mxd

SECTION IV WATERSHED TECHNICAL ANALYSIS

1. Watershed Modeling

In planning the Act 167 Stormwater Management Phase 2 effort, one of the initial steps was the selection of a computer simulation package that could accurately and efficiently model the county's watersheds.

The selected modeling method and program needed to provide many capabilities related to stormwater modeling, but most importantly, it needed to achieve the following:

- Produce realistic and dependable results, while not requiring a disproportionate amount of input information
- Produce realistic simulations and results in comparison to the overall size of the study area
- Accurately and efficiently account for all pertinent physical properties of the naturally occurring hydrologic process
- Evaluate a variety of rainfall events, durations, and frequencies to generate outflow hydrographs which represented an accurate and realistic representation of the hydrologic conditions in all watersheds being studied

The model chosen for use on this plan was the U. S. Army Corps of Engineers (USACE), Hydrologic Engineering Center, Hydrologic Modeling System (HEC-HMS). The standalone HEC-HMS program was supplemented with the use of the USACE GeoHMS software package in order to take better advantage of the growing amount of countywide Geographic Information System (GIS) data available. The selection of the HEC-HMS and GeoHMS modeling software was based upon the following[5]:

- It is accepted by the Pennsylvania Department of Environmental Protection
- Provides the ability for combination modeling of the hydrology of natural watersheds as well as developed urban areas
- Provides the ability to represent engineered structures (e.g. pumps, diversions, reservoirs, etc.)
- The software places an equal value on both natural and urban watersheds (one of few software packages available that can model hydrology in watersheds with a mixture of conditions)
- The finalized model can easily be adapted for use in additional applications such as: estimating flood damage reduction, consideration of environmental restoration, future flexibility, and the ability to apply new methods that represent infiltration, new reservoir outlets, and several other components of the hydrologic cycle
- The use of the software allows for integration with other Federal, local, and private entities that are using compatible models produced from USACE software packages

While other commercially and freely developed software packages are available and possess the ability to provide similar results, HEC-HMS was chosen for the reasons outlined above as well HMS's ability to calculate flows for specific sub-watersheds along the stream/river route and then compare these flows with the overall watershed flows.

HEC-HMS has the ability to calculate runoff amounts for each specified storm or return period based on several physical, geological, and meteorological characteristics of the watershed. This flow is then generated and routed through the watershed system based on the stream's hydraulic parameters. This is one of the benefits of using the

[5] The list is partially adapted from reference material published by the United States Army Corp of Engineers

GeoHMS package in conjunction with HEC-HMS. The watershed's characteristics (listed above) are often available in GIS datasets from the County or other acceptable location. This greatly aids in streamlining the modeling process, increases the modeler's efficiency in producing the results, and helps to diminish the potential for "human error" by reducing the number of calculations that the modeler has to perform without the benefit of the software.

In essence, the amount of flow generated from any watershed is a result of the following contributing factors:

- Basin Slope
- Hydraulic Flow Parameters of Related Streams/Rivers
- Soil Type/Hydrologic Soil Conditions (used for determination of the Soil Conservation Service (SCS) soil curve number)
- Land Use within the Basin (e.g. wooded cover, grassy areas, urbanized areas, open fields, etc.)

Composite SCS curve numbers (CN) are then generated by the software using the available soils and land use information. This information, along with flow travel times, basin slopes, and available rainfall data, are the basis for the resulting watershed and sub-watershed model results.

The map shown in Figure IV-1 shows the overall watershed areas including the sub-watershed areas that were analyzed and modeled for this plan.

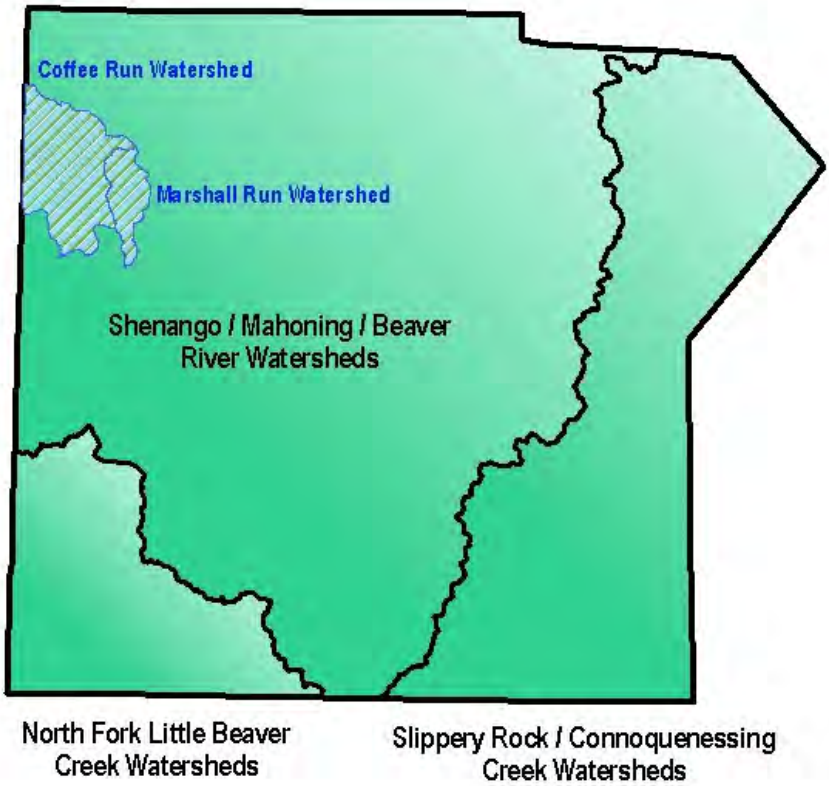


Figure IV-1

As noted in Section I, only two of the watersheds originally identified in the Phase 1 Scope of Study were modeled in Phase 2. The two watersheds modeled in this planning cycle are:

- Marshall Run
- Coffee Run

These two watersheds are located in the northwestern corner of the County and are both tributary to the Mahoning River. Both of these watersheds are located in portions of Pulaski and Mahoning Township. They flow from north to south, with their headwaters originating in Pulaski Township.

2. Modeling Process

After delineation of the major watersheds within Lawrence County based upon the natural topography of the study areas and using the available GIS data, these major watersheds were then further sub-divided into sub-watersheds for further study and analysis.

The determination of sub-watershed boundaries was based on a number of factors. Obstructions (e.g. bridges, culverts, and dams), reported problem areas (e.g. flooding, water-quality issues, excessive sedimentation, stream capacity issues, etc.), and confluence points between sub-watersheds were among the factors used in the selection of sub-watershed areas.

The most downstream point of any sub-watershed, the point where the water will leave the sub-watershed and enter another sub-watershed is known as the point of interest (POI). This is the point within each sub-watershed where the most significant results from the model are calculated. This is the point where the overall flow from the sub-watershed is determined. All areas upstream of this point are used to help determine the overall flow at any point of interest.

The point of interest is also selected as a reasonable location for considering how to best and most effectively manage and control the runoff within the watershed contributing to the POI. The watersheds POI acts as a management point, where a specific runoff rate can be determined and upstream management policies can be formulated around this quantifiable number. It also acts as a measurement point in determining any downstream impacts the overall watershed has on adjacent watersheds to which that watershed eventually drains.

All watersheds and sub-watersheds were then modeled to determine the overall runoff amounts for the following 24 - hour storm events:

- 2-year
- 10-year
- 25-year
- 50-year
- 100-year

It is the opinion of the County that the 5-year, 24-hour duration storm event adds very little value to the hydrologic evaluation of a watershed. Therefore, the County proposed to PA DEP that this duration storm be eliminated from hydrologic evaluation. The PA DEP reviewed and agreed with this decision.

An Applicant may still analyze and evaluate the 5-year storm event at their discretion. If the 5-year storm event is included however, it must meet the requirements of Article III – Stormwater Management Standards of the Municipality's local ordinance.

The factors addressed during the modeling process include:

- The peak discharge/overall runoff values at various locations along the stream and its tributaries within each modeled watershed
- The time at which the above mentioned peak discharge is reached (time to peak), and the overall timing of flow through the watershed
- Runoff contributions of individual sub-watersheds and sub-areas within those sub-watersheds at various downstream locations

The results for each individual watershed and the return periods shown can be found in the Technical Appendix of the Volume III document. This document is available at the Lawrence County Planning Department offices in New Castle.

3. Calibration

The most appropriate and accurate way to model any watershed is through the proper calibration of the model. The model should be calibrated against known field data and accurate, recent rainfall events collected within the analysis area. An acceptable alternative to the use of known physical and meteorological data is the use of statistical analysis or regression models (Paul A. DeBarry, 2004).

In its simplest form, calibration is the adjustment of model input parameters to converge upon and provide a realistic representation of the actual runoff and time conditions of the watershed based upon known, historical data.

Figure IV-2 shows a theoretical comparison between known, plotted data and the data provided by the model. An acceptably calibrated model will be one that reduces the amount of error between the plotted data when compared to one another. The information in Figure IV-2 is a simple stormwater hydrograph (flow versus time). As the two hydrographs come closer and closer together, and near a point of convergence, the model becomes more representative of realistic conditions within the watershed being modeled.

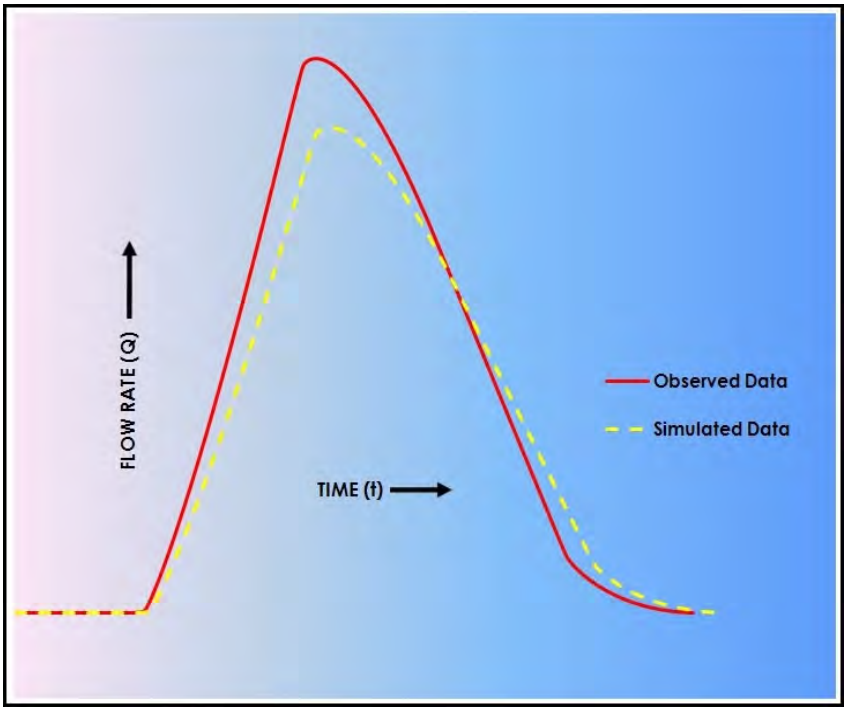


Figure IV-2

Hydrologic model calibration often uses the following procedures:

Table IV-1

Calibration Methods and Priority of Application (Paul A. DeBarry, 2004)

Priority	Data	Advantages	Disadvantages
1	Actual (historically recorded) stream flow data and rainfall hyetographs	Can adequately calibrate peak runoff, watershed timing, and runoff volumes	Historical and recorded data is often not available, especially in more rural areas; method of application is time-consuming
2	Statistical Frequency Analysis	Based on historically recorded data	Can only be used for the calibration of peak runoff amounts only; runoff volumes and watershed timing cannot be calculated The watershed in question may not fit the "regional trend[6]"
3	Regression Analysis (Regionally Derived)	Fast and not time-consuming for the modeler	Can only be used for the calibration of peak runoff amounts only; runoff volumes and watershed timing cannot be calculated

When historical precipitation and stream flow data is available, by way of recorded rain gage and stream flow information, the model can then be properly be set up to simulate hydrographs of the watershed.

If the modeler seeks to simulate a specific rainfall event, the model input needs to include information concerning the relative wetness and dryness of the watershed (antecedent moisture content) and the accurate distribution of rainfall throughout the watershed. The flow through any given watershed can be significantly impacted by the continuously changing antecedent moisture content.

Additional modifications to the simulation model are then also made in an effort to replicate the outflow hydrograph (shape and peak flow rates) at various measurement points within the watershed. The use of stream flow and rain gage data during the calibration process can only be used if the data is sufficient in amount as well as being geographically near the watershed. Since watershed distribution can vary quite significantly over relatively small areas, it is imperative that the rain and stream gages are numerous and as close as possible to the watershed in question.

The inclusion of more localized events and occurrences, such as snowmelt conditions, are typically not reliable sources of data for calibration efforts. This is because such data is not historically consistent and can often be unique to the area in question. The variation of this data over time makes it somewhat unreliable to yield realistic model simulation results.

[6] Regional trend is meant to indicate the varying flow conditions that can occur from watershed to watershed. Known rainfall data has proven that there is a possibility that precipitation conditions in one portion of a watershed can vary from that of another portion of the same watershed. This can even occur in very small watershed areas.

Lawrence County Calibration Effort

As noted previously, the two watersheds modeled during this Phase 2 planning cycle are Marshall and Coffee Runs. No existing stream gage data or other recorded information is available for either stream, so comparison of the model runs with recorded or statistically analyzed historical data are not options. There is also no detailed FEMA Flood Insurance Study peak flow information available for either of these watersheds. Therefore, the use of a regression analysis was used to properly calibrate the computer modeling efforts.

Current State of Regression Analysis Methodlogy in Pennsylvania

The most current regression analysis method for Pennsylvania is the *Regression Equations for Estimating Flood Flows at Selected Recurrence Intervals for Ungaged Streams in Pennsylvania*, (Roland & Stuckey, 2008), (Scientific Investigation Report 2008-5102), commonly referred to as USGS 5102. This method was published in 2008, after the planning effort for Lawrence County had already started. USGS 5102 presents regression equations developed for estimating flood flows at selected recurrence intervals for ungaged streams in Pennsylvania with drainage areas less than 2,000 square miles. These equations were developed using peak-flow data from 322 streamflow-gaging stations within Pennsylvania and surrounding states. All stations used in the development of the equations had 10 or more years of record data and included active and discontinued continuous-record as well as crest-stage partial-record stations. The state was divided into four regions, and regional regression equations were developed to estimate the 2-, 5-, 10-, 50-, 100-, and 500-year recurrence-interval flood flows. The equations were developed by means of a regression analysis that used basin characteristics and flow data associated with the stations. This method established equation variables for the following basin characteristics: drainage area; mean basin elevation; and the percentages of carbonate bedrock, urban area, and storage within a basin. The regression equations can be used to predict the magnitude of flood flows for specified recurrence intervals for most streams in the state; however, they are not valid for streams with drainage areas generally greater than 2,000 square miles or with substantial flow regulation, diversion, or mining activity within the basin.

Regression Analysis Methodology Used During the Current Planning Cycle

Since the Lawrence County Plan effort started prior to the release of USGS 5102, the calibration efforts described below are based on its predecessor, *Techniques for estimating magnitude and frequency of peak flows for Pennsylvania streams*" (Stuckey and Reed, 2000) USGS 4189. This method is still accepted by PennDOT and consequently is still useful for projects requiring that PennDOT standards be followed.

We recommend, however, that future design projects or calibration efforts use USGS 5102.

Lawrence County Calibration Results

In order to calibrate the watersheds, a validated flow result within the watershed would need to be known for each event. In this event, consistent stream gage data was unavailable for the entire County. For this reason, the watersheds were calibrated by comparing the un-calibrated model results to a regression analysis. The regression analysis that was used was "*Techniques for estimating magnitude and frequency of peak flows for Pennsylvania streams*" (Stuckey and Reed, 2000). This commonly accepted form of regression analysis presents equations that predict flood frequencies with return intervals or 10, 25, 50, 100, and 500-year intervals for un-gauged streams in Pennsylvania.

Specific basin characteristics were used in the regression analysis formulas depending upon how the watershed being studied correlates with one of two delegated regions within Pennsylvania. These regions were delineated based upon technical evaluations that reveal the flooding within Region A seems hydrologically unrelated to the flooding in Region B. See Figure IV-3 below for the Region map.

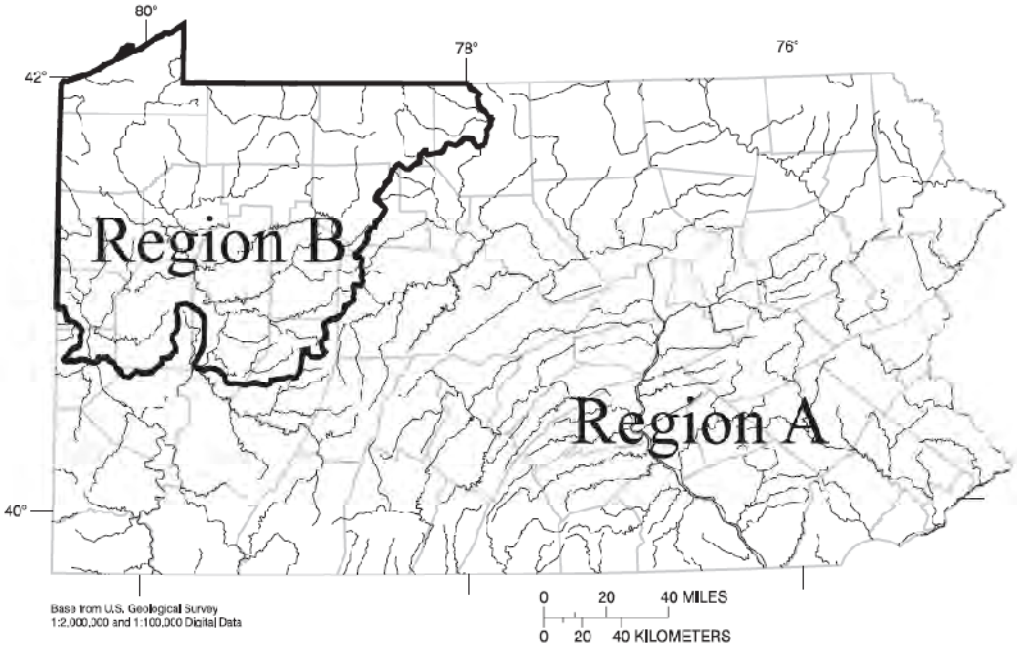


Figure IV-3
(Stuckey and Reed, 2000)

The County falls mainly within Region B. A small area in the Southwestern corner of the County falls within Region A. However, based on the goals of the plan, this specific area of the County was not designated for further study. Regression equations for Region B were developed from 54 stream flow-gauging station records and have two (2) variables, drainage area and the percentage of basin controlled by lakes, swamps, and reservoirs. The area of the State that comprises Region B does not contain any significant areas of carbonate rock coverage (Figure IV-4). The percentage of urban area coverage is consistently low for stream flow-gauging stations in Region B. An overall lack of urban area coverage results in un-meaningful results during analysis. The percentage of forest-type coverage was also not a significant variable and was therefore omitted from the analysis. From this information, each sub-basin area was analyzed utilizing the equations shown in Figure IV-4 below. It was also assumed that CA, or the percentage of basin controlled by lakes, swaps or reservoirs was zero.

Q_T return flow (ft^3/s)	Basin characteristic coefficients						Residual standard error		Coefficient of determination (R^2)
	Intercept (A)	Drainage area (b)	Percentage forested area (c)	Percentage urban development (d)	Percentage carbonate area (e)	Percentage controlled area (f)	Log units	Percent	
Region A									
Q_{10}	2.5243	0.7770	-0.9712	1.0217	-1.7184	-0.5719	0.18	43	0.93
Q_{25}	2.7145	.7556	-1.0324	.7608	-1.5302	-.5302	.19	45	.91
Q_{50}	2.8441	.7414	-1.0821	.5785	-1.3955	-.4980	.21	50	.89
Q_{100}	2.9665	.7278	-1.1342	.4040	-1.2691	-.4637	.23	55	.87
Q_{500}	3.2294	.6994	-1.2666	.0208	-.9877	-.3834	.27	66	.82
Region B									
Q_{10}	2.3105	.7255	---	---	---	-1.2425	.12	28	.96
Q_{25}	2.4418	.7108	---	---	---	-1.3700	.13	30	.95
Q_{50}	2.5276	.7017	---	---	---	-1.4695	.14	33	.94
Q_{100}	2.6069	.6932	---	---	---	-1.5677	.16	38	.92
Q_{500}	2.7673	.6776	---	---	---	-1.8055	.19	45	.89

OR

Region A

$$Q_{10} = 334.4\ DA^{.7770}\ (1 + .01F)^{-.9712}\ (1 + .01U)^{1.0217}\ (1 + .01C)^{-1.7184}\ (1 + .01CA)^{-.5719}$$

$$Q_{25} = 518.2\ DA^{.7556}\ (1 + .01F)^{-1.0324}\ (1 + .01U)^{.7608}\ (1 + .01C)^{-1.5302}\ (1 + .01CA)^{-.5302}$$

$$Q_{50} = 698.4\ DA^{.7414}\ (1 + .01F)^{-1.0821}\ (1 + .01U)^{.5785}\ (1 + .01C)^{-1.3955}\ (1 + .01CA)^{-.4980}$$

$$Q_{100} = 925.8\ DA^{.7278}\ (1 + .01F)^{-1.1342}\ (1 + .01U)^{.4040}\ (1 + .01C)^{-1.2691}\ (1 + .01CA)^{-.4637}$$

$$Q_{500} = 1{,}696\ DA^{.6994}\ (1 + .01F)^{-1.2666}\ (1 + .01U)^{.0208}\ (1 + .01C)^{-.9877}\ (1 + .01CA)^{-.3834}$$

Region B

$$Q_{10} = 204.4\ DA^{.7255}\ (1 + .01CA)^{-1.2425}$$

$$Q_{25} = 276.6\ DA^{.7108}\ (1 + .01CA)^{-1.3700}$$

$$Q_{50} = 337.0\ DA^{.7017}\ (1 + .01CA)^{-1.4695}$$

$$Q_{100} = 404.5\ DA^{.6932}\ (1 + .01CA)^{-1.5677}$$

$$Q_{500} = 585.2\ DA^{.6776}\ (1 + .01CA)^{-1.8055}$$

DA is drainage area, in square miles;
F is percentage of forest cover, in percent;
U is percentage of urban development, in percent;
C is percentage of basin underlain by carbonate rock, in percent;
CA is percentage of basin controlled by lakes, swamps, or reservoirs, in percent; and
b, c, d, e, f are basin characteristic coefficients of regression.

Figure IV-4
(Stuckey and Reed, 2000)

Calibration results for Coffee and Marshall Runs can be found in Tables IV-2 and IV-3.

Table IV-2 Coffee Run Calibration Results										
		10-year Event			25-year Event			100-year Event		
Node or Reach ID	Tributary Drainage Area (mi^2)	Regression Peak Flow (CFS)	Calibrated Model Peak Flow (CFS)	% Difference	Regression Peak Flow (CFS)	Calibrated Model Peak Flow (CFS)	% Difference	Regression Peak Flow (CFS)	Calibrated Model Peak Flow (CFS)	% Difference
W690/reach 1	0.85473	182.40	181.5	0%	247.40	250.2	1%	362.80	369.2	2%
W720/reach 2	0.17018	56.56	51.1	10%	78.56	73.6	6%	118.52	113.9	4%
J259	1.02491	208.08	207	1%	281.48	286.8	2%	411.46	426.2	4%
W700/reach 3	0.16166	54.49	59.8	10%	75.74	81.1	7%	114.37	117.4	3%
J251	1.18657	231.41	237	2%	312.36	315.8	1%	455.43	469.1	3%
W740/reach 5	0.33454	92.36	93.6	1%	127.01	128.3	1%	189.35	187.9	1%
W750/reach 4	0.20823	65.48	63.4	3%	90.67	89	2%	136.31	133.5	2%
W870/reach 7	0.37711	100.74	98.3	2%	138.29	136	2%	205.74	201.1	2%
J242	0.58534	138.59	133.1	4%	189.03	178.8	5%	279.05	256.9	8%
W820/reach 8	0.205	64.74	66.1	2%	89.67	92.4	3%	134.84	138.3	3%
W840/reach 9	0.19292	61.95	67.8	9%	85.88	91	6%	129.28	130.7	1%
J229	0.98326	201.91	200.9	1%	273.30	275.3	1%	399.79	403.6	1%
J245	2.50437	397.87	390.5	2%	531.19	533.3	0%	764.36	773.6	1%
W760/reach 11	0.16028	54.15	56.3	4%	75.28	77.1	2%	113.69	113.11	1%
W860/reach 10	0.34312	94.07	108	15%	129.31	142	10%	192.70	198.3	3%
J239	3.00777	454.41	450.1	1%	605.05	597.4	1%	867.84	842.8	3%
W800/reach 13	0.31165	87.73	93.8	7%	120.77	125.2	4%	180.27	178	1%
J226	3.31942	488.10	494.5	1%	648.97	651.8	0%	929.22	917.3	1%
W930/reach 14	0.10938	41.04	46.8	14%	57.38	61.8	8%	87.24	87.2	0%
J220	3.4288	499.72	504.1	1%	664.10	663.6	0%	950.34	932.9	2%
W1090/reach 15	1.2868	245.43	249.7	2%	330.90	334.5	1%	481.76	479.1	1%
J274	4.7156	629.70	639.2	2%	832.92	848.4	2%	1185.26	1199.4	1%
W1120/reach 16	0.15383	52.56	62.7	19%	73.11	81.8	12%	110.50	113.8	3%
J212	4.86943	644.53	644.4	0%	852.14	856	0%	1211.93	1209.5	0%
W1150/reach 21	0.46884	117.98	124.4	5%	161.44	167.6	4%	239.26	240.7	1%
W1180/reach 25	0.10855	40.82	46.5	14%	57.07	61.8	8%	86.78	88	1%
W1220/reach 26	0.29186	83.65	96	15%	115.27	125.7	9%	172.26	175	2%
J236	0.40041	105.22	137.2	30%	144.32	180.6	25%	214.47	253.3	18%
J254	5.73868	726.10	714.3	2%	957.67	947.7	1%	1358.09	1338.3	1%
W970/reach 23	2.1762	359.32	342.5	5%	480.72	460.5	4%	693.44	690.5	0%
W1200/reach 22	1.3408	252.86	219	13%	340.71	317	7%	495.69	493.3	0%
outlet	9.25568	1027.09	967.4	6%	1345.16	1295.3	4%	1891.62	1878.5	1%

Table IV-3
Marshall Run Calibration Results

		10-year Event			25-year Event			100-year Event		
Node or Reach ID	Tributary Drainage Area (mi^2)	Regression Peak Flow (CFS)	Calibrated Model Peak Flow (CFS)	% Difference	Regression Peak Flow (CFS)	Calibrated Model Peak Flow (CFS)	% Difference	Regression Peak Flow (CFS)	Calibrated Model Peak Flow (CFS)	% Difference
W190/reach 2	0.10846	40.79	45.7	12%	57.03	59.9	5%	86.73	83.6	4%
W220/reach 1	0.26645	78.30	85.1	9%	108.04	111.3	3%	161.72	155.2	4%
J35	0.37491	100.31	129.8	29%	137.72	169.8	23%	204.91	237	16%
W230/reach 9	0.51407	126.13	138.8	10%	172.36	185.3	8%	255.03	264.1	4%
W240/reach 3	0.25653	76.17	71.8	6%	105.16	103.2	2%	157.52	159	1%
J30	1.14551	225.57	224	1%	304.64	303.4	0%	444.44	440.2	1%
W270/reach 10	1.0397	210.26	224.8	7%	284.36	300.6	6%	415.57	429.7	3%
W260/reach 7	0.61753	144.08	140.7	2%	196.36	192.1	2%	289.60	280.6	3%
outlet	2.80274	431.72	424.8	2%	575.43	577.8	0%	826.39	836.6	1%

SECTION V STANDARDS AND CRITERIA FOR STORMWATER CONTROL

A. Watershed Level Control Philosophy

Within any watershed, an increase in development or disturbance to the natural hydrology results in an overall increase in peak runoff rates, stormwater runoff volumes, and in many cases, a decrease in overall stormwater runoff quality.

The traditional approach to stormwater management has been the site specific or on-site control approach. The goal was to create a situation where the post-development peak runoff rates did not exceed those of the pre-development rates. This was often done through on-site collection and then conveyance to a large detention basin (or system of basins), located somewhere on the low point of the site. For many years, this was the methodology and philosophy behind managing stormwater.

However, new regulations (the result of new research) have begun to dictate the mitigation of not only peak runoff rates, but also runoff volumes and the issue of water quality. On-site stormwater management is still a key factor in overall watershed management; however, these new limiting factors can complicate the management process and make the traditional methods of managing stormwater a way of the past. New technologies and implementation practices are becoming the norm and no longer the anomaly.

The management of runoff volumes from a developed site is becoming a very important contributing factor, not only to on-site stormwater management, but also in overall watershed management. On-site volume controls (through various methods such as infiltration, stormwater re-use, bio-retention, limiting the source of runoff, etc.) are greatly reducing the volume of water (and the timing of its conveyance) that needs to be transported by streams through the watershed. This aids significantly in reducing excessive flows and volumes that can result in stream bank erosion and destructive flooding. On-site volume control also helps in the recharge of groundwater tables and aquifers by keeping the water within the watershed, instead of simply releasing it at a slower rate through the water shed and into adjacent, downstream watersheds. This methodology also helps in the management of water quality, an increasingly important issue. By allowing the natural characteristics of the watershed the ability to filter and treat runoff naturally, overall water quality can be greatly improved.

B. National Pollutant Discharge Elimination System (NPDES), Phase II Requirement

"In 1990, the US Environmental Protection Agency (EPA) promulgated federal National Pollutant Discharge Elimination System (NPDES) regulations for stormwater discharges under the Clean Water Act. These regulations, among other discharge requirements, established the federal Phase I NPDES stormwater discharge program that requires permit coverage for all operators of large construction activities proposing to disturb five or more acres of land. Effective October 10, 1992, operators of large construction activities required NPDES permit coverage in Pennsylvania for such activities. In December 1999, EPA promulgated NPDES Phase II regulations that require permit coverage for small construction activities that disturb one to less than five acres, which result in a point source discharge to waters of the United States. Effective December 7, 2002, the Pennsylvania Department of Environmental Protection (DEP) integrated the federal Phase II NPDES requirements into the existing Pennsylvania Phase I NPDES permit for stormwater discharges associated with construction activities (NPDES Construction Permit). An important distinction between Phase I and II is that the small construction activities only require permit coverage when the activity disturbs one to less than five acres and will result in a point source discharge to surface waters of the Commonwealth" (Pennsylvania DEP, 2007).

The National Pollutant Discharge Elimination System (NPDES) Stormwater Program regulates stormwater discharges from three potential sources: municipal separate storm sewer systems (MS4s), construction activities,

and industrial activities. Most stormwater discharges are considered point sources, and operators of these sources may be required to receive an NPDES permit before they can discharge. This permitting mechanism is designed to prevent stormwater runoff from washing harmful pollutants into local surface waters such as streams, rivers, lakes or coastal waters.

The Pennsylvania Department of Environmental Protection (DEP) is responsible for administering the state's stormwater management program. Pennsylvania's stormwater program is closely modeled after the federal NPDES program, which requires stormwater be treated to the maximum extent practicable. Pennsylvania's NPDES stormwater program establishes permitting requirements for construction sites disturbing more than one acre, industrial sites, and MS4s. All MS4s should currently be permitted, or in the permit process. Each permitted MS4 will be responsible for establishing a Stormwater Management Program (SWMP).

This program affects all municipalities in "urbanized areas" of the state. This definition applies to all Lawrence County municipalities as listed in Table V-1.

Table V-1

County Name	Municipality Name	Urbanized Area Name (UA)
Lawrence	Ellport Borough	Pittsburgh
Lawrence	Ellwood City Borough	Pittsburgh
Lawrence	Perry Twp.	Pittsburgh
Lawrence	Wayne Twp.	Pittsburgh
Lawrence[7]	New Castle City	N/A

The Phase II Rule defines a small MS4 stormwater management program consisting of six elements that when implemented together, are expected to result in significant reductions of pollutants discharged into receiving water bodies (United States Environmental Protection Agency, Revised, 2005).

All municipalities that are required to implement the MS4 program are required to address the following six minimum control measures (MCM's):

1. Public Education and Outreach
2. Public Involvement/Participation
3. Illicit Discharge Detection and Elimination
4. Construction Site Stormwater Runoff Control
5. Post-Construction Stormwater Management in New Development and Redevelopment
6. Pollution Prevention/Good Housekeeping for Municipal Operations

At a minimum, municipal entities regulated under MS4 must:

- Specify BMPs and implement them to the "maximum extent practicable"
- Identify measurable goals for control measures

[7] MS4s outside UAs may be designated by PADEP for inclusion in the Phase II Program

- Develop an implementation schedule of activities or frequency of activities, and
- Define the entity responsible for implementation

All municipalities must adopt, amend, and implement such ordinances and regulations, including zoning, subdivision and development, building code, and erosion and sedimentation ordinances, as are necessary to regulate development within the municipality in a manner consistent with the Plan and the provisions of Act 167.

The adoption of the Lawrence County Stormwater Management Plan and model ordinance by Lawrence County Officials and by all Local Municipalities will successfully satisfy the basic requirements noted above. Acceptance by all necessary stakeholders and parties will also satisfy at least one of the six required MCMs of the NPDES II program, specifically, post-construction stormwater management in new development and redevelopment.

There are no exemptions to the guidelines set forth by the NPDES program and therefore all impacted municipalities will need to comply with any additional measures and guidelines of the plan and ordinance. The additional requirements concerning water quantity and water quality control guidelines shall be strictly implemented and enforced, regardless of project size. All necessary BMPs that address and mitigate stormwater runoff peak runoff, runoff volume, and water quality must all be met in order to be considered in compliance.

Any applicants proposing development in a given NPDES municipality would be required to provide BMP design information to the municipality in order to prove the municipality's compliance with at least one of the required NPDES Phase II regulations.

C. Standards and Criteria

The purpose of the Act 167 plan is to ensure the proper management of stormwater runoff and associated issues. The plan is intended to provide information and guidance to allow the design professional to manage stormwater in a manner that is consistent with proven, acceptable, and effective engineering practices; and to protect the public welfare through the protection of environmental resources. This would include acceptable land-use management practices as well as additional measures that will conserve and protect existing water sources and all other surface waters of the Commonwealth.

The plan is also intended to reduce destructive and potentially dangerous flow conditions caused by accelerated surface runoff (due to excessive development) by reducing overall peak flow rates and volumes and return existing stream capacities to a quantity more conducive to their size. The restoration of the flood capacity of such streams is of paramount importance to protecting existing natural features as well as protecting the public and property.

The provisions that shall be implemented concerning the recharging and infiltration of stormwater runoff will not only help to achieve the goal of returning streams to their natural flow capacities, but also to help recharge groundwater tables and aquifers that have been diminishing in recent years.

The easiest way to accomplish the goals of the Act 167 plan is by the implementation of BMPs that will help to return the hydrological flow characteristics of a given watershed to a state comparable to its natural capacity and capabilities. This is the driving force behind the Act 167 Plan's concept of watershed-wide stormwater management and maintenance.

In order to achieve the desired results of the Act 167 plan, the following five objectives should be implemented so that the watersheds can be properly conserved and protected:

1. Maintain groundwater recharge
2. Maintain or improve water quality
3. Reduce channel erosion
4. Manage overbank flood events

5. Manage extreme flood events

Refer to Figure V-1 for a schematic approach on how each of the five objectives can be accomplished and how their implementation can be achieved.

The standards were developed to take into account a number of land use and development activities. The standards provide the design professional with proven and common stormwater management methods and guidelines for their implementation.

The standards also incorporate information from the following tasks or assessments completed during both Phase 1 and Phase 2 activities:

Mapping of physical characteristics

- Maps depicting the characteristics of soils and land use have been included in this Plan. These areas were identified using existing spatial data. This information can then be streamlined and used as specific impact parameters for the computer model used for analysis of the necessary watersheds. The results of these model analyses can then be used to formulate rate release district maps as well as rate release values in these watersheds.

Obstruction Locations

- Mapping depicting the location of known structures and obstructions has been included in this Plan. These obstructions were identified by way of surveys sent to each municipality, through available spatial data, and through field visits. Based on the limited scope of the project and Plan, the identified obstructions have not been analyzed for capacity or potential impacts because of future development. This task will be addressed in more detail during the next planning cycle.

Land Development Patterns

- Mapping depicting the areas most likely poised for future growth has been included in this Plan. These areas were identified by way of surveys sent to each municipality and by the County Planning Department. Potential strategies for negative impact mitigation are addressed in various locations within this Plan.

Flood Hazard Areas

- Based on the reduced scope of the project and Plan development and based on limited historical and future planning, a detailed review of such areas and their impacts on flooding or stormwater runoff has not been included in this plan. Section III of this Plan identifies areas those areas that lie within floodplains and the specific land use of those areas. This task will be addressed in more detail during the next planning cycle.

Drainage problems and Solutions

- Mapping depicting the current known problem areas and their location within the county are included within the Plan. Mapping is based on municipal and stakeholder surveys conducted during Phase 1. The means for addressing these problems are addressed in various locations throughout the Plan and with a detailed description and breakdown of specific BMP measures that can be implemented in order to alleviate a specific problem area's impact on the watershed(s) in which it is located. The most common problems were identified and specific criteria for alleviating their impacts are included in this Plan.

Stormwater Collection and Conveyance Systems

- Based on the reduced scope of the project and Plan development and based on limited historical information pertaining to existing collection and conveyance systems, a detailed review of such systems and their impacts on flooding or stormwater runoff has not been included in this plan. This task will be addressed in more detail during the next planning cycle.

Alternative Runoff Control Techniques

- Based on the reduced scope of the project and Plan development, specific criteria for identifying alternative runoff control techniques on a watershed-by-watershed basis has not been included in this plan. These criteria should be considered for future revisions of the plan. In lieu of prioritization of localized implementation criteria, the Plan shall be used in broader terms and currently contains information on addressing several factors that may or may not be present in each specific watershed. This task will be addressed in more detail during the next planning cycle.

Federal, State, and Local Flood Control Projects

- As of the publication of this Plan, no known flood control projects exist or are intended for implementation. Future revisions of the Plan should incorporate any new flood control projects and their potential impacts on the watershed(s) in which they reside.

Identification of Areas for Future Stormwater Collection and Conveyance Systems

- Growth in Lawrence County is slow and sporadic enough that the County and municipalities are primarily in a reactive mode regarding extension of stormwater collection and control facilities. Based on the reduced scope of the project and Plan development, specific criteria designating areas to be served by stormwater collection and control facilities have not been included. Consequently, estimates relating to the design capacity and cost of such facilities are not included in this planning cycle. The Model Stormwater Ordinance within this Plan, and required to be adopted by each municipality (in its simplest form) does contain information and guidelines related to financing, construction and operation, and institutional arrangements to implement and operate the facilities. The information provided is intended as guidance information only. This task will be addressed in more detail during the next planning cycle.

Location of Flood Plains

- Mapping depicting the current FEMA flood plain and flood hazard areas and their location within the county is included within the Plan.

Criteria and Standards for Stormwater Control

- The Model Stormwater Management Ordinance contained within this Plan contains specific criteria and standards for the control of stormwater runoff from existing and new developments that are necessary to minimize dangers to property and life and carry out the purposes of the Plan. At its most basic structure, this Model Ordinance is required to be adopted by each municipality (more stringent measures can be enacted on a municipality-by-municipality basis).

Plan Implementation Priorities

- Only Marshall and Coffee Runs are addressed in this planning cycle. All other watersheds identified in the Phase 1 Scope of Study were excluded from this planning cycle. Based on the limited scope of the project and Plan development, specific criteria for implementation on a watershed-by-watershed basis have not been included in this plan. These criteria should be considered for future revisions of the Plan. In lieu of prioritization of specific implementation factors, the Plan shall be used in broader terms and currently contains information on addressing several factors that may or may not be present in each specific watershed. This task will be addressed in more detail during the next planning cycle.

It is required that the plan be reviewed and revised in five (5) year cycles in order to identify and address the relevance of the plan as well as addressing the following items that may not be included in the current plan and are related to mitigation of future problems and consistency with other land use plans:

- This allows for the identification of new problems or areas within the watershed that require attention and potential strategies for alleviating them. Plan revision also allows for the implementation of newer and more efficient technical strategies and procedures for the management of stormwater runoff.
- This allows for the implementation of new regulatory practices and resolutions that may have been enacted at the local, State and Federal levels that influence the management and future management of stormwater runoff. This includes new regulatory guidance and land use plans that impact future development and stormwater runoff management methods and technology.

Detailed stormwater management measures and BMP information can be found in the Pennsylvania Stormwater Best Management Practices Manual, (Document #363-0300-002), prepared by the Pennsylvania Department of Environmental Protection (PADEP BMP Manual). Such information includes:

- Selection Criteria
- Sizing and Computational Information
- Maintenance
- Construction Specifications
- Applicability
- Safety Procedures

The PADEP BMP Manual is the key source for information concerning acceptable and applicable stormwater management BMP measures in Pennsylvania that will allow the designer to achieve conformance with Control Guideline – 1 (CG-1) or Control Guideline -2 (CG-2), which is outlined within the manual.

PennDOT and Pennsylvania Turnpike Commission Projects

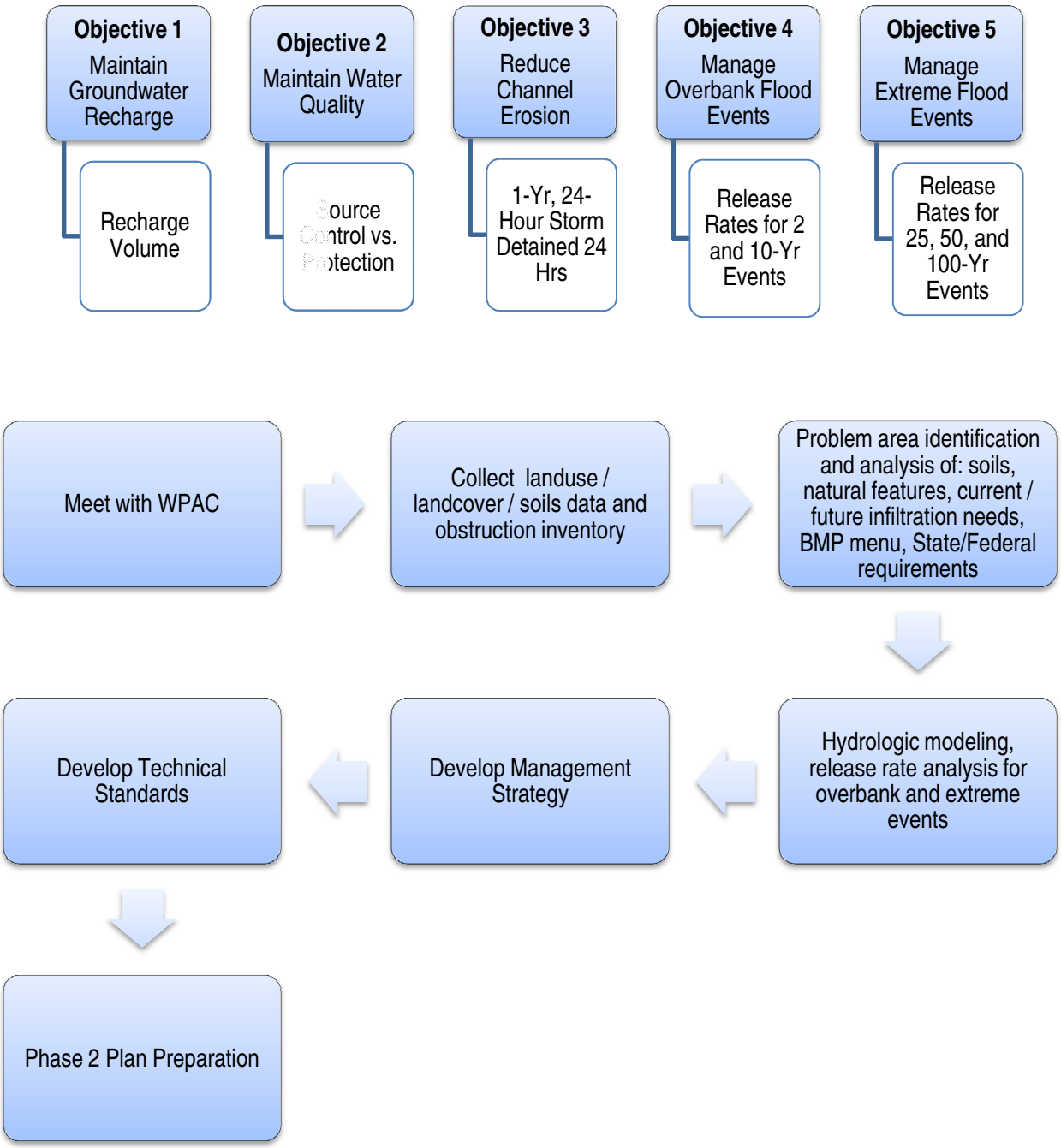
In addition to the information contained herein, for projects regulated by PennDOT or the Pennsylvania Turnpike Commission (PTC), the following shall govern their administration:

For purposes of Act 167 Stormwater Management Plans (Plans), design policy pertaining to stormwater management facilities for PennDOT and PTC roadways and associated facilities are provided in Sections 13.7 (Anti-degradation and Post Construction Stormwater Management Policy) of PennDOT Publication No. 13M, Design Manual Part 2 (August 2009), as developed, updated, and amended in consultation with PADEP. As stated in DM-2.13.7.D (Act 167 and Municipal Ordinances), PennDOT and PTC roadways and associated facilities shall be consistent with Act 167 Plans. DM-2.13.7.B (Policy on Anti-degradation and Post Construction Stormwater Management) was developed as a cooperative effort between PennDOT and PADEP. DM-2.13.7.C (Project Categories) discusses the anticipated impact on the quality, volume, and rate of stormwater runoff.

Where standards in Act 167 Plans are impracticable, PennDOT or PTC may request assistance from DEP, in consultation with the county, to develop an alternative strategy for meeting state water quality requirements and the goals and objectives of the Act 167 Plans.

For purposes of this Act 167 Plan, road maintenance activities are regulated under 25 Pa Code Chapter 102.

Figure V-1
Five Comprehensive Management Objectives and Analysis Process



Objective 1 – Maintain Groundwater Recharge

Surface water reaches the ground surface and then sheet flows to adjacent streams or water bodies. A portion of this surface water returns to the atmosphere through evapotranspiration or sublimation. Yet another percentage of the water returns to the soil through infiltration and groundwater recharge. Typically, water infiltrates through the soil until it is transferred through the evapotranspiration process or it reaches the groundwater table and replenishes the local aquifer.

The movement of water through the sub-surface is complex, and less permeable soils, clay layers, and rock strata are often encountered, especially in areas in the central and western portions of Pennsylvania. This water moving through the soil is typically referred to as one of the following:

- Gravitational water or drainage water
- Capillary Water (water held in soil pores by surface attraction, sometimes called "capillary action")
- Hygroscopic Water (water tightly held within soil particles and removable only through the physical drying process of the soil)

While capillary water does play a role in evaporation processes, gravitational/drainage water is the primary concern from a stormwater management perspective. Figure V-2 provides an illustrative representation of the water cycle process.

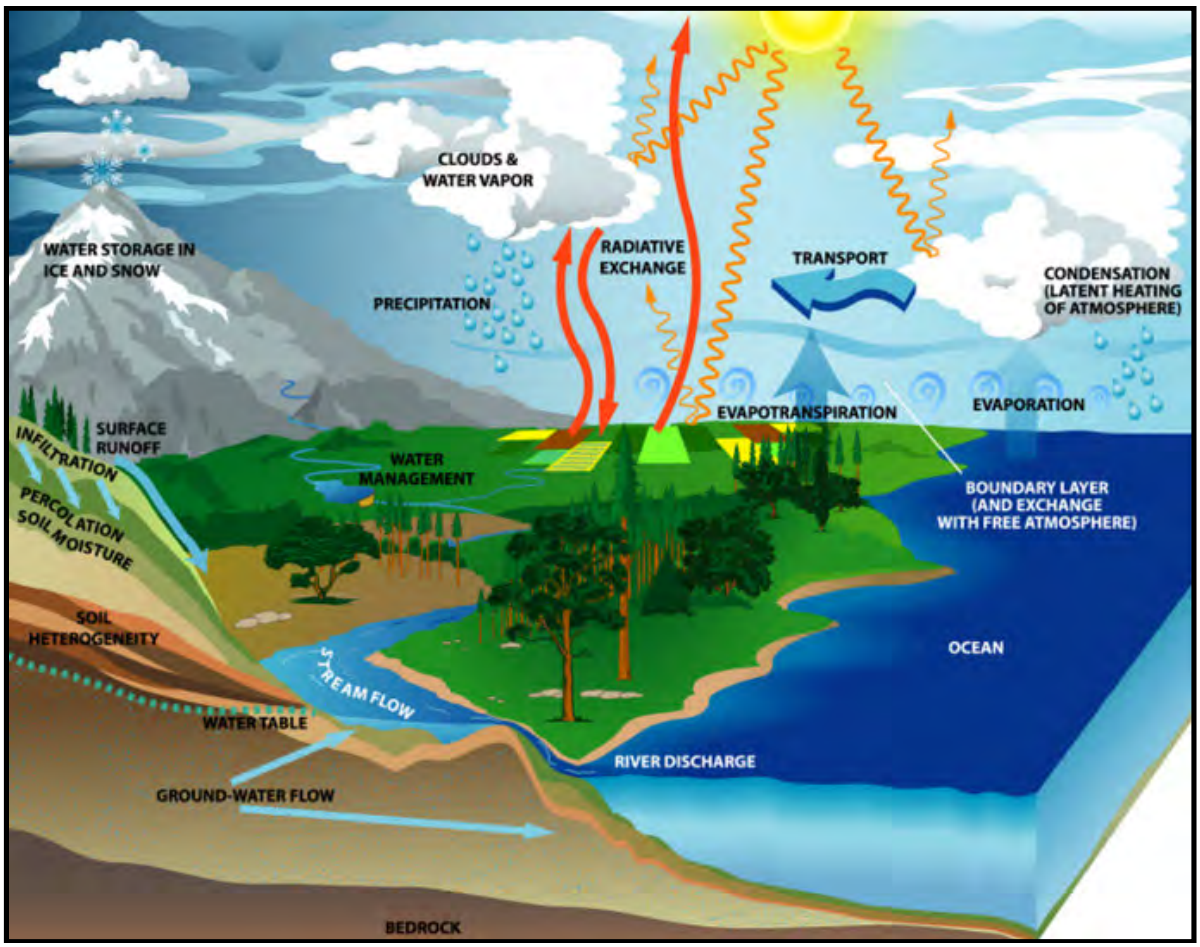


Figure V-2
(US Climate Change Science Program, 2003)

The process and ease by which gravitation water is transmitted through soil layers is based upon several factors. These factors include:

- Layering
- Structure
- Texture
- Presence of macropores (flow pathways within the soil)

The texture of a soil is based upon the ratio of sand, clay, and silt present in the soil. The permeability and hydraulic conductivity of a soil layer is significantly affected by the grain size of the soil layer. In general, these flow characteristics decrease as the grain size of the soil layer decreases. Gravitation or drainage water moves more easily through sand than it does through silty or clay-based soils. The texture of an individual soil layer also influences the shape of the wetting front as water travels through it due to the cohesive forces of both the water and the soil particles themselves.

One of the most critical components of understanding the methods and practice by which the designer will recharge the existing groundwater aquifer is by gaining an understanding of the specific soils on a project site and how their individual characteristics will influence the infiltration and absorption of excess stormwater runoff.

Maintaining groundwater recharge helps maintain watershed hydrology and is a method of meeting specific stormwater management regulations for volume control, peak-rate control, and even water quality.

There are many acceptable and practical methods for infiltrating water and thereby meeting the requirements for ground water recharge. The PADEP BMP Manual breaks BMPs down by the desired function of the designer as well as by structural or non-structural methods. Non-structural methods can be a cost effective means of addressing the infiltration/recharge issue, as well as the other necessary technical objectives when dealing with stormwater runoff. However, there are times when non-structural methods are not practical or cannot provide the necessary results from a quantitative standpoint. Some of the more common structural and non-structural BMP applications are listed in Table V-2.

Table V-2[8]

Recommended BMPs for Groundwater Recharge/Infiltration

Non-Structural BMPs	Structural BMPs
Protection of Sensitive Areas	Infiltration Basins and Trenches
Site Clustering	Subsurface Infiltration Beds
Minimize Soil Compaction	Drywells/Seepage Pits
Reduce Street/Parking Imperviousness	Constructed Filters
Minimize Total Disturbed Area	Rain Gardens
Rooftop Disconnection	Floodplain Restoration Practices

[8] BMP methods are taken directly from the Pennsylvania DEP's, *Pennsylvania Stormwater Best Management Practices Manual*, and are intended for use in the most commonly encountered site conditions. Specialized BMPs should be used as necessary.

A comprehensive list of non-structural and structural BMPs and their applicability towards a specific technical objective can be found in Figures V-7 and V-8 at the end of this chapter.

The requirements pertaining to the proper and adequate design, sizing and application of stormwater BMPs shall be in strict accordance with local and Commonwealth regulations, as well as the design information contained in the PADEP BMP Manual. The PADEP BMP Manual provides comprehensive information concerning the applicability of specific BMPs as well as other necessary requirements concerning soil testing, case studies, available resources, design formulas, information pertaining to vegetative covers, and other necessary guidance materials. It should be noted however, that while the PADEP BMP Manual is the preeminent source for proper BMP design in Pennsylvania, it is intended to be used as a guide and should not discourage the experienced design professional from using additional BMPs or to curtail the innovative process and application of stormwater management methods that may not be listed in the current BMP Manual version. While the manual does contain specific guidelines and criteria that must be followed, it is not intended to be the sole source for stormwater management design. Additional and hybrid management methods will be considered by the proper regulatory agency on a case-by-case basis.

Another additional factor to consider during the implementation of recharge/infiltration BMP usage is the surrounding site conditions. Not all sites chosen for development will be sites that have been untouched and undisturbed for several years. There are also specific sites within the Commonwealth that have been identified for their special contribution to the waters of the Commonwealth or have been deemed environmentally sensitive areas. The PADEP BMP Manual refers to these specific types of sites as "special management areas." The following list identifies some of the more commonly encountered special management areas:

- Karst Areas
- Brownfields
- Previously Mined Areas
- Surface and Well Water Supply Areas
- Highways and Roads
- Special Protection Watersheds (High-Quality and Exceptional Value Watersheds)

Special care and consideration must be taken when these types of sites are encountered. The presence of such sites does not necessarily prohibit the designer from using infiltration practices. However, specific guidelines and overall environmentally sensitive decisions should be exercised when these types of sites are encountered. These types of sites are extremely prevalent in western Pennsylvania, with the possible exception of karst areas, which tend to occur more often in central and southeastern Pennsylvania.

Karst Areas: Karst is the description given to areas underlain by substantial areas of carbonate bedrock (limestone and dolomite) that have been partially dissolved. The movement and shifting motion this specific type of strata over millions of years have caused fractures and faults to develop. These fractures have also undergone substantial chemical weathering by weakly acidic water. This has caused the bedrock to dissolve, leaving behind voids and severely weakened areas. These voids are a major contributor to such anomalies as sinkholes, caves, and surface depressions. These areas are also often related with significant variations in the depth to bedrock and groundwater tables, as well as streams that "disappear" into the subsurface. A decision concerning the use or non-use of infiltration in these areas is a critical one. While infiltration is recommended, it must be done only after careful consideration and selective decision-making has taken place. Extensive subsurface investigation is recommended in these areas and special care should be used when selecting the areas on the development in which to attempt infiltration. The presence of karst topography does not need necessarily need to be a prohibitive factor in the decision to infiltrate. Source control (reducing surface runoff at the point it is created) is another important factor. Reducing the overall amount of runoff generated will greatly aid in the design required for the infiltration process.

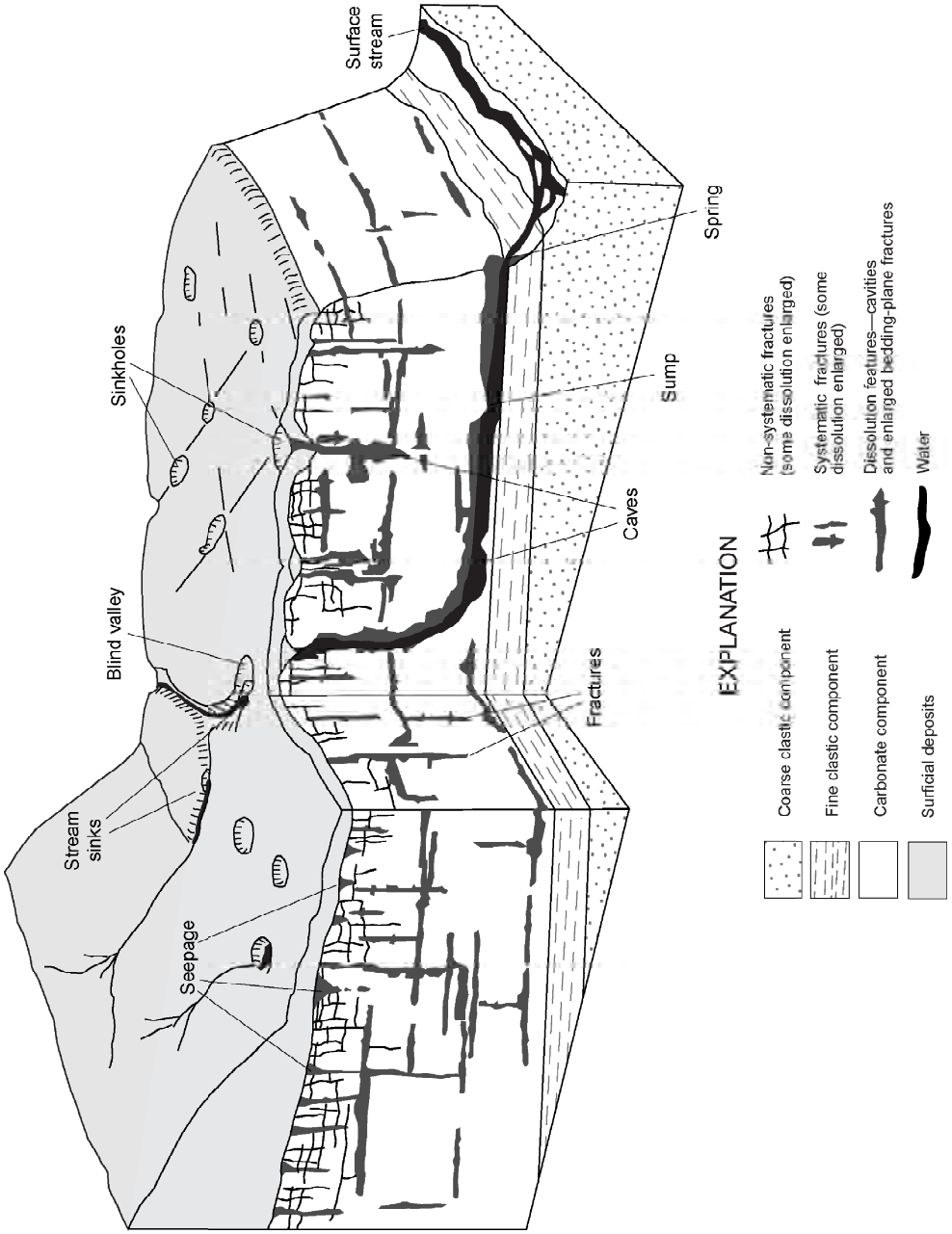


Figure V-3
(Lively, 1995)

The PADEP BMP Manual suggests some of the following BMPs for application in karst areas:

Table V-3[9]

Recommended BMPs for Karst Areas

Increased Storage	Increased Infiltration	Decreased Velocity	Pollution Control / Water Quality
Dry Detention Ponds	Runoff/Level Spreaders	Increased Vegetation Density	Filter Berms
Wet Retention with Lined Settling Ponds	Porous Pavement	Vegetated Swales	Gravel or Sand Filtration Systems
Shallow Detention Ponds	Improved Sinkholes / Class V Injection Wells[10]	Terraced Slopes	Peat Moss or Activated Carbon Filtration Systems
Vegetated Roofs	Perforated Pipes	Rip Rap (preferably using carbonate rock, e.g. limestone)	Constructed Wetlands (Lined)
	Bioretention Cells/Rain Gardens		Increased Vegetation Density/Rain Gardens
			Compost

Brownfield Areas: Brownfields are areas within the Commonwealth where the potential presence of hazardous materials and pollutants could hinder future development. Applicable laws concerning the classification of brownfields should be consulted prior to beginning the process of any potential development work; however, brownfields can often be found in areas (though not limited to) that fall into the following categories:

- Abandoned steel mill facilities or sites
- Abandoned industrial facilities or sites
- Areas where petroleum or petroleum by-products were stored (e.g. fueling stations)
- Areas related to specific mining activities
- Abandoned commercial facilities or parking facilities

Areas such as these pose a threat to the environment by being contaminated with a number of possible pollutants.

However, while these areas are often deemed a blight on the community, they are prime locations for the use of smart-growth technologies. The redevelopment of these sites can help revitalize depressed areas, contribute to environmental clean up through mitigation of the hazardous materials, and serve the public interest by providing a mixed-use environment to help the community thrive.

[9] BMP methods are taken directly from the Pennsylvania DEP's, *Pennsylvania Stormwater Best Management Practices Manual*.
[10] Class V Injection wells are used to inject non-hazardous fluids underground. The more common types of injection wells include simplistic, gravity-based systems (e.g. stormwater drainage wells, cesspools, septic tanks) and more sophisticated systems such as aquifer storage/recovery wells and geothermal electric power wells. (United States Environmental Protection Agency, 2007)

When applying for any permits for a site deemed as a brownfields site, it is important to disclose the following information, as well as any other necessary or requested information, per the PADEP BMP Manual:

- Existing and previous land uses
- Potential pollutants, along with a summary of sampling data.
- Source and location of the potential pollutant(s) on the Erosion and Sediment Control (E&S) Plan drawings,
- A description of what measures are proposed to manage and control discharges of these pollutants to eliminate the potential for pollution to surface waters of the Commonwealth.

Table V-4[11]

Recommended BMPs for Brownfields

Soil Contact Areas	Non-Soil Contact Areas
Bio-Retention in areas where soil has been remediated or pollutants are NON-SOLUBLE in nature. Soils containing soluble pollutants should be filtered through the bio-retention areas and then allowed to exit via by-pass piping. Infiltration in these areas should not be permitted.	Stormwater Collection/Re-Use • Vegetated Roofs • Cisterns • Rain Barrels
Stormwater management options are available for use on brownfield sites where the contaminated soil has been completely removed from the site. These options include minimizing earth disturbance and soil compaction, minimizing impervious areas, maximizing stormwater infiltration (where applicable), and dispersing runoff to BMPs scattered across the site rather than concentrating runoff to just a few locations.	
With the exception of structural stormwater infiltration BMPs, the stormwater management BMP measures listed in PADEP BMP Manual are also available for use on brownfield sites where potentially contaminated soil is isolated and sealed, or the contaminated soil was blended with clean soil. Since soil contaminants are still present at these sites, the use of structural stormwater infiltration BMPs should be used only if the residual soil contaminants are non-soluble pollutants.	
Refer to the PADEP BMP Manual and supporting documentation for additional information on stormwater management, remediation, and environmental due diligence concerning the development of brownfield sites.	

Highways and Roads: Highways and roadways within the Commonwealth have the potential to severely affect the hydrologic integrity of any watershed. The increase of impervious area (a near certainty in new roadway construction) results in excessive peak runoff rates and volumes. The other key issue concerning highway and roadway construction in relationship to stormwater management is that of water quality. The potential for heavy metals, de-icing salts and chemicals, petroleum pollutants, hazardous materials from vehicular spills, as well as thermal impacts during hot-weather months, can all contribute to de-graded water quality. The following table taken from the PADEP BMP Manual lists suggested BMPs available for roadway and highway applications:

[11] BMP methods are taken directly from the Pennsylvania DEP's, *Pennsylvania Stormwater Best Management Practices Manual*, and are intended for use in the most commonly encountered site conditions. Specialized BMPs should be used as necessary.

Table V-5[12]

Recommended BMPs for Highway and Roadway Applications

Non-Structural BMPs	Structural BMPs
Reduced roadway/cartway widths (as applicable, and in accordance with all local and Federal regulations)	Vegetated Swales and Infiltration Trenches along contours perpendicular to the road and along the right-of-way
Reduction or elimination of curbs and gutters	Bioretention areas along the roadway
Reduction of stormwater collection/conveyance infrastructure (as applicable, and in accordance with all local and Federal regulations)	Bioretention and Bio-Infiltration in cul-de-sac areas
	Catch Basin Inserts and Treatment Devices

Mined Areas: Areas of proposed development that have been previously mined should be treated with special care. Areas that have been strip/ surface mined or are underlain by deep wall mining facilities are an extremely difficult location in which to apply stormwater BMPs. Acid mine drainage caused by previously (and presently) mined areas is one of the largest environmental problems in Pennsylvania. The infiltration and percolation of water through mined areas has resulted in thousands of miles of contaminated streams and waterways. Infiltration and groundwater recharge BMPs are prohibited in such areas, thus rendering most available structural BMPs unusable for development in these areas. There are only a few acceptable and practical structural BMP methods available for use in these areas. BMPs such as vegetated roofs and capture/re-use (e.g. rain barrels) methods are applicable. Limiting and prohibiting infiltration or percolation of stormwater runoff into previously mined sites is of the utmost importance.

The most reasonable solution for the management of runoff is through the re-direction of stormwater runoff from areas contaminated with mine wastes. If this is not entirely feasible then the use of lined BMPs should be considered to separate the runoff from the contaminated soils. Lined detention basins for rate mitigation are an option for storage. Volume reduction in these areas is specifically difficult to achieve. Rate mitigation and water quality should be the primary factors for the designer. The most important item to consider when proposing a plan for development is to provide for the protection and restoration of native vegetative cover to the greatest extent possible. Natural vegetative cover provides the best method of treating and restoring these soils back to their native conditions (Pennsylvania Department of Environmental Protection, 2006).

Groundwater Supply Areas: Any stormwater management practice in areas adjacent to ground water supply sources is of critical importance. It is estimated that approximately half of Pennsylvania's residents receive their drinking water from ground water supply sources (Pennsylvania Department of Environmental Protection, 2006)

In relationship to the protection of groundwater supplies, three (3) zones must be taken into consideration when proposing the use of infiltration practices for new development:

- Zone 1 – The innermost protective zone surrounding a well, spring, or existing infiltrative gallery. This zone ranges from 100 to 400 feet depending on the site-specific source and characteristics of the aquifer (Pennsylvania Department of Environmental Protection, 2006). Proposed infiltration BMPs should not be located in Zone 1 protection areas (Pennsylvania Department of Environmental Protection, 2006).

[12] BMP methods are taken directly from the Pennsylvania DEP's, *Pennsylvania Stormwater Best Management Practices Manual*, and are intended for use in the most commonly encountered site conditions. Specialized BMPs should be used as necessary.

- Zone 2 – The capture zone that encompasses the area of the aquifer through which it supplies water to a well, spring, or existing infiltration gallery. This zone is determined to be a one-half mile radius around the source unless more extensive hydrogeological testing is done. Extreme care should be used when implementing infiltration BMPs in Zone 2 areas. Aquifers can become easily contaminated, and therefore extensive pretreatment measures should be used to filter and diminish pollutants (Pennsylvania Department of Environmental Protection, 2006).
- Zone 3 – The area beyond the capture zone and contributes significant recharge to the capture zone aquifer in Zone 2 (Pennsylvania Department of Environmental Protection, 2006).

  A minimum distance of 50 feet should be used when placing infiltration BMPs adjacent to privately owned wells and water sources serving non-community supply systems (Pennsylvania Department of Environmental Protection, 2006).

As in nearly all instances, some of the best measures available for adequately managing stormwater runoff are to eliminate or reduce the amount of runoff at its source of generation. This can be done by reducing impervious areas or through the capture and re-use of stormwater runoff. Another recommended practice is the scattering of stormwater BMPs across the entire development site. The measure of dispersing stormwater runoff more evenly helps to maintain the hydrological balance within the watershed and helps to prevent the concentration of runoff quantities and pollutants at only a few points within the watershed. The pre-treatment of stormwater runoff prior to dispersing it can make water quality mitigation much easier and more effective.

Table V-6[13]

Recommended BMPs for Areas Adjacent to Ground Water Supply Areas

Non-Infiltrative BMPs
Reduce Parking Imperviousness
Rooftop Disconnection
Vegetated Roof
Rain Gardens/Bioretention
Capture and Re-Use
Wet Ponds
De-icing alternatives consisting of sand or other inert materials

Surface Water Supply Areas and Special Protection Watersheds: Stormwater management practice in areas adjacent to surface water supply sources and special protection watersheds (exceptional value, EV and high quality, HQ, as determined by the PA DEP) is of critical importance. The PA DEP anti-degradation requirements can be met in these watersheds by infiltrating a volume in the post-development conditions that is equal or greater than that of the pre-development infiltration volume. Another component of this requirement is that the post-development runoff is pre-treated and managed so that it will not degrade the physical, chemical, or biological characteristics of the receiving water body (Pennsylvania Department of Environmental Protection, 2006).

The project should be designed and constructed in a manner that will minimize the amount of impervious area. Any post-development runoff that is generated should then be infiltrated to the maximum extent possible. Water quality BMPs should be implemented across the site for adequate treatment but also to help in spreading the water across

[13] BMP methods are taken directly from the Pennsylvania DEP's, *Pennsylvania Stormwater Best Management Practices Manual*, and are intended for use in the most commonly encountered site conditions. Specialized BMPs should be used as necessary.

the watershed and not concentrating it at only a few points. The last component is that the final volume and rate of any stormwater discharge must be properly managed to prevent the physical degradation of the receiving waterway, including scour and stream bank stabilization. Appropriate BMPs for pre-treatment and for addressing water quality issues can be found in Table V-7, later in this chapter.

While infiltration is a key factor in stormwater management in areas adjacent to surface water supply areas and special protection watersheds, care must be taken during the design process. Any proposed infiltration BMPs within two miles on either side of surface water supply areas or special protection waters must be designed and constructed to provide maximum pollutant removal prior to the runoff being infiltrated or discharged to the receiving stream.

The proximity of infiltration areas and adjacent surface water areas and special protection waters should follow the following guidelines:

- Zone A – Represents a 1/4 mile buffer on either side of the river or stream extending from the area 1/4 mile downstream of the intake upstream to the five hour time-of-travel (TOT) (Pennsylvania Department of Environmental Protection, 2006).
- Zone B – Represents a two-mile buffer on either side of the water body extending from the area 1/4 mile downstream of the intake upstream to the 25 hour TOT. (Pennsylvania Department of Environmental Protection, 2006).
- Zone C – The remainder of the watershed area (Pennsylvania Department of Environmental Protection, 2006).

Objective 2 - Water Quality

Maintained landscape areas and impervious surfaces (e.g. roadways, parking lots, common pedestrian areas, etc.) collect pollutants that are carried in solidified form, or are dissolved and transported via runoff to the surface waters of the Commonwealth. Pollutants such as nitrates, phosphorus, suspended solids, oils, and petroleum by-products can be transported to, and cause the pollution of nearby streams and lakes.

It has been shown in many studies that these pollutants display their heaviest concentrations at the start of a runoff event, often referred to as the “first flush.” Many particulates such as suspended solids, trash/litter, heavy metals, organic particles and clay particles can often be observed in a water body prior to the occurrence on the peak runoff.

Areas where accelerated pollutants are generated in are often referred to as pollutant “hot spots.” These hot spots often occur at the following locations:

- Fueling Stations
- Parking Lots
- Dumpsters and Trash Disposal Areas
- Industrial Sites
- Areas Prone to Heavy Travel and Traffic

While these areas appear obvious as potential sources of pollution, the notion that pervious areas do not generate pollution is a large misconception. Maintained lawns, landscaped areas, gardens, and other “natural” areas can cause pollution due to the use of chemicals and fertilizers. An undisturbed, pervious area can often possess the ability to treat and remove pollutants from direct runoff. However, the previously mentioned areas are often constructed upon heavily compacted soils that do not allow any natural infiltration or surface filtration of potentially polluted runoff. In essence, these heavily compacted areas can often take on the physical characteristics of impervious (e.g. paved, concrete, rooftops, etc.) areas.

The proper approach to managing stormwater quality is a two-phased method. The first phase is control of point source of pollutants, and the second phase is protecting, restoring, and creating the natural systems that are able to capture and remove these pollutants from direct stormwater runoff.

Stormwater quality and quantity are inherently linked. Their singular management can become a simultaneous endeavor, even in situations where this is not the designer's initial intent. This is related to the fact that many stormwater *quantity* BMPs, by the nature and physical process of how they function, actual serve as effective stormwater *quality* BMPs as well.

The two most common types of pollutants found in stormwater runoff are solutes (dissolved particles) or particulates (particles still in solidified form). An example of these two types of pollutants can be found by examining two common fertilizers, phosphorous (often referred to as total phosphorus or TP) and nitrate (NO_3). Stormwater BMPs that rely on filtration or delayed detention are highly effective at the removal of total phosphorous because the pollutant typically remains in particulate form and will bond to colloidal soil particles. This keeps the particulates larger in size, making them more easily captured.

Nitrates on the other hand, tend to be found in soluble form and are not impacted by structural BMPs that rely on filtration or capture of suspended solids. Therefore, it is imperative to consider exactly what types of pollutants are to be targeted.

As with many BMP applications, when compared with their intended use, the use of a cost-benefit analysis can often be a useful tool in determining the most effective means of implementing a BMP treatment design. While it may seem elementary in nature, one additional method of treating pollutants is to curtail the generation of them at the source. The selection of vegetative cover that requires little to no treatment or fertilization, emergency spill management plans, oil/grease separation devices, and any other means that either eliminates/decreases the potential for pollutants, or greatly aids in their immediate capture prior to being introduced to stormwater runoff is a very effective means of treating potential pollutants.

The PADEP BMP Manual offers many non-structural and structural solutions for treating pollutants in stormwater runoff that will help the designer meet the requirements of the technical objectives for water quality. Table V-3 lists some of the more common and recommended BMPs for water quality.

Table V-7[14]

Recommended BMPs for Water Quality Treatment

Non-Structural BMPs	Structural BMPs
Protect Sensitive and Special Value Areas	Landscape Restoration
Protect/Conserve/Enhance Riparian Areas	Constructed Wetlands
Cluster Uses at Each Site; Build on Smallest Area Possible	Vegetated Filter Strips
Concentrate Uses Area Wide Through Smart Growth Practices	Constructed Filters
Minimize Soil Compaction in Disturbed Areas	Infiltration Trenches/Infiltration Basins
Re-Vegetate and Re-Forest Disturbed Areas, Using Native Species	Subsurface Infiltration Beds

[14] BMP methods are taken directly from the Pennsylvania DEP's, *Pennsylvania Stormwater Best Management Practices Manual*, and are intended for use in the most commonly encountered site conditions. Specialized BMPs should be used as necessary.

A comprehensive list of non-structural and structural BMPs and their applicability towards a specific technical objective can be found in Figures V-7 and V-8 at the end of this chapter.

Another area of particular concern in regards to water quality is that of impaired waters and total maximum daily/pollutant loadings (TMDLs).

Using the watershed approach requires selection or definition of watershed size, and begins with a comprehensive assessment of water quality problems in the watershed. Pennsylvania has already begun this effort with its Un-assessed Waters Initiative, which will assess over 83,000 miles of surface waters. After water quality problems are identified, a planning process occurs to develop strategies that can successfully address and correct water pollution problems in the watershed. Pennsylvania is using this process, in conjunction with federal Clean Water Act requirements, for establishing TMDLs to clean up polluted streams so that they meet water quality standards. Water quality standards are the combination of water uses, such as water supply, recreation and aquatic life, to be protected and the water quality criteria necessary to protect them.

TMDLs must be developed for several categories[15]:

- Point sources (permitted sewage and industrial discharges)

  Point source TMDL development is very similar to developing water quality-based effluent limitations for water discharge permits. The TMDL is developed to meet water quality standards for the critical period during the summer, when streams are at low flow and the effluent makes up a greater percentage of the water. This method assures that under less severe conditions, water quality will also be protected. DEP has carried out this same type of analysis using several well-established modeling tools for many years under the National Pollutant Discharge Elimination System (NPDES) program. Under this program, DEP calculates limits on the amount of pollutants that sewage and industrial facilities may discharge and still protect water quality. New tools were not needed for these types of TMDLs and most have been completed. By regulation, the TMDLs are implemented through DEP's issuance and enforcement of permits.

- Nonpoint sources (agriculture and urban runoff)

  Nonpoint sources are not subject to the same regulatory requirements as point sources.

  Furthermore, the critical period for nonpoint or runoff sources is not during low flow conditions, but when rainfall washes pollutants across the land and into the streams. For these reasons, the tools that determine TMDLs for point sources do not work for nonpoint sources. DEP has developed a reference watershed approach to develop nonpoint source TMDLs. This method compares an unimpaired watershed of similar size, geology and land use distribution to the impaired watershed. Geographic Information Systems (GIS) technology is employed in the characterization of land use, background pollutant concentrations in soil and groundwater and other physical and chemical properties of each watershed. Computer simulation models are then used to estimate the loading rates in each watershed and to determine the load reductions of pollutants needed to correct the impairment. A load allocation is assigned to each contributing source, and those sources identified as the causes of impairment are given prescribed reductions. The TMDL sets the stage for citizens to define a plan to correct the impairments. DEP will support their efforts to develop the plan and, through Growing Greener grants, will provide funds to put practices in place to correct the problems. For nonpoint source TMDLs, the input of local citizens replaces the regulated implementation procedures for point source TMDLs.

[15] Per PA DEP Document 3800-FS-DEP2248

- Lakes

  Lakes have characteristics that differentiate TMDLs from other waters. Lakes are not free flowing like streams, but are contained waters that trap pollutants for long periods. Most lake impairments are from high nutrient or sediment loads. Wherever possible, lake TMDLs are developed with the information in the lake study reports that were sponsored by local watershed groups or other local interests. Target acceptable pollutant loads are set at the level of a watershed largely unaffected by human induced impacts. Load allocations are given to the pollutant sources using the same methods as nonpoint source TMDLs. Other indicators of water quality are also considered in the evaluation of a lake. One indicator is the Tropic Status Index (TSI), which refers to the degree of nutrient enrichment in the lake. Nutrient enrichment causes growths of algae that consume oxygen and interfere with the health of the aquatic organisms in the lake. The TSI is affected by factors such as lake volume, water residence time and nutrient loads to the lake. After target loads are set, the TSI is evaluated under reduced nutrient load conditions to assure that the pollutant reductions will bring the TSI into an acceptable range. Implementation of lake TMDLs is best accomplished though local participation.

- Abandoned mine drainage (also called acid mine drainage or AMD)

  AMD from abandoned surface and underground coalmines is a leading source of impairment to Pennsylvania waters. AMD can seriously degrade the aquatic habitat and the quality of water supplies because of toxicity, corrosion, incrustation and other effects from dissolved constituents. The TMDL analysis of AMD streams uses a statistical method of determining the in-stream allowable loading rate at the point of interest in the stream. Discharges that are permitted or have a responsible party are point sources, and make up the waste load allocation portion of the TMDL. Nonpoint sources are all other sources and constitute the load allocation. AMD impaired watersheds are evaluated for aluminum, iron, manganese and pH using statistics and Monte Carlo (probability) simulations to model existing conditions, to determine required reductions and to calculate allowable concentrations. When the reductions are met, the water quality standards will be met.

- Specific bio-accumulative chemicals (PCBs and chlordane that contaminate fish, resulting in fish advisories limiting or banning the number of fish that a person can safely consume)

  The overall goal of a PCB/chlordane TMDL is to achieve the fishable/swimmable goal of the Clean Water Act. Fish consumption advisories are issued when fish samples exceed certain triggers. For PCBs, the advisory is based on protection of human consumers from neurological effects. A Federal Drug Administration (FDA) action level determines when an advisory for chlordane is issued. Advisories cause the water to be listed as impaired and make TMDLs necessary. The method used for PCB/chlordane TMDLs is to translate the fish tissue concentration into a water column concentration by using a bio-concentration factor. Bio-concentration factors are mathematical expressions that account for fish accumulating the pollutants in their bodies. Accumulation is based on pollutants in the sediment being ingested by small organisms, which are then consumed by larger organisms, small fish and larger fish, each time magnifying the amount of pollutant that is introduced into tissue of the consumer. The TMDL defines how much the loading of pollutant must decrease in order to meet the water quality standard. Meeting the water quality standard in the water means the fish living in the water will be acceptable to consume.

- Complex situations (combinations of different types)

  Complex TMDLs draw on the procedures for all the TMDL types previously discussed.

A list of TMDLs currently identified in Lawrence County by major watershed, along with pertinent information is listed below[16]:

Table V-8

County TMDLs by Major Watershed

Watershed	Information	Status
Beaver River	County: Lawrence, Beaver Category: Fish Consumption Cause: Chlordane, PCB HUC: 5030101, 5030104	EPA Approved 4/9/2001
Duck Run	County: Lawrence Category: AMD Cause: Metals HUC: 5030105	EPA Approved 4/9/2009
Ohio River	County: Lawrence, Allegheny, Beaver, Washington Category: Fish Consumption Cause: Chlordane, PCB HUC: 5030101, 5030106, 5030201	EPA Approved 4/9/2001
Shenango River	County: Lawrence, Mercer Category: Fish Consumption Cause: Chlordane, PCB HUC: 5030102, 5030104	EPA Approved 4/9/2001

Refer to Table III-4 in Section III for a County summary of non-attaining segments of the Streams Integrated List representing stream assessments for the Clean Water Act Section 305(b) reporting and Section 303(d) listing.[17] PA DEP protects four (4) stream water uses: aquatic life, fish consumption, potable water supply, and recreation. If a stream segment is not attaining any one of its four uses, it is considered impaired.

Objective 3 – Reduce Channel Erosion

Several areas of stream bank erosion were found within Lawrence County and the associated watersheds during the stakeholder surveys and site visits. As storm flows increase, the corresponding flow velocities in streams also increase, thus exacerbating stream bank erosion problems. Typical stream bank capacities are equivalent to approximately the 1 ½-year storm, and stream banks begin to erode when flows approximate this depth. Therefore, stream flows kept to near the one-year storm flow would minimize stream bank erosion. Detaining the 2-year post-development storm to the one-year predevelopment storm and detaining the 1-year storm a minimum of 24 hours would therefore minimize the number of storms causing stream bank erosion. However, the County does not intend to implement this approach during this planning cycle. Instead, the County will assess the effect of implementing the

[16] PA DEP TMDL Website http://www.dep.state.pa.us/watermanagement_apps/tmdl/default.aspx, more detailed information pertaining to these TMDLs and their physical properties, including locations and quantities can be found on the website
[17] PA DEP Office of Water Management, Bureau of Water Supply & Wastewater Management, Water Quality Assessment and Standards Division, 2006

proposed model ordinance countywide and evaluate whether this approach should be reconsidered during the next planning cycle

The PADEP BMP Manual's approach to mitigating the 2-yr, 24-hour stormwater runoff volume also greatly assists in achieving this Objective. The on-site retention (through infiltration, re-use, etc.) of this runoff volume interrupts site-specific stormwater runoff events and delays the arrival of any site-specific hydrographs to the watershed's point of interest (POI). The continuous delay of water contribution to a watershed's conveyance stream will greatly decrease the volume of water that the stream must convey at any one time (and flow velocity as well). This delay allows less water to be conveyed over a longer period. This not only helps restore the benefits of the natural water cycle, but also aids in the reduction of stream channel erosion.

Table V-9[18]

Recommended BMPs for Preventing Stream bank Erosion
(Tennessee Department of Environment and Conservation)

Vegetative BMPs	Structural BMPs
Stream Buffers	Infiltrative Practices to Reduce Overall Volume
Erosion Control Blankets and Netting	Detention/Retention to Delay Time to Peak of Peak Flows
Select Vegetative Covering	Sediment Filtering Devices (silt fence, interceptor devices, sediment basins, constructed wetlands, slope drains, etc.)
Disturbed Area Stabilization (e.g. mulch, sod, etc.)	Check Dams (to reduce flow velocities)
Spray Polymers and Other Binding Agents (for use in areas with very fine soil particles)	Protective Channel Linings (e.g. geotextiles, gabion baskets, rip rap linings, etc.)

Objective 4 – Manage Overbank Flood Events

Overbank and localized flooding events are a common problem in Lawrence County. Overbank events have the potential to damage conveyance structures and property downstream from the overbank event location. Overbank events are often caused by new development and the subsequent discharge of additional stormwater runoff to adjacent streams that do not have the capacity to convey the flows without exceeding the defined bed and bank of the stream.

The typical stream usually has the capacity to convey storm events up to the 2-year storm. The 2-year event is therefore generally assumed to be the point where a stream reaches its "bank full" capacity. This is the point where the stream is flowing completely full and is about to spill over bank and encroach into the adjacent flood plain.

An overbank event is typically considered a flooding event that occurs due to a rainfall between the 2-year and 10-year storm events (Center for Watershed Protection, 2000). Anything beyond the 10-year event usually floods to a much greater extent, commonly referred to as an "extreme event," which will be discussed in the next section.

The typical method for preventing overbank events is to properly manage runoff from the 2-year through 10-year storm events. This is most effectively done by not increasing the peak discharge of these storm events from the pre-development to post-development scenarios. Peak rate and volume mitigation of these storm events is a crucial

[18] BMP methods are suggested based upon research and real-world performance, and are intended for use in the most commonly encountered site conditions. Specialized BMPs should be used as necessary.

factor in managing and preventing overbank events. In areas where there is a history of excessive overbank event occurrences, additional mitigation might be necessary to address the problem at a watershed level basis.

The necessity to go beyond managing stormwater to a degree where it is quantitatively equal from the pre-development and post-development conditions may not be adequate. Additional control measures using the "release rate" concept may be required in certain watersheds. The release rate concept will be discussed in more detail later in this Section.

While overbank events can have a detrimental impact on downstream property and structures, they also provide a beneficial effect to the ecosystem within the floodplain. The deposition of suspended sediments can help replenish topsoil to agricultural lands as well as raising the elevation adjacent to streams, which can help prevent further erosion over time. Overbank events that occur in typically rural and non-inhabited areas are often a benefit to the local ecosystem and are generally not considered for extensive mitigation measures.

Objective 5 – Manage Extreme Flood Events

Extreme events are similar to overbank events in that they represent a flooding scenario due to the lack of capacity in the conveying stream. However, these extreme events go beyond those of the previously discussed overbank events in their ability to cause damage.

Storm events in excess of the 10-year event have the greatest potential for causing extreme events. The most common storms (based on common modeling practices) that can lead to extreme events are the 25, 50, and 100-year storm events.

It is virtually impossible to eliminate all occurrences of overbank and extreme flooding events. However, it is prudent to control the frequency at which these events occur. The goal is to achieve a balance or between the recurrence interval of overbank and extreme events. This balancing point or benchmark is created so that upstream development can occur and yet not create a situation where downstream events occur on a more frequent basis and have more damaging effects.

D. Release Rate Stormwater Management District Concept (For Overbank and Extreme Events)

Throughout the Commonwealth, many of the previously created Act 167 plans implemented a "release rate" approach to stormwater management. The release rate concept is simply a way of managing post-development runoff rates by pre-determining a release rate (as a percentage value of the pre-development peak runoff rates) that is applicable to a specific watershed or portion of a watershed.

This release rate value is created to limit the amount of water being discharged from a smaller, sub-watershed area into a larger watershed area downstream. This is typically done in areas where problems already exist and flooding events are more common. Release rates are a way of over-detaining stormwater runoff to help alleviate downstream capacity problems.

A release rates is calculated by analyzing the peak rate of runoff for an overall watershed area, as well as the time at which this flow peaks. This time is then applied to each individual sub-watershed area. The rate of runoff from each individual sub-watershed area (at the overall watershed's peak time) is documented. The runoff rate from the overall watershed is then divided by the runoff rate from the sub-watershed's runoff rate (at the peak time of the overall watershed). If the peak runoff rate for the overall watershed is greater than that of the individual sub-watershed, a value that is greater than or equal to 1.0 is achieved. This indicates that no additional rate release constraints need to be applied to the sub-watershed area. However, if the overall watershed's peak rate of runoff is less than that of any sub-watershed's peak runoff (at the time to peak of the overall watershed), then a decimal value is achieved (Paul A. DeBarry, 2004)

Release Rate Calculation Example:

In a fictitious watershed consisting of two sub watersheds comprising one overall watershed, the pre-development runoff rates are shown in Figure V-4:

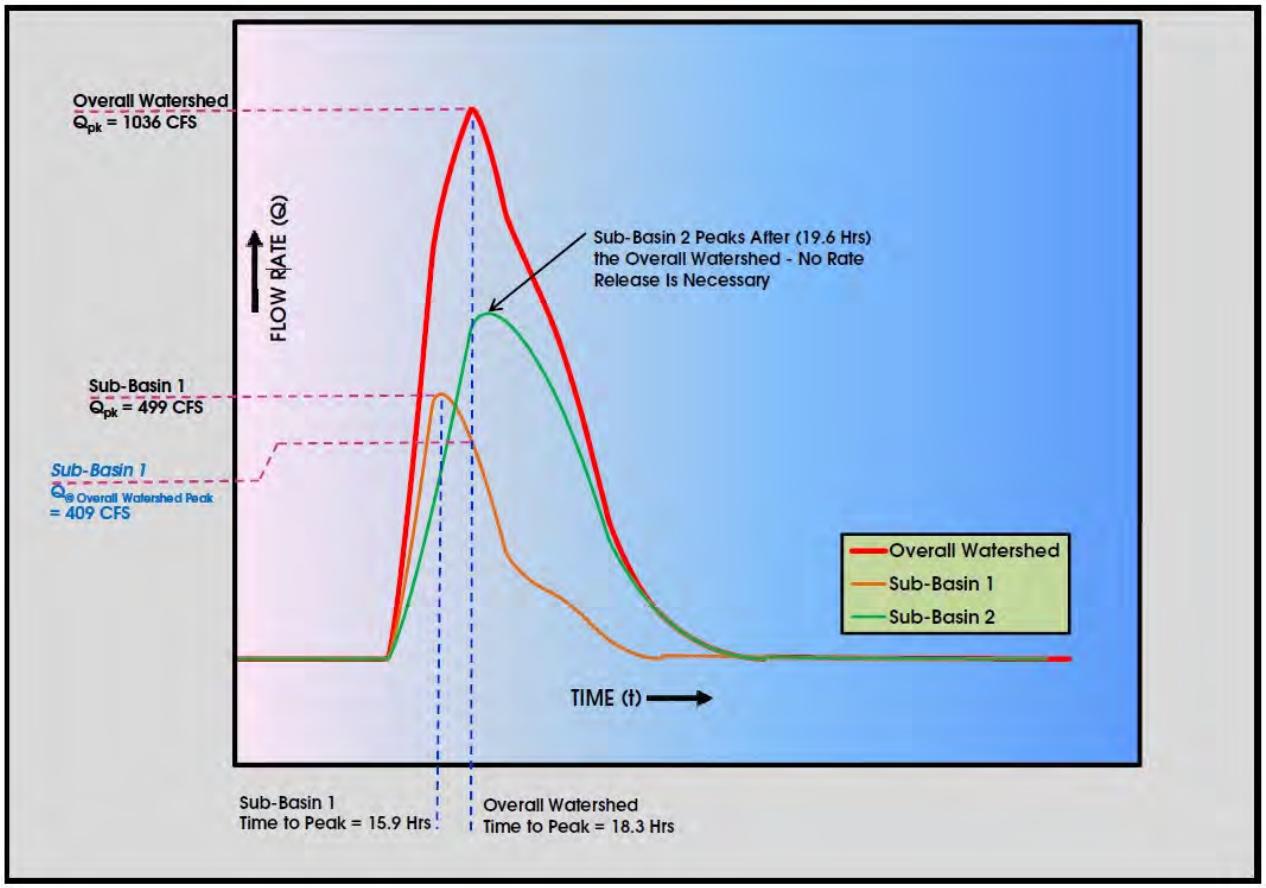


Figure V-4

The pre-development runoff rate of Sub-Basin 1 is 499 CFS and this watershed peaks at 15.9 hours. The pre-development runoff rate of Sub-Basin 2 is 650 CFS and this watershed peaks at 19.6 hours. The pre-development runoff rate of the overall watershed (Sub-Basin 1 and Sub-Basin 2 combined) is 1036 CFS and this watershed peaks at 18.3 hours.

Based upon the fact that Sub-Basin 1 peaks prior to the overall watershed, Sub-Basin 1 contributes a flow of 409 CFS at the time of peak of the overall watershed.

In the rate release method, only sub-watersheds that peak prior to the overall watershed are taken into account. Therefore, Sub-Basin 2 does not require any release controls.

Development within Sub-Basin 1 later occurs which results in an overall increase of runoff from Sub-Basin 1. The flow increases from 499 CFS to 713 CFS. Traditionally, the design of a detention structure would be implemented to control the peak rate of runoff from the developed watershed to ensure that the post-development rate is equal to or less than that of the pre-development conditions. The results of the impacts

of the new detention basin that will control flow and limit post-development runoff to 499 CFS (the pre-development flow rate) are shown in Figure V-5:

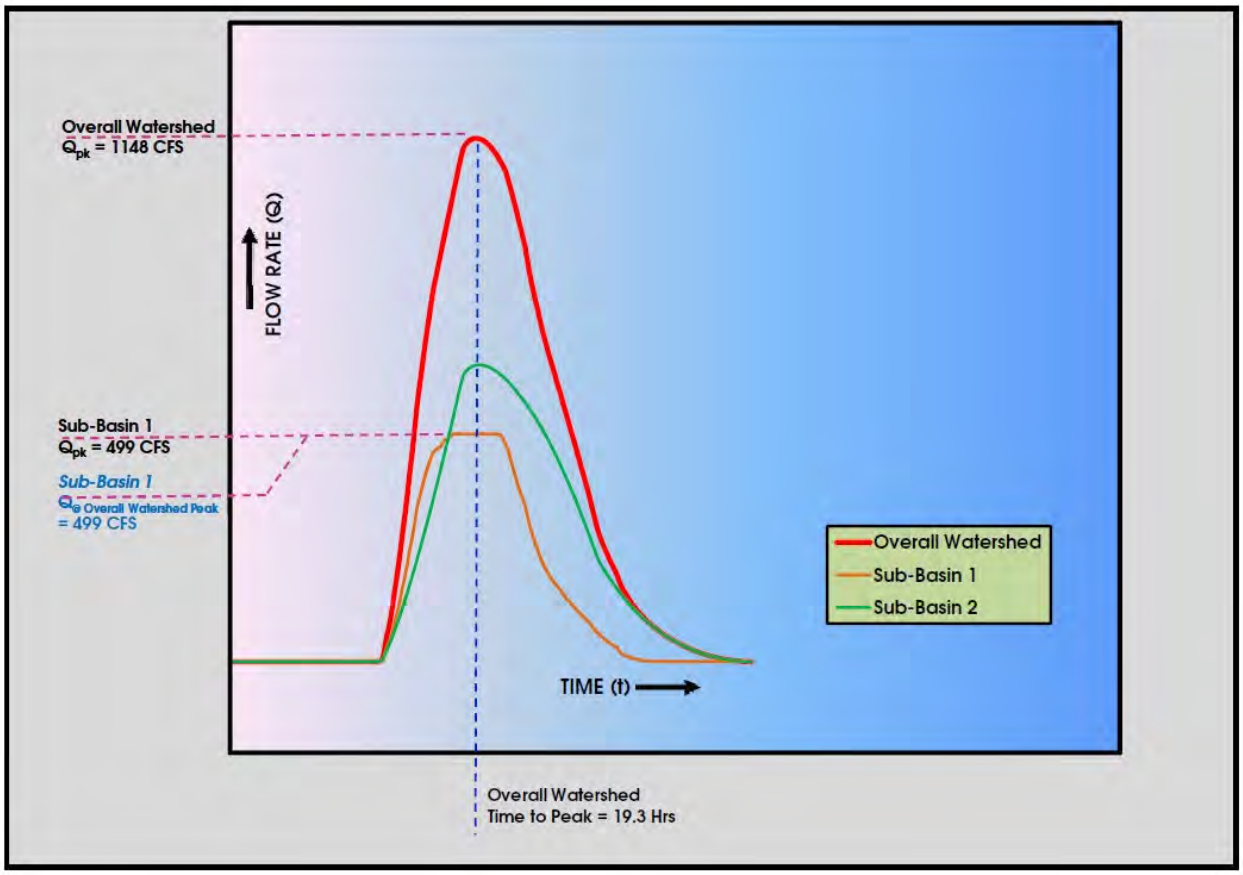


Figure V-5

As can be seen from the figure, the pre-developed flow rate of 499 CFS from Sub-Basin 1 has been maintained. However, the amount of flow that Sub-Basin 1 contributes to the overall watershed, at the overall watershed's time to peak, has increased by 90 CFS. This is a result of the new detention structure in Sub-Basin 1 releasing a higher volume of water, at a slower rate and over a longer period. While the flow discharging from Sub-Basin 1 is equal between the pre and post-developed conditions, the overall watershed's discharge rate has increased 112 CFS.

Therefore, instead of simply controlling the rate of release of Sub-Basin 1 as a singular entity, it must be analyzed in a more comprehensive manner, as part of the overall watershed.

Taking into account the pre-development runoff rate of Sub-Basin 1 at the time the Sub-Basin peaks (499 CFS) and the amount of runoff from Sub-Basin 1 at the time the overall watershed peaks (409 CFS), this creates the need for rate release control.

The calculation is done by dividing the amount of pre-development runoff from Sub-Basin 1 at the time the overall watershed peaks (in this case 409 CFS) and the peak rate of runoff from Sub-Basin 1. Keeping in mind only sub-basins that peak prior to the overall watershed peaks require rate controls.

Therefore: **409 CFS / 499 CFS = 81.9%**

In order to simplify the release rate districts or zones, the calculated release rates can be rounded slightly. In this case, 81.9% will be rounded to **80%**. This is now the allowable release rate for Sub-Basin 1. Any development that will result in a net increase of runoff from the pre-developed condition to the post-developed condition will require an additional 80% beyond the pre-development peak runoff rate.

A sample development in this example Sub-basin 1 may have a development condition peak flow of 100 CFS. Using the calculated release rate, then the final post-development site can only release a peak flow of 80% of 100 CFS, or 80 CFS.

Looking at the original example, when the 80% release rate is applied to Sub-Basin 1, the following results are achieved:

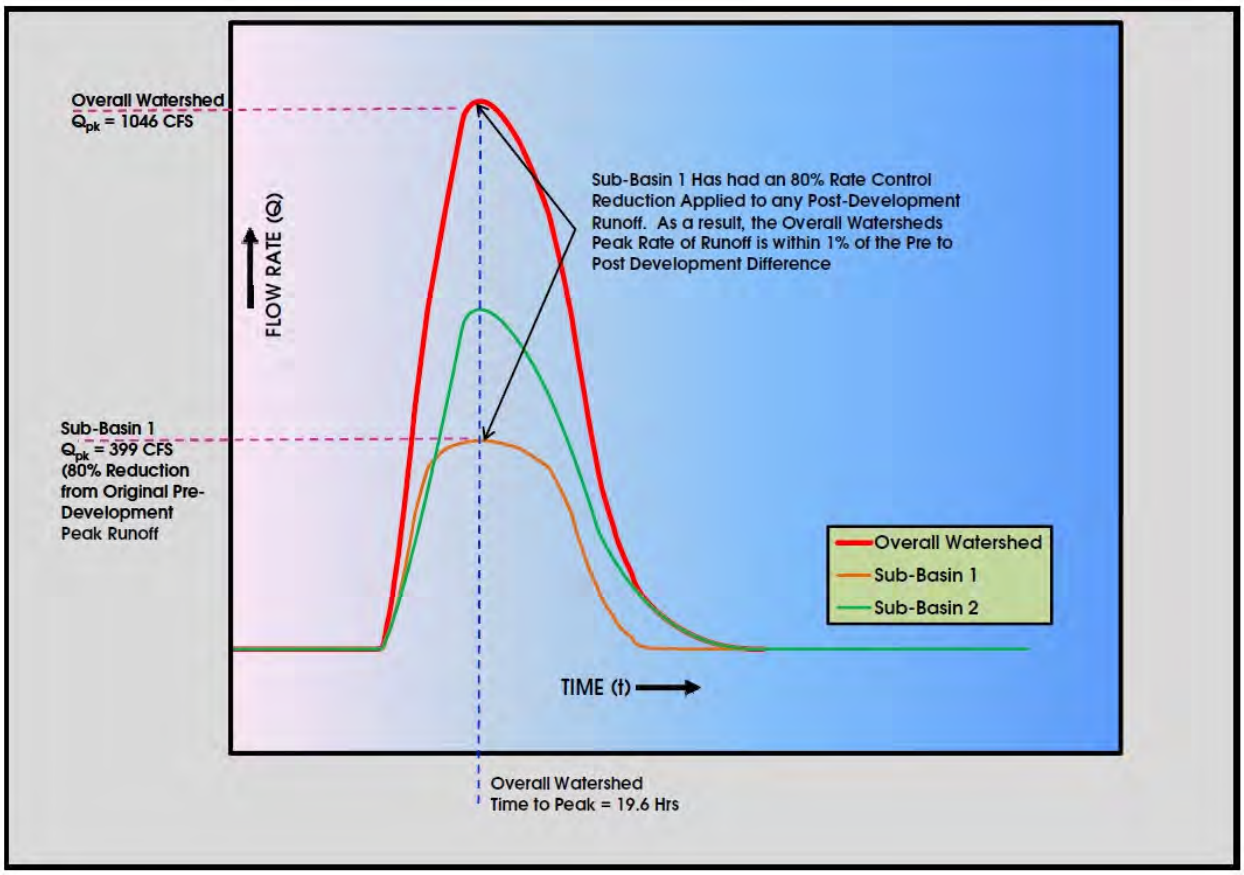


Figure V-6

The overall peak rate of runoff from Sub-Basin 1 is now 399 CFS. Sub-Basin 2 remains un-changed, as it was not necessary to apply rate release controls.

The peak rate of runoff from the overall watershed is now 1046 CFS, an increase of only 10 CFS from the entire watershed. This results in a net change of less that 1% between the pre and post-development runoff rates from the overall watershed. Therefore, the 80% release rate application to Sub-Basin 1 achieved its intended results. Due to the nature of the calculations and specific rounding of values, getting the values to match exactly is nearly impossible. However, a net change of less than 1% is well within the threshold of what the theory is trying to accomplish and it has now been accomplished in this watershed.

Release rate analyses performed on the Marshall and Coffee Run watersheds did not justify establishing post-development release rates below 100% of the pre-development. As noted earlier, hydrologic modeling and release rate analyses were not performed on any other watersheds within Lawrence County due to the reduction in Plan Scope and budget. Future planning cycles will model and evaluate additional watersheds within the County.

E. Structural and Non-Structural BMPs

The following two figures are a comprehensive listing of structural and non-structural BMPs available for the assistance in mitigation of the four major stormwater functions in Pennsylvania. The BMPs are ranked (in potential efficiency) from high to low for each of the four functions, peak rate mitigation, recharge, volume mitigation, and stormwater quality.

The BMPs come directly from the PADEP BMP Manual and are accompanied by the following acronyms (indicating potential effectiveness when properly applied and administered):

VH Very High

H High

HL High to Low (a special category in which specific parameter dictate a BMPs effectiveness)

MH Medium to High

LM Low to Medium

L Low

VL Very Low

LN Low to None

N None or Not Applicable

The figure(s) can be used by a design professional by determining which desired function is to be mitigated and then working down the chart and selecting BMP(s) that will work singularly or in combination with other BMPs to mitigate a specific function or multiple functions. The most effective means of selecting BMPs is to choose a BMP or multiple BMPs that have moderately high rates of success for all, or some combination, of all the desired functions requiring mitigation.

For example, the use of the BMP dictating the reduction of parking imperviousness is an effective BMP for all four of the mentioned stormwater functions. It rates VH (very high) for three of the functions and H (high) for the fourth. This makes the potential use of this BMP a practical selection.

However, BMP selection is based on a number of criteria including:

- Applicability to existing conditions
- Efficiency
- Cost Benefit
- Maintenance Concerns

Non-Structural Best Management Practices (BMPs)			
Stormwater Desired Functions			
Volume Reduction	Recharge	Peak Rate Control	Quality
Protect Sensitive and Special Value Areas (VH)	Protect Sensitive and Special Value Areas (VH)	Protect Sensitive and Special Value Areas (VH)	Protect Sensitive and Special Value Areas (VH)
Cluster Uses at Each Site; Build on Smallest Area Possible (VH)	Cluster Uses at Each Site; Build on Smallest Area Possible (VH)	Cluster Uses at Each Site; Build on Smallest Area Possible (VH)	Protect/Conserve/ Enhance Riprarian Areas (VH)
Concentrate Uses Area Wide Thru Smart Growth Practices (VH)	Concentrate Uses Area Wide Thru Smart Growth Practices (VH)	Concentrate Uses Area Wide Thru Smart Growth Practices (VH)	Cluster Uses at Each Site; Build on Smallest Area Possible (VH)
Minimize Soil Compaction in Disturbed Areas (VH)	Minimize Soil Compaction in Disturbed Areas (VH)	Reduce Street Imperviousness (VH)	Concentrate Uses Area Wide Thru Smart Growth Practices (VH)
Reduce Street Imperviousness (VH)	Reduce Street Imperviousness (VH)	Reduce Parking Imperviousness (VH)	Minimize Soil Compaction in Disturbed Areas (VH)
Reduce Parking Imperviousness (VH)	Reduce Parking Imperviousness (VH)	Minimize Total Disturbed Area - Grading (H)	Re-Vegetate and Re-Forest Disturbed Areas, Using Native Species (VH)
Minimize Total Disturbed Area - Grading (H)	Minimize Total Disturbed Area - Grading (H)	Minimize Soil Compaction in Disturbed Areas (H)	Minimize Total Disturbed Area - Grading (H)
Rooftop Disconnection (H)	Rooftop Disconnection (H)	Rooftop Disconnection (H)	Reduce Parking Imperviousness (H)
Disconnection From Storm Sewers (H)	Disconnection From Storm Sewers (H)	Disconnection From Storm Sewers (H)	Streetsweeping (H)
Protect/Conserve/ Enhance Riprarian Areas (M)	Protect/Conserve/ Enhance Riprarian Areas (M)	Protect/Utilize Natural Flow Pathways in Overall Stormwater Planning and Design (MH)	Protect/Utilize Natural Flow Pathways in Overall Stormwater Planning and Design (M)
Protect/Utilize Natural Flow Pathways in Overall Stormwater Planning and Design (LM)	Re-Vegetate and Re-Forest Disturbed Areas, Using Native Species (LM)	Protect/Conserve/ Enhance Riprarian Areas (LM)	Reduce Street Imperviousness (M)
Re-Vegetate and Re-Forest Disturbed Areas, Using Native Species (LM)	Protect/Utilize Natural Flow Pathways in Overall Stormwater Planning and Design (L)	Re-Vegetate and Re-Forest Disturbed Areas, Using Native Species (LM)	Rooftop Disconnection (L)
Streetsweeping (LN)	Streetsweeping (LN)	Streetsweeping (LN)	Disconnection From Storm Sewers (L)

Figure V-7[19]

[19] BMP methods are taken directly from the Pennsylvania DEP's, *Pennsylvania Stormwater Best Management Practices Manual.*

Structural Best Management Practices (BMPs)			
Stormwater Desired Fuctions			
Volume Reduction	Recharge	Peak Rate Control	Quality
Floodplain Restoration (HL)*	Floodplain Restoration (HL)*	Constructed Filter (HL)*	Landscape Restoration (VH)
Constructed Filter (HL)*	Constructed Filter (HL)*	Dry Extended Detention Basin (H)	Constructed Wetlands (H)
Subsurface Infiltration Bed (H)	Dry Well/Seepage Pit (H)	Wet Pond/Retention Basin (H)	Vegetated Filter Strip (H)
Infiltration Basin (H)	Infiltration Trench (H)	Constructed Wetlands (H)	Constructed Filter (H)
Vegetated Roof (MH)	Subsurface Infiltration Bed (H)	Vegetated Swale (MH)	Infiltration Trench (H)
Runoff Capture and Reuse (MH)	Infiltration Basin (H)	Subsurface Infiltration Bed (MH)	Subsurface Infiltration Bed (H)
Riparian Buffer Restoration (M)	Rain Garden/Bioretention (MH)	Infiltration Basin (MH)	Infiltration Basin (H)
Dry Well/Seepage Pit (M)	Riparian Buffer Restoration (M)	Floodplain Restoration (M)	Riprarian Buffer Restoration (MH)
Rain Garden/Bioretention (M)	Pervious Pavement with Infiltration Bed (M)	Soil Amendment and Restoration (M)	Infiltration Berm and Retentive Grading (MH)
Infiltration Trench (M)	Soil Amendment and Restoration (LM)	Infiltration Berm and Retentive Grading (M)	Vegetated Swale (MH)
Pervious Pavement with Infiltration Bed (M)	Landscape Restoration (LM)	Dry Well/Seepage Pit (M)	Rain Garden/Bioretention (MH)
Soil Amendment and Restoration (LM)	Vegetated Filter Strip (LM)	Infiltration Trench (M)	Floodplain Restoration (MH)
Landscape Restoration (LM)	Vegetated Swale (LM)	Pervious Pavement with Infiltration Bed (M)	Soil Amendment and Restoration (M)
Infiltration Berm and Retentive Grading (LM)	Level Spreader (L)	Landscape Restoration (LM)	Water Quality Filters and Hydrodynamic Devices (M)
Vegetated Filter Strip (LM)	Wet Pond/Retention Basin (L)	Riparian Buffer Restoration (LM)	Wet Pond/Retention Basin (M)
Vegetated Swale (LM)	Constructed Wetlands (L)	Rain Garden/Bioretention (LM)	Runoff Capture and Reuse (M)
Level Spreader (L)	Runoff Capture and Reuse (L)	Special Detention Areas - Parking Lot, Rooftop (LM)	Vegetated Roof (M)
Dry Extended Detention Basin (L)	Infiltration Berm and Retentive Grading (L)	Level Spreader (L)	Dry Well/Seepage Pit (M)
Wet Pond/Retention Basin (L)	Special Detention Areas - Parking Lots, Rooftop (VL)	Runoff Capture and Reuse (L)	Pervious Pavement with Infiltration Bed (M)
Constructed Wetlands (L)	Water Quality Filters and Hydrodynamic Devices (N)	Vegetated Roof (L)	Level Spreader (L)
Special Detention Areas - Parking Lots, Rooftop (VL)	Dry Extended Detention Basin (N)	Vegetated Filter Strip (L)	Dry Extended Detention Basin (L)
Water Quality Filters and Hydrodynamic Devices (N)	Vegetated Roof (N)	Water Quality Filters and Hydrodynamic Devices (N)	Special Detention Areas - Parking Lot, Rooftop (L)

Figure V-8[20]

[20] BMP methods are taken directly from the Pennsylvania DEP's, *Pennsylvania Stormwater Best Management Practices Manual.*

Additional Means for Objective Achievement

In addition to the criteria listed within this Plan, other methods of achieving the outlined methods may be required. Some of the more common and tangible methods for objective achievement include, but are not limited to:

- Changes, upgrades, and improvements to municipal maintenance policies
  - Including both frequency and method of practice, as well as dedicated funding
- Construction or improvement projects that will increase the efficiency and effectiveness of community stormwater and flood control facilities, collection and conveyance systems, and treatment appurtenances
- Improvements and changes to municipal construction codes and design standards which better implement methods and technologies that will address stormwater at the source and not at the eventual problem area
- Improvements and retrofit scenarios where existing stormwater and flood management facilities are made more efficient and effective in managing stormwater runoff and increasing their ability to support public welfare as well as private and public property

There is not a specific timeframe for completion of these upgrades. However, they should be implemented in a timely fashion and a fashion in which removed constraints allow. New technology, additional funding, increased public support, timely revisions to this Plan will all contribute to the expediting of improvement implementation.

Non-Achievable Objectives

Not all objectives can be immediately met through the implementation of this Plan. It is the intent of the Plan to meet each objective to the greatest extent possible. However, it is not feasible to correct every problem, known or otherwise, within the county.

Some of the potential reasons for not meeting objectives or correcting/mitigating known problems are:

- Reduction in scope in development of the Plan
- Limited technology or inefficient technology
- Financial constraints or limited resources for implementation of technology
- Political and social issues that complicate the corrective action necessary
- Lack of immediate public education and outreach programs (which through implementation of this Plan will better educate and inform the public of the impacts of stormwater)
- Limited historical data

The easiest and most efficient means of correcting and improving upon the limitations previously listed would involve periodic revisions (recommended every five years) of the Plan. This would include the implementation of new local, State, and Federal guidelines and regulations that could alleviate current impediments. Improved and more efficient technology that will augment the mitigation process. Implementation of, and additional analysis of watersheds based on newly acquired data or field gathered historical data that can be used to provide more efficient watershed analyses. Support from both the public and private sectors that will assist in the implementation, funding, and educational aspects of stormwater management methodologies.

The County and municipalities contained therein shall periodically review and revise the Plan at least every five years. It will be through these required revisions that the Plan will remain a feasible and tangible source of information and data that can be used to assist in the mitigation of known problems and to achieve objectives beyond what are outlined in this current revision of the Plan.

SECTION VI MUNICIPAL ORDINANCE INTRODUCTION

A. Supporting Information

Based upon the granted authority set forth in the Storm Water Management Act, October 4, 1978, P.L. 864 (Act 167), 32 P.S. Section 680.1, et. seq., as amended, all municipalities within the Commonwealth of Pennsylvania are empowered to regulate all land use activities within their boundaries.

Act 167 requires the implementation and management of stormwater at the local level, with municipalities taking on the leadership role. In accordance with Act 167, Sections 11 (a) and (b):

1. After adoption and approval of Plan in accordance with Act 167, the location, design and construction within the watershed of storm water management systems, obstructions, flood control projects, subdivisions and major land developments, highways and transportation facilities, facilities for the provision of public utility services and facilities owned or financed in whole or in part by funds from the Commonwealth shall be conducted in a manner consistent with the watershed storm water plan.

2. Within six months following adoption and approval of the Plan, each municipality shall adopt or amend, and shall implement such ordinances and regulations, including zoning, subdivision and 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 adoption of the model ordinance as a stand-alone ordinance may not require the revision of existing subdivision, land development and/or zoning ordinances within individual municipalities; these revisions are already addressed by the repealer clause in Section 106 of the model ordinance.

A model stormwater ordinance has been prepared as a part of this plan and is available to be accepted, with minor revisions, by each subject municipality. Each municipality is free to accept the model ordinance, or have the freedom to revise the ordinance to enact more stringent requirements than what the model ordinance prescribes.

Each municipality will also be faced with the task of updating and revising any existing land development, zoning, and subdivision ordinances to provide the correlating language that references the adopted stormwater management ordinance. These revisions would need to address to all applicable land use activities within the municipality and direct the potential applicant to the stormwater management ordinance for more detailed guidance.

The most critical of the necessary elements to be included in the model ordinance shall be:

- **The stormwater drainage standards and management criteria** – (Stormwater Management Ordinance, Article III, Section 301 and Appendix A)
- **Technical performance requirements for stormwater management facilities**
  - **Detention/Retention Facilities for Peak Rate Control** – (Stormwater Management Ordinance, Article III, Section 305 and Appendix B)
  - **Volume Control BMPs** - (Stormwater Management Ordinance, Article III, Section 304 and Appendix B)
    - Infiltration BMPs
    - Bioretention BMPs
    - Land Use/Impervious Area Reduction BMPs
    - Stormwater Collection/Re-Use BMPs

- **Water Quality Facilities and BMPs** – (Stormwater Management Ordinance, Article III, Section 301 and Appendix B)

The model ordinance should be understandable and practical in all aspects of its intent. It is not intended to be too rigid and should encourage hybrid solutions and creativity in order to achieve the overall intent, which is to manage stormwater effectively, safely, and efficiently. The ordinance, while it should be stringent in nature, should also not be overly oppressive in a manner in which it could actually limit potential development by creating restrictions that could serve as a deterrent to potential developers. It is not the purpose of the ordinance/stormwater management plan to solve stormwater issues by eliminating development. It is the intent to provide an effective and safe means by which development can continue and expand in a regulated and safe environment where the natural hydrology of the county is not only protected and maintained, but also improved by the use of new technologies that will help mitigate existing problems, as well as preventing future ones.

B. Required Ordinance Contents

- Article I- General Provisions
  - This section is intended to provide information based upon the following items:
    - A short title identifying the ordinance document.
    - A statement of findings indicating general information that reinforces the need and requirements for the creation of a universal stormwater management ordinance.
    - A section identifying the purpose of the ordinance. This will include verbiage addressing topics related to both public welfare legal precedents and requirements for the creation of the document, as well as basic technical information that the document will address.
    - A brief section outlining the statutory authority that the empowerment of the ordinance is based upon.
    - A brief section identifying the applicability of the ordinance and the types of activities the ordinance as the authority to regulate.
    - A section indicating that any additional ordinances within the municipality in question that are not consistent with the provisions of this ordinance, are hereby repealed to the extent of the inconsistencies.
    - A section describing that if any standing court order declares any section of this ordinance invalid, this decision will not affect the validity of the remaining provisions of the ordinance.
    - A statement indicating that compliance with this ordinance does not release the applicant from adherence with any other local codes, laws, or regulations. Nor does it release them from their necessary duty to acquire required permits and approvals from other governing bodies.
- Article II- Definitions
  - This section is intended to provide the appropriate and intended interpretation of certain words, terms and entities included in the ordinance.
- Article III- Stormwater Management Standards
  - This section is intended to clearly present and define the technical regulations for stormwater management within the municipality. This should, at a minimum, include the following:
    - Definition of water quality (WQ) requirements and provisions

    - All necessary design criteria and applicable supporting data
    - Requirements for meeting erosion and sedimentation control guidelines and regulations
    - Acceptable methods and models for preparing calculations
    - Information concerning applicable stormwater management districts and the implementation of specific control criteria therein
    - Small project exemption criteria
    - Waiver criteria
    - Information pertaining to timber harvesting and silviculture activities
- Article IV- Stormwater Management Site Plan Requirements
  - This section is intended to provide an outlined description of the necessary components that will represent an acceptable stormwater management site plan. It shall also include information describing the appropriate procedures for plan submittal, review, approval guidelines and protocol, fees, subsequent follow up, and closeout procedures at project completion.
- Article V-Operation and Maintenance
  - This section defines the municipality's roles and authority in the determination of operation and maintenance of any and all stormwater management facilities. The determination of the ultimate party responsible for such operation and maintenance will be made prior to final plan approval. An appropriate O/M agreement should also be included that defines the owner's responsibility for proper operation and maintenance of the facility and the municipality's rights to enforce the agreement or charge fees associated with maintenance of any facility owned by an entity other than the municipality.
- Article VI-Fees and Expenses
  - This section should outline all costs incurred in the review fee, and that the municipality may charge such fees to an applicant. The review fee may include but not be limited to costs for the following:
    - Administrative/clerical processing.
    - Review of the SWM Site Plan.
    - Attendance at Meetings.
    - Inspections
- Article VII-Prohibitions
  - This section addresses all necessary prohibitions and definition of unacceptable activities, which are deemed to not adhere to the language of the ordinance. Items of the following type, but not limited to, should be included in this section:
    - Any illegal and illicit discharges prohibited under the provisions of the ordinance
    - Specific guidelines regulating the installation and function of residential and commercial roof drain systems
    - Specific guidelines regulating the alteration or retrofitting of any existing stormwater management facility or BMP device
- Article VIII-Enforcements and Penalties

- This section outlines the municipality's rights concerning enforcement of the ordinance guidelines and applicable and allowable penalties. A detailed description of the following items should be included:
    - The municipality's right of entry
    - The municipality's right of inspection
    - The municipality's rights of enforcement of the terms of the ordinance and any associated agreements
    - Information concerning suspensions and revocation
    - A detailed listing of penalties that are considered in direct violation of the terms of the ordinance and any associated agreements
    - A detailed outline of the appeals process available to any applicant

- Article IX- References
    - Supporting documentation used for the creation and formulation of any portion of the ordinance

- Appendix A:
    - Low Impact Development Practices
- Appendix B:
    - Site Conditions Suitable for Infiltration
    - BMPs for Infiltration
    - BMPs for Rate Control
    - BMPs for Evapotranspiration
- Appendix C:
    - Operation and Maintenance Agreement, Stormwater Best Management Practices
- Appendix D:
    - Rational Formula Runoff Coefficients
- Appendix E:
    - Small Project SWM Plan Application and Worksheets
- Attachment A:
    - Additional Ordinance and Technical Guidelines Toolbox

SECTION VII PRIORITIES FOR IMPLEMENTATION

The preparation of the Lawrence County Act 167 Stormwater Management Plan concludes with the county's final acceptance of the plan and the submittal of the plan to the Pennsylvania Department of Environmental Protection (PA DEP) for final review and approval. Municipalities have a period of no more than six (6) months from the date of PADEP's approval of the County's adopted plan to complete and finalize ordinance adoption.

A. DEP Approval of the Plan

Once the final plan is adopted by Lawrence County, it is then submitted to the PA DEP for approval. A preliminary/draft copy of the stormwater management plan and model ordinance was submitted to the PA DEP prior to the county's adoption. The PA DEP reviews the draft and determines that all necessary components are present and all necessary tasks have been completed. The PA DEP then reviews the plan for the following additional items:

- Consistency and adherence with floodplain management plans
- Commonwealth regulations concerning the management of dams, waterway encroachments, and all other possible waterway obstructions
- Commonwealth and Federal flood control guidelines

This specific Act 167 Plan was prepared exclusively for Lawrence County and the municipalities located therein. However, based upon the fact that watersheds boundaries overlap between counties (and in this case actual states), the plan must be consistent and compatible with other Act 167 and stormwater management plans and policies that are already in place, or currently being prepared in adjacent jurisdictions.

B. Publishing the Final Plan

In order to remain consistent with the Scope of Study for Lawrence County, the County will publish additional copies of the plan after receipt of final approval from the PA DEP. The County will provide one copy to each municipality within Lawrence County at this time. Copies of the Lawrence County Stormwater Management Model Ordinance will be published for use by all county municipalities.

C. Municipal Adoption of Ordinance to Implement the Plan

The most critical part of implementation of the Act 167 Plan is the adoption of the required ordinance provisions by each county municipality.

As discussed in previous sections, each municipality would have the ability to accept the model ordinance "as-is," and this would meet the requirements for implementation at the municipal level. The adoption of the model ordinance as a stand-alone ordinance may not require the revision of existing subdivision, land development and/or zoning ordinances within individual municipalities; these revisions are already addressed by the repealer clause in Section 106 of the model ordinance.

The correlating provisions would refer the applicant engaged in any applicable regulated activities (as defined in the ordinance) within the municipality from the previous ordinance(s) to the newly adopted ordinance.

As an additional recommendation to the adopting municipality, it is suggested that the previously determined and approved watershed delineation areas and the management criteria assigned to them (e.g., rate release controls, etc.) be included within the municipality's zoning or sub-division ordinance(s). This creates a scenario where the stormwater management requirements will apply to all proposed land use changes and will not be limited by activities that are subject to the provisions outlined in the existing land development and sub-division ordinance(s).

D. Level of Government Involvement in Stormwater Management

The current process for the management of stormwater from a regulatory basis within the Commonwealth of Pennsylvania is a blended mixture of objectives and directives from a number of governing bodies.

Stormwater within a single watershed currently has the potential to be managed and regulated at a federal, state, county and local (municipal) level. Each of these entities can possess their own guidelines and regulations based on their specific intent and place as a stakeholder in the regulatory process. It becomes the responsibility of the developer or applicant to address, adhere, and gain approval from each separate entity based upon their singular guidelines, which at times, can even be in direct conflict or contradiction with another regulatory entities guidelines and regulations. This lack of a sole, regulatory entity, responsible for the implementation of all rules, regulations, reviews, assistance, and approval during the stormwater process makes the process in and of itself extremely difficult to navigate.

Implementation of the plan guidelines and minimum requirements of Act 167 can be accomplished without significant disruption to the current permitting and approval process in any particular watershed. The most significant action will occur at the municipal and county level. The technical review of stormwater management plans must include the input of both a representative municipality as well as the county in a joint, cooperative effort. Along with the review and approval of plan applications, intermittent updates to the computer model (created as an end product of the plan preparation, and provided as a final deliverable) are required in order for data to remain current and to indentify new or potential problems. The collection and storage of physical data (new development, changes to the watershed(s), etc.) also will be required in order to have a current inventory of county stormwater infrastructure and impacts to hydrology.

Upon final adoption of the plan, the following types of projects will be subject to the provisions of the plan and remain consistent with the rules and regulations set forth in the plan:

- New Public Facilities
- New Facilities for the Provision of Public Utilities
- New Facilities Owned or Financed by Commonwealth Funds

These public or publically funded facilities are required to comply with the plan even if they are not subject to any municipal regulation.

The primary role of the municipality will be the implementation of the Plan through ordinance adoption. This process must be completed within six months of PADEP's approval of the County's Plan. The required model ordinance provisions will be made available to each municipality by the county. The Lawrence County Conservation District and the Lawrence County Planning Commission will be available to assist any municipality in the adoption process or to assist in the necessary steps to incorporate the new guidelines into any existing ordinances.

The necessary evidence that state and federal agencies have been contacted and notified of regulated activities will also be required. This applies in most instances to any impact or potential impact to areas, through acceptable delineation practices, which are considered wetlands. This process is intended to ensure that all plan guidelines and regulations are being followed and have been implemented.

E. Correction of Existing Drainage Problems

The completion of the stormwater management plan will provide an outline and source of reference for the elimination of existing stormwater management problems within the county. Each municipality will have at its disposal a resource for identifying and addressing these problems at the local level. The municipality will not only

have a better framework for addressing and correcting existing problems, but for providing an environment in which future problems are prevented.

The information provided is not intended to be the only approach to correcting problems and in no way is anything listed considered to be mandatory. It is only a list of suggestions for providing an individual municipality a means to correcting existing problems. Since problems, as well as the means to correcting them, vary between municipalities, not every recommendation is applicable in all cases.

- A list of existing stormwater management issues within the municipality should be created and prioritized. This list should take into account the following parameters:
  - Threat to human life
  - Threat to property and existing infrastructure
  - Frequency of occurrence
  - Proximity to other existing problems
  - Financial ramifications
- A technical evaluation of each problem area, costing evaluation to determine repair requirements, and a proposed course of action for the municipality to follow
- Implementation of the corrective action plan should begin and be integrated with the municipal capital or maintenance improvement budget on an annual basis

F. Culvert Replacement

One of the most common drainage problems within the county is flooding caused by unmanaged or insufficiently managed stormwater runoff from development that is tributary to culverts. A large number of these culverts were never designed to pass the higher flows generated by excessive development. These culverts are not able to safely convey these higher flows, resulting in localized flooding, damage to infrastructure, roadway overtopping which results in driving hazards, as well as many other problems.

A culvert replacement plan should be enacted as part of the overall corrective action plan for each municipality. In general, the procedure for determining the proper culvert size is as follows:

- Identify the location of the problem culvert from the obstruction data provided in the Act 167 Plan and its assigned identification number
- Determine the appropriate design storm frequency based upon the PA DEP's Chapter 105 guidelines:
  - In determining flood flows and frequencies for purposes of this subchapter, hydrologic analysis shall be by methods generally accepted in the engineering profession
    - Rural areas—25-year frequency flood flow
    - Suburban areas—50-year frequency flood flow
    - Urban areas—100-year frequency flood flow
- Using the information provided in the Act 167 Plan, locate the appropriate flow (CFS) for the obstruction in question and based upon the return period criteria listed above. Information pertaining to certain physical characteristics (including locations) of known culverts can be found within Volumes 3 of this Plan.
- Using sound and acceptable engineering practices, size the culvert based upon the determined parameters and within any ordinance or regulatory agency having jurisdictional control over the culvert replacement

- All necessary local, state, and federal permits and approvals must be obtained prior to construction

Not all obstructions within the county were identified and/or modeled. In the event of a known problem obstruction area that is not listed in the Act 167 Plan, sound and acceptable engineering practices should be used in the proper design and replacement of the culvert. Portions of the previously listed method for replacement are still applicable, and should be implemented to the greatest extent possible. The most notable exception is that of calculated flow for the obstruction. This must be calculated by the design engineer for the culvert replacement and should be done in accordance with sound engineering practice as well as all local, state, and federal regulations governing the design of culverts in the municipality in question.

G. PennVEST Funding

PENNVEST has been empowered by Pennsylvania state law, Pennsylvania Infrastructure Investment Authority Act 16 of 1988, to administer and finance the Clean Water State Revolving Fund (CWSRF) and the Drinking Water State Revolving Fund (DWSRF) pursuant to the federal Water Quality Act of 1987, as well as to administer the American Recovery and Reinvestment Act of 2009 (ARRA) funds. PENNVEST also finances, through the issuance of special obligation revenue bonds, water management, solid waste disposal, sewage treatment and pollution control projects undertaken by or on behalf of private entities.

The PENNVEST Clean Water State Revolving Fund (CWSRF) program provides funding to projects throughout PENNSYLVANIA for the construction and maintenance of wastewater treatment facilities, storm water management projects, nonpoint source pollution controls, and watershed and estuary management.

This program offers low interest loans with flexible terms to assist a variety of borrowers that include local governments, municipalities, and privately owned entities and to establish partnerships to leverage other funding sources.

The CWSRF program is managed under the Pennsylvania State Regulations for PENNVEST funding wastewater projects. In partnership with the Pennsylvania Department of Environmental Protection, management occurs during project planning, application submission, contracting and financing, and site inspection and reporting.

The Pennsylvania Code establishes project evaluation criteria for PennVEST funding. The criteria for stormwater projects seeking PennVEST assistance is currently defined as[21]:

- Public health and safety
  - Elimination of critical ongoing safety or health hazard
  - Elimination of a chronic safety or health hazard which frequently occurs
  - Elimination of a potential safety or health hazard associated with periodic flooding
- Environmental impact
  - The improvement or prevention of a problem to the environment or to natural resources
  - Whether the project is located in areas of karst topography and susceptible to sinkhole development or has no natural watercourse within the municipal boundaries encompassing the project
- Economic development
  - Development, activity and job creation retention resulting directly or indirectly from a project
  - Opportunity to use other State programs, such as the Business Infrastructure Development, Site Development and Community Facilities Programs, to fund the project

[21] The Pennsylvania Code, §963.9a adopted July 7, 1995, effective July 8, 1995, 25 Pa.B. 2720

    - Degree of local distress in the county where the project is located

- Compliance
    - Improvement of compliance with existing laws, rules and regulations if compliance will eliminate the necessity to issue an order
    - Compliance with law, an order, decree, agreement or a deadline specified in regulation

- Adequacy and efficiency
    - The extent that the project proposes facility regionalization or system consolidation to improve operation, maintenance or function of the stormwater facility
    - The extent that the project involves multiple-governmental participation
    - The extent that the project has a sponsoring municipal entity which has a population less than or equal to 12,000 residents as reported in the latest census

In order to qualify for funding consideration, the applicant must meet two important factors:

- The project seeking funding must be located within a watershed where a DEP approved and county adopted stormwater management plan is currently in place
- The project seeking funding must be located within a watershed where a stormwater management ordinance has been implemented as is consistent with the guidelines of the county-wide stormwater management plan

H. Landowner's/Developer's Responsibilities

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

- To assure that the maximum rate of storm water runoff is no greater after development than prior to development activities; or
- To manage the quantity, velocity and direction of resulting storm water runoff in a manner which otherwise adequately protects health and property from possible injury.

Works Cited

Center for Watershed Protection. (2000). *Overbank Flooding*. Retrieved August 19, 2009, from SMRC Home: http://www.stormwatercenter.net/Slideshows/sizing-rac/sld042.htm

Lively, A. a. (1995).

Paul A. DeBarry, P. P. (2004). *Watersheds - Processes, Assessment and Management.* Hoboken: John Wiley and Sons, Inc.

Pennsylvania DEP. (2007). *DEP Fact Sheet - NPDES Permits for Stormwater Discharges Associated with Construction Activities, Document 3930-FS-DEP3042.* Harrisburg, PA: Pennsylvania DEP.

Pennsylvania Department of Environmental Protection. (2006). *Pennsylvania Stormwater Best Management Practices.* Harrisburg, PA.

Roland, M. A., & Stuckey, M. H. (2008). *Regression Equations for Estimating Flood Flows at Selected Recurrence Intervals for Ungaged Streams in Pennsylvania.* Reston, VA: U.S. Geologic Survey and U.S. Department of the Interior.

Stuckey and Reed, M. H. (2000). *Techniques for Estimating Magnitude and Frequency of Peak Flows for Pennsylvania Streams.* Lemoyne, PA: Cooperation with the Pennsylvania Department of Transportation.

Tennessee Department of Environment and Conservation. (n.d.). *TDEC:WPC: Erosion and Sediment Control Handbook*. Retrieved August 6, 2009, from The Official State of Tennessee's Department of Environment and Conservation, State Parks Website: http://www.state.tn.us/environment/wpc/sed_ero_controlhandbook/

United States Environmental Protection Agency. (2007, December 12). *Class V Wells Home*. Retrieved from U.S. Environmental Protection Agency: http://www.epa.gov/OGWDW/uic/class5/index.html

United States Environmental Protection Agency. (Revised, 2005). *Stormwater Phase II Final Rule - Small MS4 Stormwater Program Overview - EPA 833-F-00-002.* Washington D.C.: U.S. Envinronmental Protection Agency.

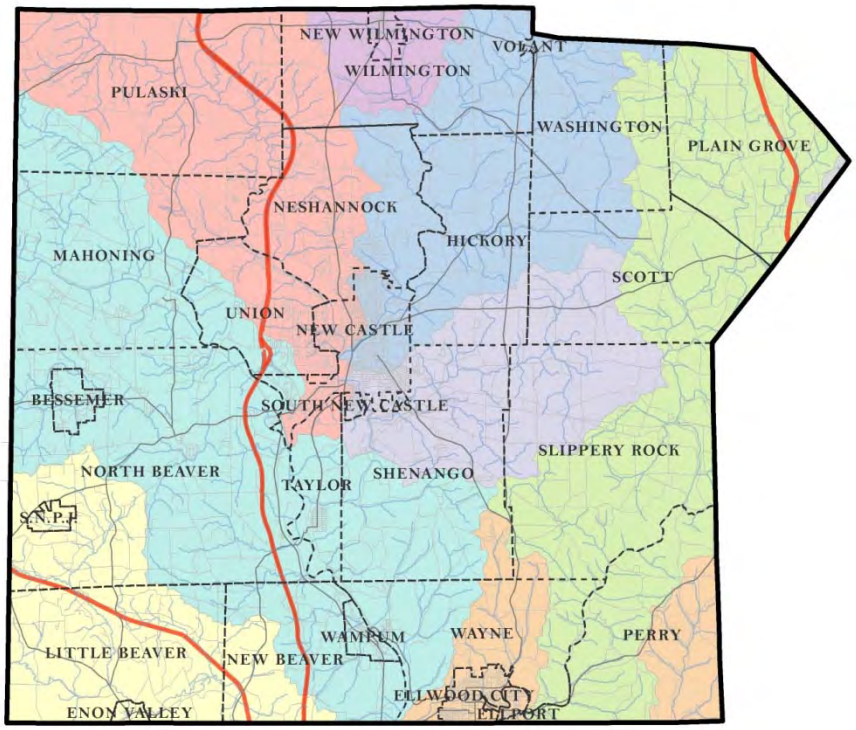
US Climate Change Science Program. (2003, July). *Chapter 5. Water Cycle. From Strategic Plan of the US Climate Change Science Program (Final Report)*. Retrieved from US Climate Change Science Program: http://www.climatescience.gov/Library/stratplan2003/final/ccspstratplan2003-chap5.htm

LAWRENCE COUNTY

ACT 167 PHASE 2

STORMWATER MANAGEMENT PLAN

VOLUME 3 – APPENDICES



PREPARED FOR:

LAWRENCE COUNTY
430 Court Street
New Castle, PA 16101

PREPARED BY:

LAWRENCE COUNTY
PLANNING DEPARTMENT
430 Court Street
New Castle, PA 16101

CONSULTANT:

L.R. KIMBALL
415 Moon Clinton Road
Coraopolis, PA 15108

L.R.Kimball
ARCHITECTURE • ENGINEERING • COMMUNICATIONS TECHNOLOGY

LAWRENCE COUNTY WATERSHED PLANNING ADVISORY COMMITTEE (WPAC)

WPAC Member	Organization
Amy McKinney	Lawrence County Planning Department
Jay Russell & Megan Gahring	Lawrence County Conservation District
	Cities
Tamara Gibson	New Castle
	Boroughs
Head of Governing Body	Bessemer
Head of Governing Body	Ellport
Rohanda Zellhart	Ellwood City
Tyrone Petrich & Duane Clawson	Enon Valley
David Hairhoger	New Beaver
Fred Garret	New Wilmington
Head of Governing Body	S.N.P.J.
Head of Governing Body	South New Castle
Head of Governing Body	Volant
Head of Governing Body	Wampum
	Townships
Head of Governing Body	Hickory
Head of Governing Body	Little Beaver
Head of Governing Body	Mahoning
Head of Governing Body	Neshannock
James Gagliano, Jr.	North Beaver
Head of Governing Body	Perry
Head of Governing Body	Plain Grove
Head of Governing Body	Pulaski
Head of Governing Body	Scott
Head of Governing Body	Shenango
Head of Governing Body	Slippery Rock
Head of Governing Body	Taylor
Head of Governing Body	Union
Head of Governing Body	Washington
Dennis Hall	Wayne
Dale Elcer	Wilmington

CONTENTS

APPENDIX A PENNSYLVANIA STORMWATER MANAGEMENT ACT 167 OF 1978 1

APPENDIX B MODEL STORMWATER MANAGEMENT ORDINANCE 1

APPENDIX C TECHNICAL ANALYSIS 1

A. Technical Summary 1

B. Watershed Schematics 3

C. Subcatchment Data 6

D. Meteorological Data 12

E. Stream Reach Routing Data 17

F. Obstruction Routing Data 19

G. Regression Analysis 32

H. Results 35

APPENDIX D STAKEHOLDER SURVEY RESPONSES 1

APPENDIX E FIELD VERIFICATION DATA 1

PLAN FORMAT

The format of the Lawrence County Stormwater Management Plan consists of three Volumes:

Volume 1 - Executive Summary

Provides an overview of Act 167 and a summary of the standards and criteria developed for the Plan.

Volume 2 – Plan Content

Provides an overview of stormwater management, purpose of the study, data collection, all GIS maps, present conditions, projected land development patterns, calculation methodology, the Model Ordinance and implementation discussion.

Volume 3 – Appendices

Provides supporting data, watershed modeling parameters and modeling runs, peak flows, release rates, the existing municipal ordinance matrix, and obstructions inventory. Due to large volumes of data, one copy of Volume 3 will be on file at the Lawrence County Department of Planning.

APPENDIX A PENNSYLVANIA STORMWATER MANAGEMENT ACT 167 OF 1978

AN ACT

Providing for the regulation of land and water use for flood control and storm water management purposes, imposing duties and conferring powers on the Department of Environmental Resources, municipalities and counties, providing for enforcement, and making appropriations.

TABLE OF CONTENTS

Section 1. Short title.
Section 2. Statement of legislative findings.
Section 3. Purpose and policy.
Section 4. Definitions.
Section 5. Watershed storm water plans and contents.
Section 6. Municipal and public participation in watershed planning.
Section 7. Joint plans and coordination of planning.
Section 8. Adoption and amendment.
Section 9. Review and approval by the department.
Section 10. Failure to submit plan; mandamus.
Section 11. Effect of watershed storm water plans.
Section 12. Failure of municipalities to adopt implementing ordinances.
Section 13. Duty of persons engaged in the development of land.
Section 14. Powers and duties of the Department of Environmental Resources.
Section 15. Civil remedies.
Section 16. Preservation of existing rights and remedies.
Section 17. Grants and reimbursements to municipalities and counties.
Section 18. Appropriations.
Section 19. Repealer and savings clause.
Section 20. Effective date.

The General Assembly of the Commonwealth of Pennsylvania hereby enacts as follows:

Section 1. Short title.

This act shall be known and may be cited as the "Storm Water Management Act."

Section 2. Statement of legislative findings.

The General Assembly finds that:

(1) Inadequate management of accelerated runoff of storm water resulting from development throughout a watershed increases flood flows and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of streams and storm sewers, greatly increases the cost of public facilities to carry and control storm water, undermines flood plain management and flood control efforts in downstream communities, reduces ground-water recharge, and threatens public health and safety.

(2) A comprehensive program of storm water management, including reasonable regulation of development and activities causing accelerated runoff, is fundamental to the public health, safety and welfare and the protection of the people of the Commonwealth, their resources and the environment.

Section 3. Purpose and policy.

The policy and purpose of this act is to:

(1) Encourage planning and management of storm water runoff in each watershed which is consistent with sound water and land use practices.

(2) Authorize a comprehensive program of storm water management designated to preserve and restore the flood carrying capacity of Commonwealth streams; to preserve to the maximum extent practicable natural storm water runoff regimes and natural course, current and cross-section of water of the Commonwealth; and to protect and conserve ground waters and ground-water recharge areas.

(3) Encourage local administration and management of storm water consistent with the Commonwealth's duty as trustee of natural resources and the people's constitutional right to the preservation of natural, economic, scenic, aesthetic, recreational and historic values of the environment.

Section 4. Definitions.

The following words and phrases when used in this act shall have, unless the context clearly indicates otherwise, the meanings given to them in this section:

"Department." The Department of Environmental Resources of the Commonwealth of Pennsylvania.

"Municipality." A city, borough, town or township, or any county or other governmental unit when acting as an agent thereof, or any combination thereof acting jointly.

"Pennsylvania Municipalities Planning Code." The act of July 31, 1968 (P.L.805, No. 247), as amended.

"Person." An individual, partnership, public or private association or corporation, firm, trust, estate, municipality, governmental unit, public utility or any other legal entity whatsoever which is recognized by law as the subject of rights and duties. Whenever used in any section prescribing or imposing a penalty, the term "person" shall include the members of a partnership, the officers, members, servants and agents of an association, officers, agents and servants of a corporation, and the officers of a municipality or county, but shall exclude any department, board, bureau or agency of the Commonwealth.

"Public utility service." The rendering of the following services for the public:

(1) gas, electricity or steam production, generation, transmission or distribution;

(2) water diversion, pumping, impoundment, or distribution;

(3) railroad transportation of passengers or property;

(4) operation of a canal, turnpike, tunnel, bridge, wharf or similar structure;

(5) transportation of natural or artificial gas, crude oil, gasoline or petroleum products, materials for refrigeration or other fluid substances by pipeline or conduit;

(6) telephone or telegraph communications; and

(7) sewage collection, treatment or disposal.

"Storm water." Drainage runoff from the surface of the land resulting from precipitation or snow or ice melt.

"Watershed." The entire region or area drained by a river or other body of water, whether natural or artificial.

"Watershed storm water plan." A plan for storm water management adopted by a county in accordance with section 5.

Compiler's Note: The Department of Environmental Resources, referred to in the def. of "department," was abolished by Act 18 of 1995. Its functions were transferred to the Department of Conservation and Natural Resources and the Department of Environmental Protection.

Section 5. Watershed storm water plans and contents.

(a) Within two years following the promulgation of guidelines by the department pursuant to section 14, each county shall prepare and adopt a watershed storm water management plan for each watershed located in the county as designated by the department, in consultation with the municipalities located within each watershed, and shall periodically review and revise such plan at least every five years. The department may, for good cause shown, grant an extension of time to any county for the preparation and adoption of a watershed storm water management plan.

(b) Each watershed storm water plan shall include, but is not limited to:

(1) a survey of existing runoff characteristics in small as well as large storms, including the impact of soils, slopes, vegetation and existing development;

(2) a survey of existing significant obstructions and their capacities;

(3) an assessment of projected and alternative land development patterns in the watershed, and the potential impact of runoff quantity, velocity and quality;

(4) an analysis of present and projected development in flood hazard areas, and its sensitivity to damages from future flooding or increased runoff;

(5) a survey of existing drainage problems and proposed solutions;

(6) a review of existing and proposed storm water collection systems and their impacts;

(7) an assessment of alternative runoff control techniques and their efficiency in the particular watershed;

(8) an identification of existing and proposed State, Federal and local flood control projects located in the watershed and their design capacities;

(9) a designation of those areas to be served by storm water collection and control facilities within a ten-year period, an estimate of the design capacity and costs of such facilities, a schedule and proposed methods of financing the development, construction and operation of such facilities, and an identification of the existing or proposed institutional arrangements to implement and operate the facilities;

(10) an identification of flood plains within the watershed;

(11) criteria and standards for the control of storm water runoff from existing and new development which are necessary to minimize dangers to property and life and carry out the purposes of this act;

(12) priorities for implementation of action within each plan; and

(13) provisions for periodically reviewing, revising and updating the plan.

(c) Each watershed storm water plan shall:

(1) contain such provisions as are reasonably necessary to manage storm water such that development or activities in each municipality within the watershed do not adversely affect health, safety and property in other municipalities within the watershed and in basins to which the watershed is tributary; and

(2) consider and be consistent with other existing municipal, county, regional and State environmental and land use plans.

Section 6. Municipal and public participation in watershed planning.

(a) The county shall establish, in conjunction with each watershed storm water planning program, a watershed plan advisory committee composed of at least one representative from each municipality within the watershed, the county soil and water conservation district and such other agencies or groups as are necessary and proper to carry out the purposes of the committee.

(b) Each committee shall be responsible for advising the county throughout the planning process, evaluating policy and project alternatives, coordinating the watershed storm water plans with other municipal plans and programs, and reviewing the plan prior to adoption.

(c) Prior to adoption, each plan shall be reviewed by the official planning agency and governing body of each municipality, the county planning commission and regional planning agencies for consistency with other plans and programs affecting the watershed. All such reviews shall be submitted to the department with the proposed plan.

Section 7. Joint plans and coordination of planning.

Where a watershed includes land in more than one county, the department may require the affected counties to prepare, adopt and submit a joint plan for the entire watershed.

Section 8. Adoption and amendment.

(a) Prior to adoption or amendment of a watershed storm water plan, the county shall hold a public hearing pursuant to public notice of not less than two weeks. The notice shall contain a brief summary of the principal provisions of the plan, and a reference to the places within each affected municipality where copies may be examined or purchased at cost.

(b) Adoption or amendment of the plan shall be by resolution carried by an affirmative vote of at least a majority of the members of the county governing body. The resolution shall refer expressly to the maps, charts, textual matter and other materials intended to form the hole or part of the official plan, or amendment thereto, and the action shall be recorded on the adopted plan, part or amendment.

Section 9. Review and approval by the department.

(a) The department shall, in consultation with the Department of Community Affairs, review all watershed storm water plans and revisions or amendments thereto. It shall approve the plan if it determines:

(1) that the plan is consistent with municipal flood plain management plans, State programs which regulate dams, encroachments, and water obstructions, and State and Federal flood control programs; and

(2) that the plan is compatible with other watershed storm water plans for the basin in which the watershed is located, and is consistent with the policies and purposes of this act.

(b) Should the department neither approve or disapprove a watershed plan or amendment or revision thereto within 90 days of its submission to the department, the plan or amendment or revision shall be deemed to be approved.

(c) Any person aggrieved by a final decision of the department approving or disapproving a watershed plan or amendment thereto, may appeal the decision to the Environmental Hearing Board in accordance with the provisions of section 1921-A of the act of April 9, 1929 (P.L. 177, No. 175), known as "The Administrative Code of 1929," and the "Administrative Agency Law." ((c) repealed in part Oct. 5, 1980, P.L. 693, No. 142)

Section 10. Failure to submit plan; mandamus.

The department may institute an action in mandamus to compel counties to adopt and submit plans in accordance with this act. (10 repealed in part Oct. 5, 1980, P.L. 693, No. 142 and repealed insofar as inconsistent Oct. 15, 1980, P.L. 950, No. 164)

Section 11. Effect of watershed storm water plans.

(a) After adoption and approval of a watershed storm water plan in accordance with this act, the location, design and construction within the watershed of storm water management

systems, obstructions, flood control projects, subdivisions and major land developments, highways and transportation facilities, facilities for the provision of public utility services and facilities owned or financed in whole or in part by funds from the Commonwealth shall be conducted in a manner consistent with the watershed storm water plan.

(b) Within six months following adoption and approval of the watershed storm water plan, each municipality shall adopt or amend, and shall implement such ordinances and regulations, including zoning, subdivision and 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.

Section 12. Failure of municipalities to adopt implementing ordinances.

(a) If the department finds that a municipality has failed to adopt or amend, and implement such ordinances and regulations as required by section 11, the department shall provide written notice of violation to the municipality.

(b) Within 60 days of receipt of the notice of violation, the municipality shall report to the department the action which it is taking to comply with the requirement or regulation.

(c) If within 180 days of receipt of the notice of violation, the municipality has failed to comply with such requirement or regulation, as determined by the department, the department shall notify the State Treasurer to withhold payment of all funds payable to the municipality from the General Fund. Provided, that prior to any withholding of funds, the department shall give both notice to the municipality of its intention to notify the State Treasurer to withhold payment of funds and the right to appeal the decision of the department within the 180-day period following notification. The hearing shall be conducted before the Environmental Hearing Board in accordance with the provisions of the act of April 9, 1929 (P.L. 177, No. 175), known as "The Administrative Code of 1929," and Chapters 5 and 7 of Title 2 (Administrative Law and Procedure), of the Pennsylvania Consolidated Statutes. If an appeal is filed within the 180-day period, funds shall not be withheld from the municipality until the appeal is decided.

(d) Any person, other than a municipality, aggrieved by an action of the department shall have the right within 30 days of receipt of notice of such action to appeal such action to the Environmental Hearing Board, pursuant to section 1921-A, act of April 9, 1929 (P.L. 177, No. 175), known as "The Administrative Code of 1929," and the provisions of Chapters 5 and 7 of Title 2 (Administrative Law and Procedure) of the Pennsylvania Consolidated Statutes.

Section 13. Duty of persons engaged in the development of land.

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

(1) to assure that the maximum rate of storm water runoff is no greater after development than prior to development activities; or

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

Section 14. Powers and duties of the Department of Environmental Resources.

(a) The Department of Environmental Resources shall have the power and its duty shall be to:

(1) Coordinate the management of storm water in the Commonwealth.

(2) Provide in cooperation with the Department of Community Affairs technical assistance to counties and municipalities in implementing this act.

(3) After notice and public hearing and subject to the requirements of subsection (b) of this section, publish guidelines for storm water management, and model storm water ordinances for use by counties and municipalities.

(4) Review, in cooperation with the Department of Community Affairs, and approve all watershed plans and revisions thereto.

(5) Cooperate with appropriate agencies of the United States or of other states or any interstate agencies with respect to the planning and management of storm water.

(6) Serve as the agency of the Commonwealth for the receipt of moneys from the Federal Government or other public or private agencies or persons and expend such moneys as appropriated by the General Assembly for studies and research with respect to planning and management of storm water.

(7) Conduct studies and research regarding the causes, effects and hazards of storm water and methods for storm water management.

(8) Conduct and supervise educational programs with respect to storm water management.

(9) Require the submission of records and periodic reports by county and municipal agencies as necessary to carry out the purposes of this act.

(10) After notice and hearing and with the approval of the Environmental Quality Board, designate watersheds for the purpose of this act.

(11) Do such other acts consistent with this act required to carry out the purposes and policies of this act.

(b) The guidelines for storm water management and model storm water ordinances shall be submitted to the General Assembly for approval or disapproval and shall be considered by the General Assembly under the procedures created for consideration of Reorganization Plan provided in the act of April 7, 1955 (P.L. 23, No. 8), known as the "Reorganization Act of 1955."

Compiler's Note: Section 502(c) of Act 18 of 1995, which created the Department of Conservation and Natural Resources and renamed the Department of Environmental Resources as the Department of Environmental Protection, provided that the Environmental Quality Board shall have the powers and duties currently vested in it, except as vested in the Department of Conservation and Natural Resources by Act 18 of 1995, which powers and duties include those set forth in section 14.

Section 15. Civil remedies.

(a) Any activity conducted in violation of the provisions of this act or of any watershed storm water plan, regulations or ordinances adopted hereunder, is hereby declared a public nuisance.

(b) Suits to restrain, prevent or abate violation of this act or of any watershed storm water plan, regulations or ordinances adopted hereunder, may be instituted in equity or at law by the department, any affected county or municipality, or any aggrieved person. Except in cases of emergency where, in the opinion of the court, the circumstances of the case require immediate abatement of the unlawful conduct, the court may, in its decree, fix a reasonable time during which the person responsible for the unlawful conduct shall correct or abate the same. The expense of such proceedings shall be recoverable from the violator in such manner as may now or hereafter be provided by law. ((b) repealed in part Oct. 5, 1980, P.L. 693, No. 142)

(c) Any person injured by conduct which violates the provisions of section 13 may, in addition to any other remedy provided under this act, recover damages caused by such violation from the landowner or other responsible person. (15 repealed insofar as inconsistent Oct. 15, 1980, P.L. 950, No. 164)

Section 16. Preservation of existing rights and remedies.

(a) The collection of any penalty under the provisions of this act shall not be construed as estopping the Commonwealth, any county, municipality or aggrieved person from proceeding in courts of law or equity to abate nuisances under existing law or to restrain, at law or in equity, violation of this act.

(b) It is hereby declared to be the purpose of this act to provide additional and cumulative remedies to abate nuisances.

Section 17. Grants and reimbursements to municipalities and counties.

(a) The Department of Environmental Resources is authorized to administer grants to municipalities and counties to assist or reimburse them for costs in preparing official storm

water management plans and actual administrative and enforcement and implementation costs and revisions to official plans for storm water management required by this act. Grants and reimbursements shall be made from and to the extent of funds appropriated by the General Assembly for such purposes, and shall be made in accordance to rules and regulations adopted by the Environmental Quality Board.

(1) The grant shall be equal to 75% of the allowable costs for preparation of official storm water management plans, administrative, enforcement and implementation costs incurred by any municipality or county.

(2) For the purposes of this section, such State grants shall be in addition to grants for similar purposes made to any municipality or county by the Federal Government: Provided, That the grants authorized by this section shall be limited such that the total of all State and Federal grants does not exceed 75% of the allowable costs incurred by the municipality or county.

(b) Nothing in this section shall be construed to impair or limit application of this act to any municipality or person, or to relieve any municipality or person of duties imposed under this act.

(c) If, in any fiscal year, appropriations are insufficient to cover the costs or grants and reimbursement to all municipalities and counties eligible for such grants and reimbursements in that fiscal year, the Department of Environmental Resources shall report such fact to the General Assembly and shall request appropriation of funds necessary to provide the grants authorized in this section. If such a deficiency appropriation is not enacted, any municipality or county which has not received the full amount of the grant for which it is eligible under this section shall be as a first priority reimbursed from appropriations made in the next successive fiscal year. (17 amended May 24, 1984, P.L. 324, No. 63)

Compiler's Note: Section 502(c) of Act 18 of 1995, which created the Department of Conservation and Natural Resources and renamed the Department of Environmental Resources as the Department of Environmental Protection, provided that the Environmental Quality Board shall have the powers and duties currently vested in it, except as vested in the Department of Conservation and Natural Resources by Act 18 of 1995, which powers and duties include those set forth in section 17.

Section 18. Appropriations.

The sum of §500,000, or as much thereof as may be necessary, is hereby appropriated for the fiscal period beginning July 1, 1978, and ending June 30, 1979, to the Department of Environmental Resources for the purposes of administrative and general expenses in implementing the provisions of this act.

Compiler's Note: The Department of Environmental Resources, referred to in this section, was abolished by Act 18 of 1995. Its functions were transferred to the Department of Conservation and Natural Resources and the Department of Environmental Protection.

Section 19. Repealer and savings clause.

(a) All acts or parts of acts inconsistent herewith are hereby repealed to the extent of such inconsistency.

(b) The provisions of this act shall not affect any suit or prosecution pending or to be instituted to enforce any right or penalty or punish any offense under the authority of any act of Assembly or part thereof repealed by this act.

Section 20. Effective date.

This act shall take effect immediately.

APPENDIX B MODEL STORMWATER MANAGEMENT ORDINANCE

Draft Model Stormwater Management Ordinance

for the

Lawrence County Act 167 Stormwater Management Plan

prepared by

L. R. Kimball
415 Moon Clinton Road
Moon Township, PA 15108

May 2010 ©

L.R.Kimball℠
ARCHITECTURE • ENGINEERING • COMMUNICATIONS TECHNOLOGY

Guidance for use of this Model Ordinance:

This Model Ordinance includes two types of information:

1. Standards or requirements
2. Guidelines

Standards or Requirements

Standards or requirements are written in plain text and include PA DEP standards or requirements, as well as those standards or requirements that L.R. Kimball recommends be included in the adopted Ordinance.

Guidelines

Guidelines are presented in Attachment A. Guidelines are for use by the Municipality in consultation with their Code Enforcement staff, their Engineer, and their Solicitor, as deemed necessary. Guidelines are provided to assist the Municipality in "fine tuning" this Ordinance so that it better meets their needs. Guidelines offer additional technical criteria, construction requirements, administration and enforcement recommendations or options, and other guidance that the Municipality may use as it sees fit.

ACT 167 STORMWATER MANAGEMENT ORDINANCE

ORDINANCE NO. _____

MUNICIPALITY OF

_____

LAWRENCE COUNTY, PENNSYLVANIA

Adopted at a Public Meeting Held on

_____, 20__

Article I- General Provisions

Section 101. Short Title
Section 102. Statement of Findings
Section 103. Purpose
Section 104. Statutory Authority
Section 105. Applicability
Section 106. Repealer
Section 107. Severability
Section 108. Compatibility with Other Ordinance Requirements

Article II- Definitions

Article III- Stormwater Management Standards

Section 301. General Requirements
Section 302. Exemptions
Section 303. Waivers
Section 304. Volume Controls
Section 305. Rate Controls
Section 306. Calculation Methods
Section 307. Other Requirements
Section 308. Timber Harvesting/Silviculture

Article IV- SWM Site Plan and Report Requirements

Section 401. Plan and Report Contents
Section 402. Plan Submission
Section 403. Plan Review
Section 404. Modification of Plans
Section 405. Resubmission of Disapproved SWM Site Plans
Section 406. Record Drawings and Final Inspection

Article V-Operation and Maintenance

Section 501. Responsibilities
Section 502. Operation and Maintenance Agreements

Article VI-Fees and Expenses

Section 601. General

Article VII-Prohibitions

Section 701. Prohibited Discharges and Connections
Section 702. Roof Drains
Section 703. Alteration of BMPs

Article VIII-Enforcements and Penalties

Section 801. Right of entry
Section 802. Inspection
Section 803. Enforcement
Section 804. Suspensions and Revocation
Section 805. Penalties
Section 806. Appeals

Article IX- References

Appendix A: Low Impact Development Practices

Appendix B: Site Conditions Suitable for Infiltration
BMPs for Infiltration
BMPs for Rate Control
BMPs for Evapotranspiration

Appendix C: Operation and Maintenance Agreement, Stormwater Best Management Practices

Appendix D: Rational Formula Runoff Coefficients

Appendix E: Small Project SWM Plan Application and Worksheets

Attachment A: Additional Ordinance and Technical Guidelines Toolbox

ARTICLE I -GENERAL PROVISIONS

Section 101. Short Title

This Ordinance shall be known and may be cited as the " _____ Stormwater Management Ordinance."

Section 102. Statement of Findings

The governing body of the Municipality finds that:

A. Inadequate management of accelerated runoff of Stormwater resulting from development throughout a watershed increases flows and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of streams and storm sewers, greatly increases the cost of public facilities to carry and control Stormwater, undermines flood plain management and flood control efforts in downstream communities, reduces groundwater recharge, threatens public health and safety, and increases non-point source pollution of water resources.

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

C. Stormwater is an important water resource, which provides groundwater recharge for water supplies and base flow of streams, which protects and maintains surface water quality.

D. Federal and state regulations require certain Municipalities to implement a program of Stormwater controls. These Municipalities are required to obtain a permit for Stormwater discharges from their separate storm sewer systems under the National Pollutant Discharge Elimination System (NPDES).

Section 103. Purpose

The purpose of this Ordinance is to promote health, safety, and welfare within the Municipality and its watershed by minimizing the harms and maximizing the benefits described in Section 102 of this Ordinance, through provisions designed to:

A. Meet legal water quality requirements under state law, including regulations at 25 Pa. Code Chapter 93 to protect, maintain, reclaim and restore the existing and designated uses.

B. Preserve the natural drainage systems as much as possible.

C. Manage Stormwater runoff close to the source.

D. Provide the minimum procedures and performance standards for Stormwater planning and management.

E. Maintain groundwater recharge, to prevent degradation of surface and groundwater quality and to otherwise protect water resources.

F. Prevent scour and erosion of stream banks and streambeds.

G. Provide proper operations and maintenance of all permanent Stormwater Management Best Management Practices (BMPs) implemented within the Municipality.

H. Provide standards to meet NPDES permit requirements.

Section 104. Statutory Authority

A. Primary Authority:

The Municipality is empowered to regulate these activities by the authority of the Act of October 4, 1978, P.L. 864 (Act 167), 32 P.S. Section 680.1, et seq., as amended, the "Stormwater Management Act" and the ***(appropriate Municipal code)***.

B. Secondary Authority:

The Municipality is empowered to regulate land use activities that affect runoff by the authority of the Act of July 31, 1968, P.L. 805, No. 247, The Pennsylvania Municipalities Planning Code, as amended.

Section 105. Applicability

All Regulated Activities and all activities that may affect Stormwater runoff, including land development or earth disturbance, are subject to regulation by this Ordinance.

Section 106. Repealer

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

Section 107. Severability

In the event that a court of competent jurisdiction declares any section or provision of this Ordinance invalid, such decision shall not affect the validity of any of the remaining provisions of this Ordinance.

Section 108. Compatibility with Other Ordinance Requirements

Approvals issued and actions taken under this Ordinance do not relieve the Applicant of the responsibility to secure required permits or approvals for activities regulated by any other code, law, regulation or ordinance.

ARTICLE II –DEFINITIONS

For the purposes of this Ordinance, 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 words "shall" and "must" are mandatory; the words "may" and "should" are permissive.

D. The words “used or occupied” include the words “intended, designed, maintained, or arranged to be used or occupied.”

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 Activity - The work of producing crops including tillage, land clearing, plowing, disking, harrowing, planting, harvesting crops, or pasturing and raising of livestock 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 because 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, developer or other person who has filed an application for approval to engage in any Regulated Earth Disturbance activity at a project site in the Municipality.

Bank full – The channel at the top-of-bank or point where water begins to overflow onto a floodplain.

Base Flow – Portion of stream discharge derived from groundwater; the sustained discharge that does not result from direct runoff or from water diversions, reservoir releases, piped discharges, or other human activities.

Bioretention – A Stormwater retention area that utilizes woody and herbaceous plants and soils to remove pollutants before infiltration occurs.

BMP (Best Management Practice) - Activities, facilities, designs, measures or procedures used to manage Stormwater impacts from Regulated Activities, to meet State Water Quality Requirements, to promote groundwater recharge and to otherwise meet the purposes of this Ordinance. BMPs include but are not limited to infiltration, filter strips, low impact design, bio-retention, wet ponds, permeable paving, grassed swales, forested buffers, sand filters and detention basins. Structural SWM BMPs are permanent appurtenances to the project site.

Carbonate Bedrock (Areas) - Rock consisting chiefly of carbonate minerals, such as limestone and dolomite; specifically a sedimentary rock composed of more than 50% by weight of carbonate minerals that underlies soil or other unconsolidated, superficial material.

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 drainage ways, swales, streams, ditches, canals, and pipes flowing partly full.

Channel Erosion - The widening, deepening, and headward cutting of small channels and waterways, caused by Stormwater runoff or bank full flows.

Cistern - An underground reservoir or tank for storing rainwater.

Conservation District - A conservation district, as defined in section 3(c) of the Conservation District Law (3 P. S. § 851(c)), which has the authority under a delegation agreement executed with the Department to administer and enforce all or a portion of the erosion and sediment control program in this Commonwealth.

Culvert - A structure with appurtenant works, which carries water 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 semi fluid, or a refuse bank, fill or structure for highway, railroad or other purposes which does or may impound water or another fluid or semi fluid.

Delineation - The process of determining a wetland's physical boundaries**.**

Designee - The agent of the Lawrence County Planning Commission, Lawrence County Conservation District 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.

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. (See Return Period)

Detention - the volume of runoff that is captured and released into the Waters of this Commonwealth at a controlled rate.

Detention Basin - An impoundment designed to collect and attenuate Stormwater peak runoff by temporarily storing the runoff and releasing it at a predetermined rate. Detention basins are designed to drain completely shortly after any given rainfall event and are dry until the next rainfall event.

PA DEP - The Pennsylvania Department of Environmental Protection.

Development - See "Earth Disturbance Activity." The term includes redevelopment.

Discharge – To release water from a project, site, aquifer, drainage basin or other point of interest (verb); The rate and volume of flow of water such as in a stream, generally expressed in cubic feet per second (volume per unit of time) (noun). See also Peak Discharge.

Discharge Point – The point to which Stormwater flows.

Disconnected Impervious Area (DIA) - An impervious or impermeable surface that is disconnected from any stormwater drainage or conveyance system and is redirected or directed to a pervious area, which allows for infiltration, filtration, and increased time of concentration as specified in *Appendix G, Disconnected Impervious Area.*

Disturbed Area – An un-stabilized land area where an earth disturbance activity is occurring or has occurred.

Ditch – (See Channel).

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

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

Earth Disturbance Activity - A construction or other human activity which disturbs the surface of the land, including, but not limited to, clearing and grubbing, grading, excavations, embankments, road maintenance, building construction and the moving, depositing, stockpiling, or storing of soil, rock or earth materials.

Emergency Spillway – A conveyance area that is used to pass peak discharge greater than the maximum design storm controlled by a Stormwater Management facility.

Encroachment – A structure or activity that changes, expands, or diminishes the course, current or cross section of a watercourse, floodway, floodplain, or body of water.

Ephemeral stream – A stream with flowing water only during, and for a short duration after, precipitation events in a typical year. Ephemeral streambeds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow.

Erosion - The natural process by which the surface of the land is worn away by water, wind or chemical action.

Erosion and Sediment Pollution Control Plan - A plan for a project site which identifies BMPs to minimize accelerated erosion and sedimentation.

Exceptional Value Waters – Surface waters of high quality which satisfy Pennsylvania Code Title 25 Environmental Protection, Chapter 93, Water Quality Standards, § 93.4b(b) (relating to anti-degradation).

Extended Detention Volume (EDV) - Release of detained runoff in excess of Permanently Removed Volume (PRV) over a period of time not less than 24 and not more than 72 hours.

Existing Condition – The dominant land cover during the five (5) year period immediately preceding a proposed Regulated Activity.

Felling - The process of cutting down standing trees.

Flood - A temporary condition of partial or complete inundation of 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 Federal Emergency Management Agency (FEMA) maps and studies as being a special flood hazard area. Also included are areas that comprise Group 13 Soils, as listed in Appendix A of the Pennsylvania Department of Environmental Protection (PA DEP) *Technical Manual for Sewage Enforcement Officers* (as amended or replaced from time to time by PA DEP).

Floodway - The channel of the watercourse and those portions of the adjoining floodplain that is reasonably required to carry and discharge the 100-year 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 floodway, the floodway includes floodplain areas within 50 feet of the top of each stream bank and the stream channel itself.

Forest Management / Timber Operations - Planning and activities necessary for the management of forestland. 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 elevation and the top of a dam, levee, tank, basin, swale, or diversion berm. 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 convey surface water.

Groundwater - Water beneath the earth's surface, often between saturated soil and rock that supplies wells and springs.

Groundwater Recharge - Replenishment of existing natural underground water supplies without degrading groundwater quality.

Harvesting - The felling, skidding, loading, and transporting of timber products.

High Quality Waters – Surface waters having quality which exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water by satisfying Pennsylvania Code Title 25 Environmental Protection, Chapter 93 Water Quality Standards, § 93.4b(a).

Hydric Soils - Soils that are characterized by the presence of water.

Hydrograph – A graph of stormwater or runoff discharge versus time for a selected point in the drainage system.

Hydrologic Soil Group (HSG) - Infiltration rates of soils vary widely and are affected by subsurface permeability as well as surface intake rates. Soils are classified into four HSG's (A, B, C, and D) according to their minimum infiltration rate, which is obtained for bare soil after prolonged wetting. The Natural Resources Conservation Service (NRCS) of the US Department of Agriculture defines the four groups and provides a list of most of the soils in the United States and their group classification. The soils underlying the project site may be identified from a soil survey report that can be obtained from local NRCS offices or conservation district offices. Soils become less pervious as the HSG varies from A to D.

Hydrophytic Vegetation - Plant life that is adapted to living in wet conditions.

Impervious Surface (Impervious Area) - A surface that prevents the infiltration of water into the ground. Impervious surfaces (or covers) shall include, but not be limited to:

i. roofs, additional indoor living spaces, patios, garages, storage sheds and similar structures
ii. new streets or sidewalks, decks, parking areas, and driveway areas using traditional paved surfaces that prevent infiltration into the ground. New decks, parking areas, and driveways are not defined as impervious areas if they are designed to allow long-term infiltration.
iii. existing gravel parking areas, driveways, and roads shall be treated as slightly pervious and shall be analyzed using the appropriate SCS curve number based on their HSG; proposed gravel parking areas, driveways, and roads shall be treated as impervious areas for all calculations

Impoundment - A retention or detention bas**in designed** to retain Stormwater runoff and release it at a controlled rate.

Infiltration – Movement of surface water into the soil, where it is absorbed by plant roots, evaporates into the atmosphere, or percolates downward to recharge groundwater.

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

Inlet - The upstream end of any structure through which water may flow.

Intermittent Stream - A stream with flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.

Karst – A type of topography or landscape characterized by surface depressions, sinkholes, rock pinnacles / uneven bedrock surface, underground drainage and caves. Karst is formed on carbonate rocks, such as limestone or dolomite.

Landing (or deck) - A place where logs or tree-length materials are assembled for loading and transport.

Land Development (Development) – any of the following activities:

(1) The improvement of one lot or two or more contiguous lots, tracts or parcels of land for any purpose involving:

- a group of two or more residential or nonresidential buildings, whether proposed initially or cumulatively, or a single nonresidential building on a lot or lots regardless of the number of occupants or tenure; or
- the division or allocation of land or space, whether initially or cumulatively, between or among two or more existing or prospective occupants by means of, or for the purpose of streets, common areas, leaseholds, condominiums, building groups or other features.

(2) A subdivision of land.

Litter Layer - The layer of fallen leaves, twigs, and decaying woody material that provides a sponge-like mat covering forest soils.

Lot - A part of a subdivision or a parcel of land used as a building site or intended to be used for building purposes, whether immediate or future, which would not be further subdivided.

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

Manning Equation (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.

Municipal Engineer – A professional engineer licensed as such in the Commonwealth of Pennsylvania, duly appointed as the engineer for a Municipality, planning agency or joint planning commission.

Municipality -_____, Lawrence County, Pennsylvania.

Natural Recharge Area – Undisturbed surface area or depression where Stormwater collects, and a portion of which infiltrates and replenishes the underground and groundwater.

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

Non-structural Best Management Practice (BMPs) – Methods of controlling Stormwater runoff quantity and quality, such as innovative site planning, impervious area and grading reduction, protection of natural depression areas, temporary ponding on site and other techniques.

NPDES - National Pollutant Discharge Elimination System, the federal government's system for issuance of permits under the Clean Water Act, which is delegated to PA DEP in Pennsylvania.

NRCS - Natural Resources Conservation Service (previously SCS).

Outfall - "Point source" as described in 40 CFR § 122.2 at the point where the Municipality's storm sewer system discharges to surface waters of the Commonwealth.

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

PA DOT - Pennsylvania Department of Transportation.

Parent Tract – The parcel of land from which a land development or subdivision originates, determined from the date of Municipal adoption of this ordinance.

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

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

Permanently Removed Volume (PRV) – The volume of runoff that is permanently removed from the runoff and not released into surface Waters of this Commonwealth during or after a storm event.

Pervious Surface (Pervious Area) – Any area or ground surface not defined as impervious and that may be vegetated or un-vegetated.

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

Planning Commission - The municipal or County planning commission authorized under the Pennsylvania Municipalities Planning Code.

Point Source - any discernible, confined and discrete conveyance, including, but not limited to, any pipe, ditch, channel, tunnel, or conduit from which Stormwater is or may be discharged, as defined in State regulations at 25 Pa. Code § 92.1.

Post-Construction – Period after construction where disturbed areas are stabilized, Stormwater controls are in place and functioning and all proposed improvements in the approved land development plan are completed.

Pre-development – Undeveloped/Natural Condition.

Pre-treatment – Techniques employed in Stormwater BMPs to provide storage or filtering to trap coarse materials and other pollutants before they enter the system.

Project Site - The specific area of land where any Regulated Activities in the Municipality are planned, conducted, or maintained.

Qualified Professional – A Professional Engineer licensed by the Pennsylvania Department of State or otherwise qualified by law to perform the engineering work required by the Ordinance.

Recharge – The replenishment of groundwater through the infiltration of rainfall or Stormwater runoff.

Record Drawings - Those drawings maintained by the Applicant, Applicant's Contractor, or Applicant's Agent as the Applicants project is constructed; and upon which is documented the actual locations of the building components and changes to the original contract documents. These, or a copy of same, are turned over to the Municipality at the completion of the project.

Redevelopment – The demolition, construction, reconstruction, alteration, or improvement exceeding 2,000 square feet of land disturbance performed on sites where existing land use is commercial, industrial, institutional, or multifamily residential. Maintenance activities such as top-layer grinding and re-paving are not considered redevelopment. Interior remodeling projects and tenant improvements are also not considered redevelopment. Utility trenches in streets are not considered redevelopment unless more than 50% of the street width is removed and re-paved.

Regulated Activities - All activities involving land development or earth disturbance activity that may affect stormwater runoff.

Regulated Earth Disturbance Activity - Activity involving Earth Disturbance subject to regulation under 25 PA Code Chapters 92, Chapter 102, or the Clean Streams Law.

Release Rate - The percentage of existing conditions 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 - A structure in which Stormwater is stored and not released during the storm event. Retention Basins do not function without operational intervention to release stored Stormwater unless designed as infiltration-only basins.

Retention / Removed - The volume of runoff that is captured and not released directly into the surface Waters of this Commonwealth during or after a storm event.

Return Period - The interval, in years, within which a storm event of a given magnitude can be expected, on average, to recur. For example, the 25-year return period rainfall would be expected, on average, to recur every twenty-five years. The probability of a 25-year storm occurring in any one year is 0.04 or 4%

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.

Road Maintenance - Earth disturbance activities within the existing road cross-section, such as grading and repairing existing unpaved road surfaces, cutting road banks, cleaning or clearing drainage ditches and other similar activities.

Roof Drains - A drainage conduit or pipe that collects water runoff from a roof and leads it away from the structure.

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.

SALDO – Subdivision and Land Development Ordinance.

SCS – Soil Conservation Service (currently known as NRCS, Natural Resources Conservation Service). Also a commonly referred to method ("SCS Method") for the hydrologic computation and estimation of runoff from rainfall information that has been developed by the United States Department of Agriculture's Soil Conservation Service (SCS).

Sediment - Soils or other materials transported by surface water as a product of erosion.

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

Sediment Pollution - The placement, discharge or any other introduction of sediment into the waters of the Commonwealth.

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

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 groundwater.

Separate Storm Sewer System - A conveyance or system of conveyances (including roads with drainage systems, Municipal streets, catch basins, curbs, gutters, ditches, man-made channels or storm drains) primarily used for collecting and conveying Stormwater runoff.

Shallow Concentrated Flow - Stormwater runoff flowing in shallow, defined rills prior to entering a defined channel or waterway.

Sheet Flow – A flow process associated with broad, shallow water movement on sloping ground surfaces that is not channelized or concentrated.

Skidding - Moving of logs or felled trees along the surface of the ground from the stump to the point of loading.

Skid Road/Haul Road – Those roads, trails, or other openings upon which trees, logs, equipment, or vehicles are moved within the site of the work.

Slash - Unusable woody material such as large limbs, tops, cull logs, and stumps that remain after timber harvesting.

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).

Special Geologic Features - Carbonate bedrock features, including but not limited to closed depressions, existing sinkholes, fracture traces, lineaments, joints, faults, caves and pinnacles, which may exist and must be identified on a site when Stormwater management BMPs are being considered.

Spillway – A conveyance that is used to pass the peak discharge of the maximum design storm controlled by the Stormwater facility.

State Water Quality Requirements - The regulatory requirements to protect, maintain, reclaim, and restore water quality under Pennsylvania Code Title 25 and the Clean Streams Law.

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 exclude domestic sewage and industrial wastes.

Stormwater - Drainage runoff from the surface of the land resulting from precipitation or snow or ice melt.

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 adopted by the County of Lawrence as required by the Act of October 4, 1978, P.L. 864, (Act 167), as amended, and known as the "Stormwater Management Act".

Stormwater Management BMPs - Is abbreviated as **SWM BMPs** throughout this Ordinance.

Stormwater Management Site Plan - The plan prepared by the Applicant or his representative indicating how Stormwater runoff will be managed at the project site in accordance with this Ordinance. Stormwater Management Site Pla**n** will be designated as **SWM Site Plan** throughout this Ordinance.

Stream – A natural watercourse.

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

Subarea (Sub-watershed) - 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, partition by the court for distribution to heirs or devisees, transfer of ownership or building or lot development (Refer to the PA Municipalities Planning Code, current version.)

Surface Waters of the/this 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, or parts thereof, whether natural or artificial, within or on the boundaries of this Commonwealth.

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

Timber Operations - See Forest Management.

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

Top-of-Bank – Highest point of elevation in a stream channel cross section at which a rising water level just begins to flow out of the channel and over the floodplain.

USACE - United States Army Corp of Engineers

Vernal Pond – Seasonal depressional wetlands that are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall.

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

Waters of the/this Commonwealth - Rivers, streams, creeks, rivulets, impoundments, ditches, watercourses, storm sewers, lakes, dammed water, wetlands, ponds, springs and 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.

Watershed - Region or area drained by a river, watercourse or other body of water, whether natural or artificial.

Wet Basin – A detention basin that is designed to detain Stormwater and which always contains water.

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 STANDARDS

Section 301. General Requirements

A. Written approval of a SWM Site Plan must be issued by the Municipality prior to commencement of Regulated Activities unless exempt from this requirement under Section 302.

B. SWM Site Plans approved by the Municipality shall be on site throughout the duration of the Regulated Activity.

C. The Municipality may, after consultation with the PA DEP, approve measures for meeting the State Water Quality Requirements other than those in this Ordinance, provided they meet the minimum requirements of, and do not conflict with, State law including but not limited to the Clean Streams Law.

D. For all Regulated Activities, implementation of peak rate controls and preparation of a SWM Site Plan are required, unless exempted by Section 302 of this Ordinance

E. Impervious Areas:

1. The measurement of impervious areas shall include all of the impervious areas in the total proposed development even if development is to take place in stages.
2. For development taking place in stages, the entire development plan must be used in determining conformance with this Ordinance.
3. For projects that add impervious area to a parcel, the total impervious area on the parcel is subject to the requirements of this ordinance, **unless**, the project is otherwise deemed exempt from stormwater management provisions per the criteria set forth in Section 302 of this plan.
4. Existing gravel parking areas, driveways, and roads shall not be considered impervious. These areas shall be treated as semi-pervious and shall be analyzed using the appropriate SCS curve number based on the appropriate HSG underlying the gravel areas, which is defined as:
    a. HSG **A** – Gravel Area Curve Number shall be **76**
    b. HSG **B** – Gravel Area Curve Number shall be **85**
    c. HSG **C** – Gravel Area Curve Number shall be **89**
    d. HSG **D** – Gravel Area Curve Number shall be **91**
5. Proposed gravel parking areas, driveways, and roads shall be considered impervious.

F. Stormwater discharges onto adjacent property shall not be created, increased, decreased, or relocated, or otherwise altered without permission of the adjacent property owner(s). Such discharges shall be subject to the requirements of this Ordinance.

G. All regulated activities shall include such measures as necessary to:

1. Protect health, safety, and property;

2. Meet the water quality goals of this ordinance by implementing measures to:
    a. Minimize disturbance to floodplains, wetlands, natural slopes over 15%, and existing native vegetation.
    b. Minimize thermal impacts to Waters of the Commonwealth.
    c. Preserve and maintain trees and woodlands. Maintain or extend riparian buffers and protect existing forested buffer. Provide trees and woodlands adjacent to impervious areas.
    d. Establish and maintain non-erosive flow conditions in natural flow pathways.
    e. Minimize soil disturbance and soil compaction. Cover disturbed areas with topsoil having a minimum depth of 4 inches. Use tracked equipment for grading.
    f. Disconnect impervious surfaces by directing runoff to pervious areas.
3. Incorporate the techniques described in Appendix A of this Ordinance (Low Impact Development Practices) whenever practical.

H. The design of all facilities over Karst shall include an evaluation of measures to minimize adverse effects.

I. Infiltration BMPs shall be spread out, made as shallow as practicable, and located to maximize use of natural on-site infiltration features while still meeting the other requirements of this Ordinance.

J. Storage facilities shall completely drain both the volume control and rate control capacities over a period of time not less than 24 and not more than 72 hours from the end of the design storm.

K. The design storm volumes to be used in the analysis of peak discharge rates shall be obtained from the Precipitation-Frequency Atlas of the United States, Atlas 14, Volume 2, US Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Hydrometeorological Design Studies Center, Silver Spring, Maryland, 20910. NOAA's Atlas 14 can be accessed at Internet address:

    http://hdsc.nws.noaa.gov/hdsc/pfds/.

L. The Municipality and its Engineer may require that regulated activities maintain a minimum distance between proposed impervious areas/stormwater management facility outlets and down slope property line(s).

M. SWM BMPs for all Regulated Activities shall be designed, implemented, operated, and maintained to meet the purposes and requirements of this Ordinance and to meet all requirements under Title 25 of the Pennsylvania Code, the Clean Streams Law, and the Stormwater Management Act.

N. For all regulated earth disturbance activities, erosion and sediment control BMPs shall be designed, implemented, operated, and maintained during the regulated earth disturbance activities (e.g., during construction) to meet the purposes and requirements of this Ordinance and to meet all requirements under Title 25 of the Pennsylvania Code and the Clean Streams Law. Various BMPs

and their design standards are listed in the *Erosion and Sediment Pollution Control Program Manual* (E&S Manual), No. 363-2134-008 (April 15, 2000), as amended and updated.

Section 302. Exemptions

A. Under no circumstance shall the Applicant be exempt from implementing such measures as necessary to:

   1. Meet special requirements for projects within High Quality (HQ) and Exceptional Value (EV) watersheds (Section 307.G).

B. The Applicant must demonstrate that the following BMPs are being used to the maximum extent practicable to receive consideration for the exemptions:

   1. Design around and limit disturbance of Floodplains, Wetlands, Natural Slopes over 15%, existing native vegetation, and other sensitive and special value features.
   2. Maintain riparian and forested buffers.
   3. Limit grading and maintain non-erosive flow conditions in natural flow paths.
   4. Maintain existing tree canopies near impervious areas.
   5. Minimize soil disturbance and reclaim disturbed areas with topsoil and vegetation.
   6. Direct runoff to pervious areas.

C. The Applicant must demonstrate that the proposed development/additional impervious area will not adversely impact the following:

   1. Capacities of existing drainage ways and storm sewer systems.
   2. Velocities and erosion.
   3. Quality of runoff if direct discharge is proposed.
   4. Existing known problem areas.
   5. Safe conveyance of the additional runoff.
   6. Downstream property owners.

D. An Applicant proposing Regulated Activities, after demonstrating compliance with Sections 302.A, 302.B, and 302.C, may be exempted from various requirements of this Ordinance according to the following table:

0 SF ≤ **new** impervious area <1000 SF	**Required:** Exempt from additional requirements
1000 SF ≤ **new** impervious area < 2500 SF	**Required:** Small Project SWM Application[1] (See Appendix F)
2500 SF ≤ **new** impervious area < 5000 SF	**Required:** Volume Control (Section 304) and Small Project SWM Application (See Appendix F)
5000 SF ≤ **new** impervious area	**Required:** Peak Rate Control (Section 305), Volume Control (Section 304), and Stormwater Management Site Plan

All Regulated Activities must comply with the State Water Quality Requirements.

E. New Single Family Residential activities on a single lot are exempt from the requirements of Section 304 - Volume Control, Section 305 - Peak Rate Control, and from the submission of a Small Project SWM Application provided the construction:

1. Complies with Sections 302.A, 302.B, 302.C, and
2. Has building setbacks of at least 75 feet from downslope property lines, and
3. Driveways:
    a. Runoff must discharge onto pervious surface with a gravel strip or other spreading device.
    b. No more than 1,000 square feet of paved surface may discharge to any one point.
    c. For each discharge point, the flow length on the pervious surface must exceed the flow length on the paved surface flow."

F. The Municipality may accept alternative stormwater management controls under this section provided that:

1. The alternative controls are documented to be acceptable to PADEP (or Delegated Authority), for NPDES requirements pertaining to post construction stormwater management requirements.

[1] The municipality can require the applicant to provide supplemental and additional information beyond the Small Project SWM Application if there is a threat to property, health or safety

2. The alternative controls comply with all other sections of this ordinance, including but not limited to Sections 301.C and 302.A-C.

G. Agricultural activities are exempt from the rate and SWM Site Plan preparation requirements of this ordinance provided the activities are performed according to the requirements of 25 Pa.Code Chapter 102.

H. Forest management and timber operations are exempt from the rate and volume control and SWM Site Plan preparation requirements of this ordinance provided the activities are performed according to the requirements of 25 Pa.Code Chapter 102. Refer to Section 308 for additional information and guidance concerning timber operations.

I. Exemptions from any provisions of this Ordinance shall not relieve the Applicant from the requirements in Sections 301. F, G, H, I, J and K.

J. Proposed Municipal projects are bound to the following requirements and criteria:

Type of Project		Description:	Requirements:
Roadway Restoration	Alignments*	Change the roadway by either reducing or eliminating horizontal and vertical curves, or changing the roadway's superelevation.	**Required:** BMP implementation that uses non-structural and restoration practices such as: • Street sweeping • Impervious disconnection • Slope roughening • Pavement width reduction • Riparian buffers • Vegetative Restoration (including road-side swales) • Soil Amendments
	Pull-Offs*	New, as part of a larger project or by itself.	
	Widening*	Increase the width of the existing travel lanes (no new lanes added) and shoulders, or extension of acceleration/deceleration ramps in existing shoulder areas.	
	Intersection*	Nominal channelization of intersections and addition of turning lanes.	**Required:** Minor practices and BMP implementation that uses low-impact practices such as: • Preservation of existing vegetation • Minimization of soil compaction • Maintenance of Erosion Control and any PCSM BMPs • Restoration and stabilization of staging areas
	Pavement	Replace portions, overlay, or mill and resurface the roadway's surface.	
	Shoulders	Resurface, stabilize, upgrade (dirt or gravel to paved), or widen the existing shoulders within the existing footprint.	
	Other	Replace and/or repair guide rail, signs, traffic signals, and drainage systems to their original specifications; various minor safety improvements.	

Type of Project		Description:	Requirements:
New Construction	Major Widening*	Addition of one or more travel lanes, including acceleration and deceleration lanes, to an existing road.	**Required:** Peak Rate Control (Section 305), Volume Control (Section 304), and Stormwater Management Site Plan
	New Alignment*	New roadway corridor.	
	Interchange*	Reconfiguration of ramps, lane modification within interchange area, etc.	
	Municipal Facilities	New stockpile sites, buildings, or other structures or facilities not otherwise addressed by the requirements of this section	

* - Projects falling into the noted categories and that have the potential to discharge into surface waters that have existing or designated HQ or EV uses (including EV wetlands), have impairments due to stormwater, are connected to combined sewer systems, or have the potential to have an adverse effect on threatened or endangered species, or critical habitat for such species, are subject to additional stormwater management requirements, beyond the requirements listed in the table. The additional BMP measures that must be considered and implemented for projects occurring in these areas are as follows:

Constructed wetlands / Wet ponds	Significant detention of peak flow rates is needed and the contributing drainage area is large; retrofit existing detention basins are feasible.
Permeable pavement	Parking lots only.
Manufactured products: Subsurface storage, water quality inlets, etc.	Subsurface storage products are designed to attenuate peak runoff events through infiltration and/or discharge rate reduction. Storm sewer inlet structures or inserts are designed to minimize the discharge of solids, floatables, and oil/grease pollutants. Regular maintenance of these products is necessary.

Projects occurring in the areas listed above and not previously bound to such requirements (roadway restoration projects), are also required to achieve the following targeted outcomes:

1. For project areas within a release rate district, reduce the post-construction runoff peak rate as required by the release rate district in this Ordinance. For project areas not within a release rate district, reduce the post-construction runoff peak rate to the pre-construction peak rate for the 1-year through 100-year storm events.
2. Reduce the post-construction runoff volume to the pre-construction runoff volume for the 2-year 24-hour storm event and smaller.

Section 303. Waivers

A. The provisions of this Ordinance are the minimum standards for the protection of the public

B. Waivers shall not be issued from implementing such measures as necessary to:

    1. Meet State Water Quality Standards and Requirements.

    2. Protect health, safety, and property.

    3. Meet special requirements for High Quality (HQ) and Exceptional Value (EV) watersheds.

C. The Municipality will consider waiver requests in accordance with Section 301.D. If an Applicant demonstrates to the satisfaction of the governing body of the Municipality that any mandatory provision of this Ordinance is unreasonable or causes unique or undue unreasonableness or hardship as it applies to the proposed Project, or that an alternate design may result in a superior result within the context of Section 102 and 103 of this Ordinance, the governing body of the Municipality upon obtaining the comments and recommendations of the Municipal Engineer and Conservation District may grant a waiver or relief so that substantial justice may be done and the public interest is secured; provided that such waiver will not have the effect of nullifying the intent and purpose of this Ordinance.

D. The Applicant shall submit all requests for waivers in writing and shall include such requests as a part of the plan review and approval process. The Applicant shall state in full the facts of unreasonableness or hardship on which the request is based, the provision or provisions of the Ordinance that are involved, and the minimum waiver or relief that is necessary. The Applicant shall state how the requested waiver and how the Applicant's proposal shall result in an equal or better means of complying with the intent or Purpose and general principles of this Ordinance.

E. The Municipality shall keep a written record of all actions on waiver requests. The Municipality may charge a fee for each waiver request, which shall be used to offset the administrative costs of reviewing the waiver request. The Applicant shall also agree to reimburse the Municipality for reasonable and necessary fees that may be incurred by the Municipal Engineer in any review of a waiver request.

F. In granting waivers, the Municipality may impose reasonable conditions that will, in its judgment, secure substantially the objectives of the standards or requirements that are to be modified.

G. The Municipality may grant applications for waivers when the following findings are made, as relevant:

    1. Requests must meet the provisions of Section 303.G and Section 303.H.

    2. That the waiver shall result in an equal or better means of complying with the intent of this Ordinance.

    3. That the waiver is the minimum necessary to provide relief.

    4. That the applicant is not requesting a waiver based on cost considerations.

5. That existing down gradient stormwater problems will not be exacerbated.
6. That runoff is not being diverted to a different drainage area.
7. That increased flooding or ponding on off-site properties or roadways will not occur.
8. That potential icing conditions will not occur.
9. That increases in peak flow or volume from the site will not occur.
10. That erosive conditions due to increased peak flows or volume will not occur.
11. That adverse impact to water quality will not result.
12. That increased 100-Year Floodplain levels will not result.
13. That increased or unusual municipal maintenance expenses will not result from the waiver.
14. That the amount of stormwater generated has been minimized to the greatest extent allowed.
15. That infiltration of runoff throughout the proposed site has been provided where practicable and pre-development ground water recharge protected.
16. That peak flow attenuation of runoff has been provided.
17. That long-term operation and maintenance activities are established.
18. That the receiving streams and/or water bodies will not be adversely impacted in flood carrying capacity, aquatic habitat, channel stability and erosion and sedimentation.

Section 304. Volume Controls

The low impact development practices provided in the PA BMP Manual shall be used for all regulated activities to the maximum extent practicable. Water volume controls shall be implemented using the Design Storm Method in Subsection A or the Simplified Method in Subsection B below. For regulated activity areas equal or less than 1 acre that do not require hydrologic routing to design the stormwater facilities, this Ordinance establishes no preference for either methodology; therefore, the applicant may select either methodology on the basis of economic considerations, the intrinsic limitations on applicability of the analytical procedures associated with each methodology, and other factors.

A. The Design Storm Method (CG-1 in the PA BMP Manual (current version)) is applicable to any size of Regulated Activity. This method requires detailed modeling based on site conditions.
    1. Do not increase the post development total runoff volume for all storms equal to or less than the 2-year 24-hour duration precipitation.
    2. For modeling purposes:
        a. Existing (pre-development) non-forested pervious areas must be considered meadow or its equivalent.
        b. Twenty (20) percent of existing impervious area, when present, shall be considered meadow in the model for existing conditions.

B. The Simplified Method (CG-2 in the PA BMP Manual (current version)) provided below is independent of site conditions and shall be used if the Design Storm Method is not followed. This method is not applicable to Regulated Activities that disturb greater than one (1) acre, or for projects that require design of stormwater storage facilities. For new impervious surfaces:

1. Stormwater facilities shall be sized to capture at least the first two inches (2") of runoff from all new impervious surfaces.
2. At least the first one inch (1.0") of runoff from new impervious surfaces shall be permanently removed from the runoff flow - i.e. it shall not be released into the surface Waters of this Commonwealth. Removal options include reuse, evaporation, transpiration, and infiltration.
3. Wherever possible, infiltration facilities shall be designed to accommodate infiltration of the entire permanently removed runoff; however, in all cases at least the first one-half inch (0.5") of the permanently removed runoff shall be infiltrated.
4. This method is exempt from the requirements of Section 305, Rate Controls.

Section 305. Rate Controls

A. Areas not covered by a Release Rate Map from an approved Act 167 Stormwater Management Plan:

Post-development discharge rates shall not exceed the Pre-Development discharge rates for the 1-, 2-, 10-, 25-, 50-, and 100-year storms. If it is shown, that the peak rates of discharge indicated by the post-development analysis are less than or equal to the peak rates of discharge indicated by the pre-development analysis for 1-, 2-, 10-, 25-, 50-, and 100-year, 24-hour storms, then the requirements of this section have been met. Otherwise, the applicant shall provide additional controls as necessary to satisfy the peak rate of discharge requirement.

B. Areas covered by a Release Rate Map from an approved Act 167 Stormwater Management Plan:

For the 1-, 2-, 10-, 25-, 50-, and 100-year storms, the post-development discharge rates will follow the release rate maps in this Ordinance. For any areas not shown on the release rate maps, the post-development discharge rates shall not exceed the Pre-Development discharge rates.

C. BMPs for Rate Controls:

A list of BMPs for peak rate controls is provided in Appendix B, Item C.

Section 306. Calculation Methods

A. Stormwater runoff from all project sites shall be calculated using a generally accepted calculation technique that is based on the NRCS soil cover complex method. Table 306-1 summarizes acceptable computation methods and the method selected by the Qualified

Professional shall be based on the individual limitations and suitability of each method for a particular site.

TABLE 306-1

ACCEPTABLE COMPUTATION METHODOLOGIES FOR STORMWATER MANAGEMENT PLANS

Method	Method Developed By	Applicability
TR-20/WINTR20 *(or commercial computer package based on TR-20)*	USDA NRCS	Applicable where use of full hydrology computer model is desirable or necessary.
TR-55/WINTR55 *(or commercial computer package based on TR-55)*	USDA NRCS	Applicable for land development plans within limitations described in TR-55.
HEC-HMS	US Army Corps of Engineers	Applicable where use of full hydrologic computer model is desirable or necessary.
Rational Formula *(or commercial computer package based on Rational Formula)*	Emil Kuichling (1889)	For sites less than fifty acres and with time of concentration less than 60 minutes (T_c< 60 min), or as approved by the Municipality
Other Methods such as SWMM, WMS, etc.	Varies	Other computation methodologies approved by the Municipality

Note: Successors to the above methods are also acceptable.

B. All calculations consistent with this Ordinance using the soil cover complex method shall use the appropriate design rainfall depths and intensities for the various return period storms according to the approximate center of the proposed development site, in accordance with the values obtained from the National Oceanic and Atmospheric Administration's (NOAA) Hydrometeorological Design Studies Center Precipitation Frequency Data Server (PFDS) at the following location for the Commonwealth of Pennsylvania:

http://hdsc.nws.noaa.gov/hdsc/pfds/index.html

Applicant shall provide documentation of PFDS data location (latitude and longitude in degrees/minutes/seconds).

C. All calculations using the Rational Formula shall use rainfall intensities consistent with appropriate times-of-concentration for overland flow and return periods from the NOAA, PFDS website, the Design Storm Curves from PA DOT Design Rainfall Curves (1986) and NOAA Atlas 14.

D. 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. NRCS lag equation divided by 0.6 as acceptable method for T_c in undeveloped areas.

E. In order to reduce stormwater runoff volumes from developed areas and encourage groundwater recharge, underground basin drains, infiltration trenches, dry wells, and cisterns are permitted to which roof leaders may be connected. These drains consist of stone-filled basins that temporarily store and release water below ground surface. Plans for such facilities shall be submitted to the Municipality for approval, and the basins shall be used only in those areas where soils, geologic, and water table conditions permit.

F. Runoff Curve Numbers (CN) for both existing and proposed conditions to be used in the soil cover complex method shall be obtained from Table 2-2 of the TR-55 manual.

G. Runoff coefficients (C) for both existing and proposed conditions for use in the Rational Formula are provided in Appendix D.

H. All flow assumptions and source of supporting data shall be provided as part of the overall plan. The Municipality reserves the right to reject any submitted values, despite the source, and to provide a substitute source for use by the applicant.

I. 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 generally accepted values from a legitimate and verifiable source. All flow assumptions and source of supporting data shall be provided as part of the overall plan. The Municipality reserves the right to reject any submitted values, despite the source, and to provide a substitute source for use by the applicant. Full flow capacity shall be assumed for closed conduits. Storm sewer systems consisting of more than three pipe junctions shall be designed using hydraulic grade line computations.

J. 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.

   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 200 acres in size, the design storm hydrograph shall be computed using a calculation method that produces a full hydrograph (i.e. TR-20, TR-55, and HEC-HMS).

K. Stormwater management and related facilities shall be provided:

   1. To permit unimpeded flow of natural watercourses. Such flow may be redirected as required, subject to the approval of the Pennsylvania Department of Environmental Protection and the Municipality.

   2. To ensure adequate drainage of all street low points.

L. Storm sewers and related installations:

   1. When located in undedicated land, they shall be placed within a drainage easement not less than twenty (20) feet wide as approved by the Municipality.

2. The use of properly designed, graded, and vegetated drainage channels is encouraged in lieu of storm sewers in commercial and industrial areas and, where approved by the Municipality, in residential areas. Such swales shall be designed to not only carry the required discharge without excessive erosion, but also to increase the time of concentration, reduce the peak discharge and velocity, and permit the water to percolate into the soil, where appropriate. Criteria related to· the use and design of drainage swales are as follows:

    a. The maximum encroachment of water on the roadway pavement along roadside swales in cut areas shall not exceed half of a through traffic lane during a 10-year frequency storm of five (5) minute duration. Frequent and/or sustained flooding of the sub-base shall be avoided.

    b. The design of all vegetated channels shall, as a minimum, conform to the design procedures outlined in the Erosion and Sediment Pollution Control Program Manual (PA DEP). Inlets shall be provided to limit road shoulder encroachment and water velocity.

    c. The side slope for any vegetated drainage channel requiring mowing of the vegetation shall have a maximum grade of three (3) horizontal to one (1) vertical on those areas to be mowed. Maximum side slopes for any vegetated drainage channel shall be two (2) horizontal to one (1) vertical.

    d. Erosion Prevention: All drainage swales shall be designed to prevent the erosion of the bed and bank areas. Suitable temporary and/or permanent stabilization during vegetative cover establishment shall be provided to prevent erosion.

    e. Storm sewers or drainage swales shall discharge to a detention or retention basin to attenuate the peak rate and volume, respectively of stormwater runoff, except as provided in the plan.

3. Storm inlet types and inlet assemblies shall conform to the Pennsylvania Department of Transportation Standards for Roadway Construction as approved by the Municipality.

4. When evidence available to the Municipality indicates that existing storm sewers have sufficient capacity as determined by hydrograph summation and are accessible, proposed stormwater facilities may connect to the existing storm sewers so long as the peak rate of discharge does not exceed the amount permitted by this Article.

M. Downstream Analysis

1. Where deemed necessary by the Municipal Engineer, the applicant shall submit an analysis of the impacts of detained stormwater flows on downstream areas within the watershed, established with the concurrence of the Municipal Engineer. The analysis shall include hydrologic and hydraulic calculations necessary to determine the impact of peak discharge modifications of the proposed development on critical locations such as dams, tributaries, existing developments, undersized culverts, and flood prone areas. Review and comment of the analysis by the Engineer of a downstream Municipality shall be obtained as deemed necessary.

N. Multiple Use Basins: The design and construction of multiple use stormwater detention facilities are strongly encouraged. In addition to stormwater management; where appropriate, facilities allow for recreational uses including: ball fields, play areas, picnic grounds, etc. Provision for parking facilities within basins and permanent wet ponds with stormwater management capabilities may also be appropriate. Prior approval and consultation with the Municipality are required before design. Multiple use basins shall be constructed so that potentially dangerous conditions are not created.

O. Alternative Detention Facilities: Alternative stormwater detention facilities including roof top, subsurface basins or tanks and in-pipe detention storage, or other approved alternative designs are permitted as determined by the Municipality.

P. Landscaping of Stormwater management facilities: Facilities constructed with berms or earthen embankments shall not be landscaped along the top of the impoundment berm, embankment, nor shall other facility areas constructed from compacted fill materials be landscaped. Heavy vegetative cover root penetration can cause soil weakening and damage to facility piping.

Section 307. Other Requirements

A. All wet basins shall be designed in a manner that seeks to mitigate the proliferation of mosquito breeding habitats and the potential spread of the West Nile Virus. This can be accomplished through the following means:

   1. The design of a Stormwater wetland/wet basin must include the selection of hydrophytic plant species for their pollutant uptake capabilities and for not contributing to the potential for vector mosquito breeding. The establishment of hydrophytic vegetation will promote the population of the wetland/ wet basin by amphibians and other mosquito predators. In natural wetlands, predatory insects and amphibians are effective at keeping mosquito populations in check during the larval stage of development while birds and bats prey on adult mosquitoes. Refer to Appendix B of the PA SWM BMP Manual (current version) for hydrophytic native plant species lists.

   2. Aeration fountains and stocked fish can be added to keep larval mosquito populations in check.

B. The Municipality reserves the right to disapprove any design that would result in the construction or continuation of a Stormwater problem area.

C. When the elevation of any existing or proposed entrance to a structure, including windows, is lower than the elevation of the public cartway serving that site, a grading plan shall be submitted, reviewed and approved as part of the SWM approval process for the proposed structure.

D. No Stormwater detention facility shall be placed within fifty (50) feet of a special geologic feature. No subsurface Stormwater conveyance facility shall be constructed within fifty (50) feet of a special geologic feature, without written permission of the Municipality.

E. Stormwater management facilities located outside of existing or proposed public rights-of-way shall be located within and accessible by easements granted to the Municipality as follows:

1. Access Easements: Where proposed stormwater management facilities are not adjacent to proposed or existing public right-of-ways or are not accessible due to physical constraints, as determined by the Municipality, a twenty (20) feet wide access easement specifying rights of entry shall be provided commensurate to need. Access easements shall provide for vehicle ingress and egress on grades of less than ten (10) percent for carrying out inspection or maintenance activities. A permanent fifteen-foot wide vehicular access road within the easement(s) shall be provided around all SWM BMPs, such as ponds and infiltration structures. The access roads shall connect to a public thoroughfare. The access road (when applicable) will also provide access at a slope no greater than 20% to the bottom of all ponds and associated outlet structures. The access road shall be constructed of either gravel or pavement and maintained per the maintenance agreement. The Municipality reserves the right to alter the design of the access to any SWM BMP.

   Vehicle ingress and egress and access roads are not required for SWM BMPs serving one Single Family Residential lot and located on the same lot they serve.

2. Maintenance Easements: The maintenance easement must be located twenty (20) feet outside of the footprint for the stormwater facility and appurtenances.

   Maintenance easements are not required for SWM BMPs serving one Single Family Residential lot and located on the same lot they serve.

3. Easements shall state that no trees, shrubs, structures, excavation, placement of fill, or re-grading are to be performed within the easement without written approval from the Municipality upon review by the Municipal Engineer. Upon approval of the Municipality, such landscaping may be placed in maintenance easements, provided it does not impede access.

4. Whenever practicable, easements shall be parallel to width and linked to property lines of the subdivision.

5. All easement agreements shall be recorded with a reference to the recorded easement indicated on the site plan. The format and content of the easement agreement shall be reviewed and approved by the Municipality and Solicitor.

F. In order to promote overland flow and infiltration, roof drains shall not discharge directly to streets or storm sewers. Roof drains may discharge directly to streets or storm sewers when deemed necessary by the Municipality. Under no circumstances shall roof drains discharge directly to sanitary sewer systems.

Projects that have the potential to discharge into surface waters that have existing or designated HQ or EV uses (including EV wetlands), have impairments due to stormwater, are connected to combined sewer systems, or have the potential to have an adverse effect on threatened or endangered species, or critical habitat for such species, are subject to additional BMP measures that must be considered and implemented for projects occurring in these more environmentally-sensitive areas:

Constructed wetlands / Wet ponds	Significant detention of peak flow rates is needed and the contributing drainage area is large; retrofit existing detention basins are construct new in open median or interchange areas
Permeable pavement	Limited to park-and-ride sites and parking lots
Manufactured products: Subsurface storage, water quality inlets, etc.	Subsurface storage products are designed to temper peak runoff events through infiltration and/or discharge rate reduction. Storm sewer inlet structures or inserts are designed to minimize the discharge of solids, floatables, and oil/grease pollutants. Regular maintenance of these products is necessary and is an important factor in assessing the feasibility of using one of these products.

Proposed infiltration BMPs within two miles on either side of surface water supply areas or surface waters that have existing or designated HQ or EV uses (including EV wetlands) must be designed and constructed to provide maximum pollutant removal prior to the runoff being infiltrated or discharged to the receiving stream. PADEP defines the following zones around such waters:

1. Zone A – Represents a 1/4 mile buffer on either side of the river or stream extending from the area 1/4 mile downstream of the intake upstream to the five hour time-of-travel (TOT) (Pennsylvania Department of Environmental Protection, 2006).
2. Zone B – Represents a two-mile buffer on either side of the water body extending from the area 1/4 mile downstream of the intake upstream to the 25 hour TOT. (Pennsylvania Department of Environmental Protection, 2006).
3. Zone C – The remainder of the watershed area (Pennsylvania Department of Environmental Protection, 2006).

G. Groundwater Supply Protection

1. Zone 1 – The innermost protective zone surrounding a well, spring, or existing infiltrative gallery. Zone 1 is the area within a radius of 400 feet around a community or public water supply source unless information is presented supporting a reduction of this requirement. Proposed infiltration BMPs are not permitted within Zone 1 protection areas (Pennsylvania Department of Environmental Protection, 2006).

2. Zone 2 – The capture zone that encompasses the area of the aquifer through which it supplies water to a well, spring, or existing infiltration gallery. Zone 2 is one-half mile radius around a community or public water supply source unless more extensive hydrogeological testing is done. Extreme care should be used when implementing infiltration BMPs in Zone 2 areas. Pretreatment measures must be used to filter and diminish pollutants (Pennsylvania Department of Environmental Protection, 2006).
3. Zone 3 – The area outside Zone 2 that contributes significant recharge to the capture zone aquifer in Zone 2 (Pennsylvania Department of Environmental Protection, 2006). Use of infiltration BMPs is not restricted.
4. Infiltration BMPs are not permitted within a radius of 50 feet from a privately owned wells and water sources serving non-community supply systems (Pennsylvania Department of Environmental Protection, 2006)

Section 308. Timber Harvesting/Silviculture

It is not the intention for this section to serve as an ordinance or regulatory document governing the practice of timber harvesting/silviculture activities. However, the intent of this section and the included guidelines is to address specific stormwater management issues related to or caused by such timber harvesting activities. These regulations shall not be considered a timber-harvesting ordinance, nor do they relieve the applicant from meeting any additional timber harvesting regulations already in place. The municipality, at its own discretion, may choose to enact any new or enforce any existing ordinance directly related to timber harvesting.

A. Logging operators shall address and comply with all applicable standards for erosion and sedimentation control and stream crossing regulations under 25 Pennsylvania Code, Chapter 102, Erosion Control Rules and Regulations, issued pursuant to the Clean Stream Law, and 25 Pennsylvania Code, Chapter 105, Dam and Waterway Management Rules and Regulations, issued pursuant to the Dam Safety and Encroachments Act. Any additional governing or amended regulations shall hereby govern all logging plans, including those mentioned by the regulatory authorities listed or by any other entity garnishing such authoritative and administrative powers.

B. Logging operators shall address and comply with all applicable standards for stormwater management as set forth in the Stormwater Management Plan of Lawrence County, and any regulations, stormwater management plans and ordinances issued or enacted pursuant thereto.

C. All logging operations shall be conducted in strict adherence with PA DEP Document 3930-BK-DEP4016 (Revised 06/2007) or the most recent, amended version.

D. At a minimum, logging operators shall address each of the following:

    1. Design of the logging road system, taking into account its influence on surface runoff, this includes haul roads, skid roads, and skid trails
    2. Water control structures
    3. Stream crossings and potential wetland impacts

4. Log landings
5. Maintenance
6. Public road use
7. Retirement of logging roads, log landings, stream crossings, structures, etc. and restoration of the same

E. Controlling erosion on logging road systems is required.

1. A functional drainage system of culverts, dips, bridges, turnouts, and out-sloping or in-sloping roads to handle stormwater runoff.
2. Keep road reasonably free of ruts, curbs and logging debris that may prevent water from moving freely into drainage structures.
3. Reduce or eliminate traffic on haul roads, skid trails and landings during wet weather and during periods when frozen roads are thawing.
4. The erosion and sediment pollution control plan must show how haul roads, skid roads, and landings are proposed to be retired.

ARTICLE IV - SWM SITE PLAN AND REPORT REQUIREMENTS

Section 401. Plan and Report Contents

A. All regulated activities that do not fall under the exemption criteria referenced herein shall submit a SWM Site Plan and Report to the municipality for review. These criteria shall apply to the total proposed development even if development is to take place in stages.

B. The following items shall be included in the SWM Site Plan:

1. Appropriate sections from the Municipal SALDO and other applicable ordinances shall be followed in preparing the SWM Site Plans. In instances where the Municipality lacks Subdivision and Land Development regulations, the County SALDO shall be followed.

2. The SWM Site Plan shall provide the following information:

a. Unless specifically given written permission by the Municipality, the following must be shown on the SWM Site Plan, prepared in a form which meets the requirements for recording in the County Office of the Recorder of Deeds:

i. Annotated maps, drawings, engineering plans, and construction details. Said plan shall be prepared by a Qualified Professional, with said preparer's seal and registration number affixed to the plan. Plans for tracts of less than twenty (20) acres shall be drawn at a scale of one inch equals no more than fifty (50) feet; for tracts of twenty (20) acres or more, plans shall be drawn at a scale of one inch equals no more than one hundred (100) feet. Plans shall be submitted on the following sheet sizes: 18" x 24", 24" x 36", or 36" x 42". All lettering shall be drawn to a size to be legible if the plans are reduced to half size. All sheets comprising a submission shall be on one size.

ii. The name of the proposed development and the name and address of the owner of the property and the individual or firm preparing the plan.

iii. Date of submission and revision, graphic scale, and North arrow.

iv. Total tract boundary with distances marked to the nearest foot and bearings to the nearest degree and the total acreage of the tract.

v. Key map (drawn to scale) showing all existing natural and man-made features beyond the property boundary affected by the project and the extent of the watershed or sub-basin which drains through the project site.

vi. Existing and proposed topographic contours shall be provided at intervals not greater than five (5) feet for existing and proposed conditions.

vii. Topographic contours at intervals less than five (5) feet may be required for flat sites, and to depict certain existing and future

stormwater management features. The reference datum used to develop topographic contours shall be stated on the plans.

viii. Existing and proposed use, including the total area of impervious surfaces after construction.

ix. Location and selected plant material used for vegetative filter paths to sinkholes, stream buffers, buffer yards, wetlands, streams, and other waters of the Commonwealth, and the location of all notices to be posted, as specified in this Ordinance. If stormwater management facilities are off-site, a note on the plan referring to location and agreements indicating responsibility for conveyance to and maintenance of the facilities; all such off-site facilities shall meet the design standards and criteria specified in this Ordinance, and details of the facilities shall be included with the plan.

b. An erosion and sediment pollution control plan, as prepared for and submitted to the County Conservation District.

c. Plan and profile, and construction detail drawings of all SWM BMPs including open channels and swales.

d. Locations of existing watercourses (including stream name per PA DEP Chapter 93 designation, or otherwise noted as “unnamed tributary” with Chapter 93 numeric designation) and existing and proposed on-lot wastewater facilities, water supply wells, and infiltration areas.

e. Locations of all access and maintenance easements, suitable for Recording.

f. Signature blocks:

The following signature block for the Municipality:

“_____, on this date (date of signature), has reviewed this SWM Site Plan in accordance with the design standards and criteria of the applicable Municipal Ordinances."

The following signature block for the Qualified Professional:

“_____, on this date (date of signature), hereby certify that this SWM Site Plan was prepared in strict accordance with all of the design standards and criteria of all applicable Municipal Ordinances.”

The following signature block for the Applicant/Owner:

“_____, on this date (date of signature), has acknowledged that I/we and/or my/our assignees/grantees shall be responsible for maintenance of the stormwater management system shown hereon, in accordance with approved stormwater management ownership and maintenance plan for this project, and that such stormwater system shall remain as a permanent fixture that cannot be altered, replaced, or removed without prior written approval from the Municipality."

g. A note indicating that a copy of the Recorded Record drawings will be submitted to the Municipality by the Applicant's Registered Engineer or Surveyor for all stormwater facilities prior to occupancy, or the release of the surety bond. The Municipality reserves the right to authorize the Municipal Engineer to review said Record Drawings.

C. The following items shall be included in the SWM Report

1. The overall Stormwater management concept for the project.
2. A determination of Site Conditions in accordance with Appendix B. A detailed site evaluation shall be completed for projects proposed in areas of carbonate geology or karst topography, and other environmentally sensitive areas such as brownfields.
3. Stormwater runoff design computations and documentation as specified in this Ordinance, or otherwise necessary to demonstrate that the maximum practicable measures have been taken to meet the requirements of this Ordinance, including the recommendations and general requirements in Section 301. All calculations shall be submitted to the Municipality on computation sheets for approval. If the Municipality determines through review and independent computation that the size(s) of stormwater management facilities is insufficient, the Municipality may require the applicant to increase the size(s) of said stormwater management facilities. If the storm drainage system design is completed on a computer installation, sufficient supporting data shall be provided to allow comprehensive review by Municipal officials.
4. Expected project construction schedule.
5. 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.
6. Copies of all permits and applications (where required) by the Pennsylvania Department of Environmental Protection, Pennsylvania Department of Transportation (PA DOT), and U.S. Army Corps of Engineers (USACOE) and other regulatory agencies.
7. The SWM Site Plan shall include an operation and maintenance (O&M) plan for all existing and proposed physical stormwater management facilities. This plan shall address long-term ownership and responsibilities for operation and maintenance as well as schedules and costs for O&M activities.
8. Hydrologic and hydraulic computations for all existing and proposed stormwater management facilities and measures.
9. Construction specifications for SWM BMPs and storm drainage systems.
10. Each stormwater management report shall contain provisions that clearly set forth the ownership and maintenance responsibility of all permanent stormwater management, and erosion and sediment control facilities. Including:

    a. Description of Maintenance Requirements.

    b. Establishment of suitable easements for access to all facilities by Public Officials, in accordance with this Article.

c. Identification of the responsible party or entity for ownership and maintenance of both temporary and permanent stormwater management facilities. In meeting this requirement, the following options are hereby provided for upon approval by the Municipality.

   Facilities may be incorporated within individual lots so that the respective lot owners will own and be responsible for maintenance in accordance with recorded deed restriction. A description of the facility or system and the terms of the required maintenance shall be incorporated as part of the deed to the property.

   Ownership and maintenance may be the responsibility of a Property Owners Association. The stated responsibilities of the Property Owners Association in terms of owning and maintaining the stormwater management facilities shall be submitted with final plans for determination of their adequacy, and upon their approval shall be recorded with the approved subdivision plan among the County deed records. In addition, the approved subdivision plan and any deed written from said plan for a lot or lots shown herein shall contain a condition that it shall be mandatory for the owner or owners of said lot to be members of said Property Owners Association.

d. For stormwater management facilities that are proposed as part of the site development plan, the applicant will be required to execute a developer agreement and a maintenance agreement with the Municipality for the construction and continued maintenance of the facilities prior to the signature approval on the final plan. Access for inspection by the municipality of all such facilities deemed critical to the public welfare at any reasonable time shall be provided.

e. In the event the above priorities cannot be achieved, or where it is required, the facilities may be dedicated to the Municipality in accordance with this Ordinance. As a condition of Municipality acceptance of said facilities, the applicant shall provide thirty (30) percent of the cost of improvements, in the form of a maintenance bond, as estimated by the applicant's Qualified Professional, and approved by the Municipality, to cover contingency maintenance costs for eighteen (18) months from the date of stormwater management facilities acceptance of dedication. The thirty (30) percent bond shall be based on the construction costs of the detention basin and outlet structure within the area dedicated to the municipality.

11. Example Report Sections:

    Introduction
    Existing Site Conditions
    Models
    Existing Soils Information
    Volume Mitigation
        Description And Background Information
    Peak Rate Mitigation
        Description And Background Information
        Pre-Development Conditions

Post-Development Conditions
Stormwater/Detention Basin Hydraulics
Storm Drain Design
Peak-Rate Mitigation Results
Effect of Project on Adjacent Properties
Expected Project Construction Schedule
Ownership and Maintenance
Appendices
Volume Mitigation Calculations, Worksheets And Information
Peak Rate Mitigation Calculations And Information
Water Quality Worksheets And Information
Precipitation Source Data
SCS Runoff Curve Numbers, Rational Runoff Coefficients, Manning's coefficients
Miscellaneous Computations
Infiltration Rate Test Data
General References
Construction Specifications for SWM BMPs

D. Small Project SWM Application
   1. Refer to Appendix F.

Section 402. Plan Submission

A. Five (5) copies of the SWM Site Plan shall be submitted as follows:
   1. Two (2) copies to the Municipality.
   2. One copy to the Municipal Engineer (when applicable)
   3. One (1) copy to the County Planning Commission/Office
B. Additional copies shall be submitted as requested by the Municipality.

Section 403. Plan Review

A. The SWM Site Plan shall be reviewed by a Qualified Professional for the Municipality for consistency with the provisions of this ordinance. After review, the Qualified Professional shall provide a written recommendation for the Municipality to approve or disapprove the SWM Site Plan. If it is recommended to disapprove the SWM Site Plan, the Qualified Professional shall state the reasons for the disapproval in writing. The Qualified Professional also may recommend approval of the SWM Site Plan with conditions and, if so, shall provide the acceptable conditions for approval in writing. The SWM Site Plan review and recommendations shall be completed within the time allowed by the Municipalities Planning Code for reviewing subdivision and land development plans.
B. The Municipality shall notify the applicant in writing within 45 calendar days whether the SWM Site Plan is approved or disapproved. If the SWM Plan involves a Subdivision or Land Development Plan, the notification period is 90 days. If a longer notification period is provided by other statute, regulation, or ordinance, the applicant will be so notified by the Municipality. If

the Municipality disapproves the SWM Plan, the Municipality shall cite the reasons for disapproval in writing.

C. The Municipality's approval of a SWM Site Plan shall be valid for a period not to exceed five (5) years. This five-year period shall commence on the date that the Municipality signs the approved SWM Site Plan. If Stormwater management facilities included in the approved SWM Site Plan have not been constructed, or if a Record Drawing of these facilities has not been approved within this five-year time period, then the Municipality may consider the SWM Site Plan disapproved and may revoke any and all permits. SWM Site Plans that are considered disapproved by the Municipality shall be resubmitted in accordance with this Ordinance.

Section 404. Modification of Plans

A modification to a submitted SWM Site Plan that involves a change in SWM BMPs or techniques, or that involves the relocation or re-design of SWM BMPs, or that is necessary because soil or other conditions are not as stated on the SWM Site Plan as determined by the Municipality, shall require a resubmission of the modified SWM Site Plan in accordance with this Article. The SWM Plan review process shall start over as stated under Section 403.

Section 405. Resubmission of Disapproved SWM Site Plans

A disapproved SWM Site Plan may be resubmitted, with the revisions addressing the Municipality's concerns, to the Municipality in accordance with this Article. The applicable Review Fee must accompany a resubmission of a disapproved SWM Site Plan.

Section 406. Record Drawings and Final Inspection

A. The Applicant/Developer shall be responsible for completing Record Drawings of all SWM BMPs included in the approved SWM Site Plan. The Record Drawings and an explanation of any discrepancies with the design plans shall be submitted to the Municipality.

B. The submission shall include a signed statement from a Qualified Professional verifying that all permanent SWM BMPs have been constructed according to the plans and specifications and approved revisions thereto.

C. After receipt of the signed statement and the Record Drawings by the Municipality, the Municipality may conduct a final inspection.

ARTICLE V - OPERATION AND MAINTENANCE

Section 501. Responsibilities

A. The Municipality shall make the final determination on the continuing maintenance responsibilities prior to final approval of the SWM Site Plan. The Municipality may require a dedication of such facilities as part of the requirements for approval of the SWM Site Plan. Such a requirement is not an indication that the Municipality will accept the facilities. The Municipality reserves the right to accept the ownership and operating responsibility for any or the entire Stormwater management controls.

B. All SWM BMPs shall be enumerated as permanent real estate appurtenances and recorded as deed restrictions.

C. The Operation and Maintenance Plan shall be recorded as a restrictive deed covenant that runs with the land.

D. The Municipality shall take enforcement actions against an owner for any failure to satisfy the provisions of this Article.

Section 502. Operation and Maintenance Agreements

The owner is responsible for Operation and Maintenance of the SWM BMP's, and for preparing an Operation and Maintenance Agreement in accordance with Appendix C. If the owner fails to adhere to the Operation and Maintenance Agreement, the Municipality may perform the services required and charge the owner appropriate fees. Non-payment of fees may result in a lien against the property.

ARTICLE VI - FEES AND EXPENSES

Section 601. General

The Municipality may include all costs incurred in the Review Fee charged to an Applicant. The Review Fee may include but not be limited to costs for the following:

A. Administrative/clerical processing.

B. Review of the SWM Site Plan.

C. Attendance at Meetings.

D. Inspections.

E. Qualified Professional Review and Meeting Costs.

F. Recording Fees and Costs for Plan Reduction to Meet County Recording Requirements (if required).

ARTICLE VII - PROHIBITIONS

Section 701. Prohibited Discharges and Connections

A. Any drain or conveyance, whether on the surface or subsurface, which allows any non-Stormwater discharge including sewage, process wastewater, and wash water to enter the Waters of this Commonwealth is prohibited.

B. No person shall allow, or cause to allow, discharges into surface waters of this Commonwealth that are not composed entirely of stormwater, except (1) as provided in Subsection C below and (2) discharges allowed under a state or federal permit.

C. The following discharges are authorized unless they are determined to be significant contributors to pollution of the Waters of this Commonwealth:

Discharges from fire fighting activities	Flows from riparian habitats and wetlands
Potable water sources including water line and fire hydrant flushing	Uncontaminated water from foundations or from footing drains
Irrigation drainage	Lawn watering
Air conditioning condensate	De-chlorinated swimming pool discharges
Springs	Uncontaminated groundwater
Water from crawl space pumps	Water from individual residential car washing
Pavement wash waters where spills or leaks of toxic or hazardous materials have not occurred (unless all spill material has been removed) and where detergents are not used	Routine external building wash down (which does not use detergents or other compounds)

D. In the event that the Municipality or PA DEP determines that any of the discharges identified in Section 701.C, significantly contribute to pollution of the Waters of this Commonwealth, the Municipality or PA DEP will notify the responsible person(s) to cease the discharge.

Section 702. Roof Drains

Roof drains and sump pumps shall discharge to infiltration or vegetative BMP's and to the maximum extent practicable to satisfy the criteria for Disconnected Impervious Areas (Appendix G).

Section 703. Alteration of BMPs

No person shall modify, remove, fill, landscape, or alter any SWM BMPs without the prior written approval of the Municipality.

ARTICLE VIII - ENFORCEMENT AND PENALTIES

Section 801. Right-of-Entry

As a condition of approval of an Applicant's Stormwater management site plan, and upon presentation of proper credentials, the Applicant agrees that the Municipality, and/or their agents, may enter at reasonable times upon any property within the Municipality to inspect the condition of the Stormwater structures and facilities concerning any aspect regulated by this Ordinance.

Section 802. Inspection

SWM BMPs shall be inspected by the land owner/developer (including Municipality for dedicated facilities) according to the following list of frequencies:

A. Annually for the first 5 years.

B. Once every 3 years thereafter,

C. During or immediately after the cessation of a 10-year or greater storm.

Section 803. Enforcement

A. It shall be unlawful for a person to undertake any Regulated Activity except as provided in an approved SWM Site Plan unless specifically exempted in Section 302.

B. It shall be unlawful to alter, remove, or fail to implement any control structure required by the SWM Site Plan.

C. Compliance Inspections regarding implementation of the SWM Site Plan are a responsibility of the Municipality.

804. Suspension and Revocation

A. Any approval for a Regulated Activity may be suspended or revoked by the Municipality for:

   1. Non-compliance with, or failure to implement any provision of the approval, including Record Drawings and Operations and Maintenance Agreements.

   2. A violation of any provision of this Ordinance or any other applicable law, Ordinance, rule or regulation relating to the Regulated Activity.

   3. The creation of any condition or the commission of any act during the Regulated Activity which constitutes or creates a hazard or nuisance, pollution, or which endangers the life or property of others.

B. A suspended approval may be reinstated by the Municipality when:

   1. The Municipality has inspected and approved the corrections to the violations that caused the suspension.

2. The Municipality is satisfied that the violation has been corrected.

C. An approval that has been revoked by the Municipality cannot be reinstated. The Applicant may apply for a new approval under the provisions of this Ordinance.

D. If a violation causes no immediate danger to life, public health, or property, at its sole discretion, the Municipality may provide a limited time for the owner to correct the violation. In these cases, the Municipality will provide the owner, or the owner's designee, with a written notice of the violation and the time allowed the owner to correct the violation. If the owner does not correct the violation within the allowed time, the Municipality may revoke or suspend any, or all, applicable approvals and permits pertaining to any provision of this Ordinance.

Section 805. Penalties

A. Any person violating the provisions of this Ordinance may be assessed a civil penalty of not more than $_____ for each violation, recoverable with costs. Each day that the violation continues constitutes a separate violation, and penalties shall be cumulative.

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

C. The cost of removal, fine, and penalties hereinabove mentioned may be entered by the Municipality as a lien against such property, or properties of individual members of a Property Owners Association, in accordance with existing provisions of law.

D. If the Municipality determines at any time that any permanent stormwater management facility has been eliminated, altered, or improperly maintained, the Municipality shall advise the responsible party of required corrective measures, and shall provide said responsible party with a specific period to implement the required corrective measures. If such action is not taken by the property owner, the Municipality may cause the work to be done and back-charge all costs to the property owners in accordance with this Ordinance.

Section 806. Appeals

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

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

ARTICLE IX – REFERENCES

A. Pennsylvania Department of Environmental Protection. (DEP Doc. #363-0300-002 or current version). *Pennsylvania Stormwater Best Management Practices Manual*. Harrisburg, PA.

B. Pennsylvania Department of Environmental Protection. 363-2134-008 (2000), as amended and updated. *Erosion and Sediment Pollution Control Program Manual*. Harrisburg, PA.

C. United States Department of Agriculture (USDA), National Resources Conservation Service (NRCS). *National Engineering Handbook*. Part 630: Hydrology, 1969-2001. Originally published as the *National Engineering Handbook, Section 4: Hydrology*. Available online at:

http://www.wcc.nrcs.usda.gov/hydro/hydro-techref-neh-630.html

D. United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). 1986. *Technical Release 55: Urban Hydrology for Small Watersheds*, 2nd Edition. Washington, D.C.

E. US Department of Commerce (USDC), National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS), Hydrometeorological Design Studies Center. 2004-2006. Precipitation-*Frequency Atlas of the United States*. Atlas 14, Volume 2, Silver Spring, Maryland, 20910. Internet address:

http://hdsc.nws.noaa.gov/hdsc/pfds/

F. United States Department of Department of Transportation (US DOT), Federal Highway Administration (FHA). 2001. Hydraulic Engineering Circular Number 22 (HEC-22), *Urban Drainage Design Manual.*

G. *PennDOT Drainage Manual,* Publication Number 584, as amended

H. Philadelphia Water Department. 2006. *Stormwater Management Guidance Manual*. Section 4.2.2: Integrated Site Design. Philadelphia, PA.

ENACTED and ORDAINED at a regular meeting of the

_____

on this _____ day of _____, 20__.

This Ordinance shall take effect immediately.

_____

[Name] [Title]

_____

[Name] [Title]

_____

[Name] [Title]

ATTEST:

_____

Secretary

APPENDIX A

LOW IMPACT DEVELOPMENT PRACTICES
ALTERNATIVE APPROACHES FOR MANAGING STORMWATER RUNOFF

Natural hydrologic conditions may be altered by development practices, which may create impervious surfaces, destroy drainage swales, construct storm sewers, and change local topography. A traditional approach to drainage has been to remove runoff from sites as quickly as possible and capture it in downstream detention basins. This approach leads to the degradation of water quality as well as additional expenditures for detaining and managing concentrated runoff.

The recommended approach is to promote practices that will minimize post-development runoff rates and volumes and minimize needs for artificial conveyance and storage facilities. To simulate pre-development hydrologic conditions, increased infiltration often is helpful to offset the effects of increasing the area of impervious surfaces. The ability to increase infiltration depends upon the soil types and land use.

Preserving natural hydrologic conditions requires careful site design that includes preservation of natural drainage features, minimization of impervious surfaces, reduction of hydraulic connectivity of impervious surfaces, and protection of natural depression storage areas. A well-designed site will contain a mix of all these features. The following describes various techniques to achieve this:

A. Preserve Drainage Features. Protect natural drainage features, particularly vegetated drainage swales and channels. Locate streets and adjacent storm sewers away from valleys and swales.

B. Protect Natural Depression Storage Areas. Depression storage areas have no surface outlet, or they drain very slowly. Depressions shall be protected and the storage capacity shall be incorporated into required detention facilities.

C. Avoid Creating Impervious Surfaces. Reduce impervious surfaces to the maximum extent possible. Building footprints, sidewalks, driveways and other features shall be minimized.

D. Avoid Connecting Impervious Surfaces. Route roof runoff over lawns and avoid using storm sewers. Grade sites to increase the travel time of Stormwater runoff. Avoid concentrating runoff.

E. Use Pervious-Paving Materials. Use pervious materials for driveways, parking lots, access roads, sidewalks, bike trails and hiking trails. Provide pervious strips between streets and sidewalks.

F. Reduce Setbacks. Reduce setbacks for buildings to shorten the driveways and entry walks.

G. Construct Cluster Developments. Construct Cluster Developments to reduce street length per lot.

APPENDIX B

A. LIST OF SITE CONDITIONS SUITABLE FOR INFILTRATION

1. Depth of bedrock below the invert of infiltration BMPs shall be greater than or equal to 2 feet.
2. Depth of seasonal high water table below the invert of infiltration BMPs shall be greater than or equal to 2 feet.
3. Soil permeability test results shall be greater than or equal to 0.10 inches / hour and less than or equal to 10 inches per hour.
4. The appropriate factor of safety, per the existing soil conditions, and per the guidance provided per the Pennsylvania Stormwater BMP Manual (current version) shall be applied to the final infiltration rate used for design.
5. Methodologies and procedures for properly determining soil infiltration rates can be found within the Pennsylvania Stormwater Best Management Practices Manual.
6. Setback distances or buffers of infiltration BMPs shall be a minimum of:
    a. One hundred (100) feet from individual water supply wells and from community or Municipal water supply wells.
    b. Twenty (20) feet from building foundations.
    c. Fifty (50) feet from septic system drain fields.
    d. Fifty (50) from karst geologic contacts such as sinkholes, closed depressions, fracture traces, faults, and pinnacles.
    e. Twenty (20) from the property line unless documentation is provided to show that all setbacks from wells, foundations and drain fields on neighboring properties will be met

B. EFFECTIVE BMPs FOR INFILTRATION

1. Infiltration trench
2. Infiltration Basin/Sub-Surface Infiltration Bed
3. Bio Filters, Rain Gardens, Bio-Infiltration, Bio Swales
4. Filters for pre-treatment.
5. Dry Well/Seepage Pits
6. Pervious Pavement/Concrete
7. Soil Amendments
8. Riparian Buffer Restoration

C. EFFECTIVE BMPs FOR RATE CONTROL

1. Wet Ponds

2. Stormwater Wetlands
3. Extended Detention (dry) Ponds
4. Vegetated Swales
5. Floodplain Restoration
6. Constructed Filters
7. Runoff volume reduction BMPs listed and B and C above such as retention, infiltration and re-vegetation.

D. EFFECTIVE BMPs FOR BIO-RETENTION AND EVAPOTRANSPIRATION

1. Rain gardens
2. Green roofs
3. Constructed Wetlands
4. Select, commercially available products (as approved by the Municipality)

Consult the Pennsylvania Stormwater Best Management Practices Manual for all available BMPs and stormwater technologies that can effectively mitigate stormwater runoff, volume, and quality issues.

APPENDIX C

OPERATION AND MAINTENANCE AGREEMENT
STORMWATER BEST MANAGEMENT PRACTICES

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

WITNESSETH

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

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

WHEREAS, the Stormwater management BMP Operation and Maintenance Plan approved by the Municipality (hereinafter referred to as the "Plan") for the property identified herein, which is attached hereto as Appendix A and made part hereof, as approved by the Municipality, provides for management of Stormwater within the confines of the Property through the use of Best Management Practices (BMPs); and

WHEREAS, the Municipality, and the Landowner, his successors and assigns, agree that the health, safety, and welfare of the residents of the Municipality and the protection and maintenance of water quality require that on-site Stormwater Best Management Practices be constructed and maintained on the Property; and

WHEREAS, the Municipality requires, through the implementation of the SWM Site Plan, that Stormwater management BMP's as required by said Plan and the Municipal Stormwater Management Ordinance be constructed and adequately operated and maintained by the Landowner, his successors and assigns.

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

1. The Landowner shall construct the BMPs in accordance with the plans and specifications identified in the SWM Site Plan.

2. The Landowner shall operate and maintain the BMPs as shown on the Plan in good working order accordance with the specific maintenance requirements noted on the approved SWM Site Plan.

3. The Landowner hereby grants permission to the Municipality, its authorized agents and employees, to enter upon the property, at reasonable times and upon presentation of proper credentials, to inspect the BMPs whenever necessary. Whenever possible, the Municipality shall notify the Landowner prior to entering the property.

4. In the event the Landowner fails to operate and maintain the BMPs per paragraph 2, the Municipality or its representatives may enter upon the Property and take whatever action is deemed necessary to maintain said BMP(s). This provision shall not be construed to allow the Municipality to erect any permanent structure on the land of the Landowner. It is expressly understood and agreed that the Municipality is under no obligation to maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the Municipality.

5. In the event the Municipality, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner shall reimburse the Municipality for all expenses (direct and indirect) incurred within 10 days of receipt of invoice from the Municipality.

6. The intent and purpose of this Agreement is to ensure the proper maintenance of the onsite BMPs by the Landowner; provided, however, that this Agreement shall not be deemed to create or affect any additional liability of any party for damage alleged to result from or be caused by Stormwater runoff.

7. The Landowner, its executors, administrators, assigns, and other successors in interests, shall release the Municipality from all damages, accidents, casualties, occurrences or claims which might arise or be asserted against said employees and representatives from the construction, presence, existence, or maintenance of the BMP(s) by the Landowner or Municipality.

8. The Municipality shall inspect the BMPs at a minimum of once every three years to ensure their continued functioning.

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

ATTEST:

WITNESS the following signatures and seals:

(SEAL) For the Municipality:

_____

(SEAL) For the Landowner:

_____

ATTEST:

_____ (City, Borough, Township)

County of _____, Pennsylvania

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

GIVEN UNDER MY HAND THIS _____ day of _____, 200___.

_____ _____

NOTARY PUBLIC **(SEAL)**

APPENDIX D

RATIONAL FORMULA RUNOFF COEFFICIENTS

		HYDROLOGIC SOIL GROUP											
		A			B			C			D		
	STORM EVENT	SLOPE RANGE			SLOPE RANGE			SLOPE RANGE			SLOPE RANGE		
LAND USE	(yrs)	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+
Cultivated Land	<25	0.08	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
	>25	0.14	0.18	0.22	0.16	0.21	0.28	0.20	0.25	0.34	0.24	0.29	0.41
Pasture	<25	0.12	0.20	0.30	0.18	0.28	0.37	0.24	0.34	0.44	0.30	0.40	0.50
	>25	0.15	0.25	0.37	0.23	0.34	0.45	0.30	0.42	0.52	0.37	0.50	0.62
Meadow	<25	0.10	0.16	0.25	0.14	0.22	0.30	0.20	0.28	0.36	0.24	0.30	0.40
	>25	0.14	0.22	0.30	0.20	0.28	0.37	0.26	0.35	0.44	0.30	0.40	0.50
Forest	<25	0.05	0.08	0.11	0.08	0.11	0.14	0.10	0.13	0.16	0.12	0.16	0.20
	>25	0.08	0.11	0.14	0.10	0.14	0.18	0.12	0.16	0.20	0.15	0.20	0.25
Residential													
Lot Size 1/8 acre	<25	0.25	0.28	0.31	0.27	0.30	0.35	0.30	0.33	0.38	0.33	0.36	0.42
	>25	0.33	0.37	0.40	0.35	0.39	0.44	0.38	0.42	0.49	0.41	0.45	0.54
Lot Size 1/4 acre	<25	0.22	0.26	0.29	0.24	0.29	0.33	0.27	0.31	0.36	0.30	0.34	0.40
	>25	0.30	0.34	0.37	0.33	0.37	0.42	0.36	0.40	0.47	0.38	0.42	0.52
Lot Size 1/3 acre	<25	0.19	0.23	0.26	0.22	0.26	0.30	0.25	0.29	0.34	0.28	0.32	0.39
	>25	0.28	0.32	0.35	0.30	0.35	0.39	0.33	0.38	0.45	0.36	0.40	0.50
Lot Size 2 acre	<25	0.16[a]	0.20	0.24	0.19	0.23	0.28	0.22	0.27	0.32	0.26	0.30	0.37
	>25	0.25[b]	0.29	0.32	0.28	0.32	0.36	0.31	0.35	0.42	0.34	0.38	0.48
Lot Size 1 acre	<25	0.14	0.19	0.22	0.17	0.21	0.26	0.20	0.25	0.31	0.24	0.29	0.35
	>25	0.22	0.26	0.29	0.24	0.28	0.34	0.28	0.32	0.40	0.31	0.35	0.46
Industrial	<25	0.67	0.68	0.68	0.68	0.68	0.69	0.68	0.69	0.69	0.69	0.69	0.70
	>25	0.85	0.85	0.86	0.85	0.86	0.86	0.86	0.86	0.87	0.86	0.86	0.88
Commercial	<25	0.71	0.71	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
	>25	0.88	0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.89	0.89	0.90
Streets	<25	0.70	0.71	0.72	0.71	0.72	0.74	0.72	0.73	0.76	0.73	0.75	0.78
	>25	0.76	0.77	0.79	0.80	0.82	0.84	0.84	0.85	0.89	0.89	0.91	0.95
Open Space	<25	0.05	0.10	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.16	0.21	0.28
	>25	0.11	0.16	0.20	0.14	0.19	0.26	0.18	0.23	0.32	0.22	0.27	0.39
Parking	<25	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
	>25	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97

(after *Rawls et al., 1981)*

APPENDIX E

SMALL PROJECT SWM APPLICATION AND WORKSHEET

Lawrence County
Small Project Stormwater Management Application

As required by the Municipality's Act 167 Stormwater Management Ordinance[4], a Small Project Stormwater Management Plan is required whenever more than 2,500 square feet of impervious surface is proposed[5]. Impervious surfaces are areas that prevent the infiltration of water into the ground and shall include, but not be limited to, roofs, patios, garages, storage sheds and similar structures, and any new streets or sidewalks.

Table E-1
To Calculate Impervious Surfaces Please Complete This Table

Surface Type	Length	X	Width	=	Proposed Impervious Area
Building (area per downspout)		x		=	
		x		=	
		x		=	
		x		=	
Driveway		x		=	
		x		=	
		x		=	
Parking Areas		x		=	
		x		=	
		x		=	
Patios/Walks		x		=	
		x		=	
		x		=	
		x		=	
Other		x		=	
		x		=	
		x		=	
Total Impervious Surface Area to be Managed *(Sum of All Areas)*					

If the Total Impervious Surface Area is LESS THAN 2,500 Square Feet, read, acknowledge, and sign below.

If the Total Impervious Surface Area is GREATER THAN OR EQUAL TO 2,500 Square Feet, complete the remainder of the Application.

Property Owner Acknowledges that submission of inaccurate information may result in a stop work order or permit revocation. Acknowledgement of such is by signature below. I declare that I am the owner or owner's legal representative. I further acknowledge that the information provided is accurate and Municipal employees are granted access to the above-described property for review and inspection as may be required.

_____ :Owner Date: _____
(Signature) (Print Name)

[4] The municipality can require the applicant to provide supplemental and additional information beyond the Small Project SWM Application if there is a threat to property, health or safety.
[5] Refer to Ordinance Section 501, Responsibilities for justification of this application

CREDITS

Credit 1: DISCONNECTION OF IMPERVIOUS AREA

When runoff from impervious areas is directed to a pervious area that allows for infiltration, filtration, and increased time of concentration, all or parts of the impervious areas may qualify as Disconnected Impervious Area (DIA). Using the criteria below, determine the portion of the impervious area that can be excluded from the calculation of total impervious areas.

Criteria: An impervious area is considered to be completely or partially disconnected if it meets the requirements below:

- Rooftop area draining to a downspout is ≤500 sf
- Paved area draining to a discharge is ≤1,000 sf
- Flow path of paved impervious area is not more than 75'
- Soil at discharge is not designated as hydrologic soil group "D"
- Flow path at discharge area has a positive slope ≤5%
- Gravel strip or other spreading device is required at paved discharges

Length of Flow Path from Discharge Point* (ft)	DIA Credit Factor
0-14	1.0
15-29	0.8
30-44	0.6
45-59	0.4
60-74	0.2
75 or More	0

*** Flow path cannot include impervious surfaces and must be at least 15' from any impervious surfaces**

Table E-2
Calculate DIA Credit and Required Capture Volume

Surface Type	Proposed Impervious Area (from previous sheet)	X	DIA Credit Factor	=	Impervious Area to be Managed	÷		=	Required Capture Volume (ft^3)
Building (area per downspout)		x		=		÷	6	=	
		x		=		÷	6	=	
		x		=		÷	6	=	
		x		=		÷	6	=	
Driveway		x		=		÷	6	=	
		x		=		÷	6	=	
		x		=		÷	6	=	
Parking Areas		x		=		÷	6	=	
		x		=		÷	6	=	
		x		=		÷	6	=	

Patios/Walks		x		=		÷	6	=	
		x		=		÷	6	=	
		x		=		÷	6	=	
		x		=		÷	6	=	
Other		x		=		÷	6	=	
		x		=		÷	6	=	
		x		=		÷	6	=	

Small Project SWM Plan Worksheet - Instructions

The Stormwater Management Ordinance developed through the *Lawrence County Act 167 Stormwater Management Plan* regulates compliance requirements for Stormwater Management in this jurisdiction. A complete copy of the ordinance can be obtained by contacting the Lawrence County Planning Department. Regulated activities shall be conducted only after the Municipality approves a stormwater management plan. The *Lawrence County Act 167 Stormwater Management Plan* will assist you in preparing the necessary information and plans for the Municipality to review and approve. This document will constitute an approved plan if all of the relevant components are installed in their entirety AND no part of the stormwater system adversely affects any other property, nor adversely affect any septic systems or drinking water wells on this, or any other, parcel. If an alternative system is to be used a plan will need to be submitted to the Municipality for approval. A design by a Qualified Professional may be required for sites that are more complex.

Construction details and materials for Stormwater BMPs can be found in the PADEP Stormwater Management BMP Manual (current version) at:

(http://www.depweb.state.pa.us/portal/server.pt/community/best_management_practices_manual/10631). All BMPs must be installed in their entirety AND the BMPs will be located as not to adversely affect other property, nor any septic systems or drinking water wells on this, or any other, parcel.

Small Project SWM Plan Worksheet

Based upon the information you have provided, a ***Stormwater Plan IS Required*** for this development activity. The Stormwater Management Ordinance developed through the *Lawrence County Act 167 Stormwater Management Plan* regulates compliance requirements for Stormwater Management in this jurisdiction. A complete copy of the *Plan* can be obtained from the Lawrence County Department of Planning.

Regulated activities shall be conducted only after the Municipality approves a stormwater management plan. The *Lawrence County Act 167 Stormwater Management Plan* will assist you in preparing the necessary information and plans for the Municipality to approve. **This document will constitute an approved plan if all of the relevant details are to be installed in the entirety AND no part of the stormwater system adversely affects any other property, nor adversely affects any septic systems or drinking water wells on this, or any other parcel.** If an alternative system is to be used, a plan will need to be submitted to the Municipality for approval. A design by a qualified professional may be required for more complex sites.

PLEASE INITIAL BELOW TO INDICATE THE STORMWATER MANAGEMENT PLAN COMPONENTS FOR THIS SITE

	Minimum Control #1 Erosion and Sediment Pollution Control Minimum Control #2 Preservation of Natural Drainage Systems and Outfalls

The relevant details from the *Lawrence County Act 167 Stormwater Management Plan* will be installed in their entirety AND the systems will be located as not to adversely affect other property, nor any septic systems or drinking water wells on this, or any other parcel.

To meet this requirement as well as State Water Quality requirements, the following must be installed and maintained:

	Capture Volume to be Managed (ft^3)			**Conversion**	**Surface Area of BMP (ft^2)**
		By Rain Garden 6" Ponding; 2' Soil Depth	X	1.20	
		Dry Well or Infiltration Trench 2'-6" Aggregate Depth	X	1.25	
		:Total		Total:	

	In lieu of meeting the above, an alternative and/or professional design is attached for approval AND the system will be located as not to adversely affect other property, any septic systems or drinking water wells on this, or any other, parcel.

Site Sketch Plan showing:

- Property lines with dimensions
- Proposed buildings with dimensions
- Proposed impervious surfaces with dimensions
- Proposed septic system, if applicable
- Proposed well site, if applicable
- Proposed stormwater managements system(s)

Operation and Maintenance Agreement

Condition on approval - The stormwater management plan must be fully implemented prior to a request for final inspection of the building or zoning permit.

Acknowledgement - By executing below, the Owner acknowledges the following:

- I declare that I am the owner of the property.
- The information provided is accurate.
- I further acknowledge that municipal representatives are granted access to the above-described property for review and inspection as may be required.

(Owner Signature)

(Date)

(Print Name)

ATTACHMENT A

ADDITIONAL ORDINANCE AND TECHNICAL GUIDELINES TOOLBOX

ADDITIONAL ORDINANCE AND TECHNICAL GUIDELINES

Municipalities may wish to use the following standards or requirements. Some of these are a replacement for standards and requirements in the Model Ordinance, and some are in addition to those listed in the Model Ordinance.

Article III

- *Municipal ordinances may contain more specific design references than included in this model ordinance, or alternatively, reference the Pennsylvania Handbook of Best Management Practices for Developing Areas (1998) or the 2000 Maryland Stormwater Design Manual, among others, for more guidance.*
- *Please note that additional design references may require additional standards for maintenance, applicability, and enforcement, to name a few. Those responsible for the enforcement and interpretation of the local ordinances should become familiar with any references cited in any adopted ordinance.*
- *For municipalities with existing stormwater ordinances, this model ordinance could be used as the framework for rewriting the existing ordinance with each locality adding complimentary and/or additional language to completely describe the design standards for stormwater management. These may include standards already adopted and in practice. This model ordinance could also be adopted as a separate component of a municipal code (with appropriate cross-referencing to zoning and subdivision ordinances). A complete review and comment by the municipality's solicitor and engineer is part of establishing or modifying local regulations and design standards.*
- *The Municipality may (at its own discretion) wish to require a pre-design conference.*
- *The Municipality may (at its own discretion) allow the use of the Rational Formula to estimate peak discharges only from drainage areas that are less than fifty acres and for storm sewer sizing calculations, which are typically small in size. For drainage areas fifty acres or greater in size discharging to a storm drainage collection system, a more accurate methodology should be considered.*
- *In lieu of using the data obtained from the NOAA, PFDS website, the Municipality may approve the use of alternate sources of rainfall data, including the PA DOT Design Storm Curve values for Region 1, per the most current version of the PA DOT Drainage Manual. A rainfall duration of 24-hours shall be used for calculations and the distribution type shall be Type-II, per TR-55.*
- *The Municipality may approve the use of any generally accepted full hydrograph approximation technique that shall use a total runoff volume that is consistent with the volume from a method that produces a full hydrograph.*
- *To intercept stormwater runoff along streets at intervals reasonable related to the extent and grade of the area drained, and to prevent substantial flow of water across intersections or flooded intersections during storms, in accordance with the procedures in the Pennsylvania Department of Transportation Design Manual Part 2. DM-2, Chapter 10 (PA DOT).*

  To ensure adequate and unimpeded flow of stormwater under driveways in, near, or across natural watercourses or drainage swales. Suitable pipes or other waterways

shall be provided as necessary.

To properly drain stormwater runoff from all land development projects. All lot and open areas shall be designed to drain to the nearest practical street or drainage system, existing or proposed, as defined by the Municipal Engineer, with no impact on adjoining properties, unless an area specifically designed for stormwater detention is provided.

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

The design capacity of storm sewers shall be in accordance with PennDOT Drainage Manual, Publication Number 584, as amended. Storm drainage systems shall be designed without surcharging inlets to provide conveyance of stormwater runoff into a detention basin or similar facility utilized to manage the rate of stormwater runoff. To avoid surcharging inlets, and to ensure that inlets will receive stormwater runoff, the hydraulic grade line at the inlet shall be at least six (6) inches below the elevation of the inlet grate. Where site grading will direct stormwater runoff from the 100-year design storm to a detention basin or similar facility utilized to manage the rate of stormwater runoff, then the storm sewer may be designed for the 10-year design storm. Where site grading will not direct stormwater runoff from the 100-year design storm to a detention basin or similar facility utilized to manage the rate of stormwater runoff, then the storm sewer shall be designed for the 100-year design storm. The location of the hydraulic grade line for the 100-year design storm shall be graphically shown on the required storm sewer profile drawings. Conveyance of storms to the detention basin, up to and including the 100-year frequency, shall be provided so as not to endanger life or seriously damage property.

Accessible drainage structures shall be located on a continuous storm sewer system at all vertical dislocations, at all locations where a transition in storm sewer pipe sizing is required, at all vertical and horizontal angle points exceeding five (5) degrees, and at all points of convergence of two or more influent storm sewer mains. The construction locations of accessible drainage structures shall be as indicated on the subdivision drainage plan or area drainage plan approved by the Municipality.

- *Swales shall be designed in accordance with Design of Roadside Channels with Flexible Linings, Hydraulic Engineering Circular No. 15 (US DOT, FHA).*

  Where vegetated drainage swales are used in lieu of or in addition to storm sewers, they shall be designed to carry the 10-year discharge without erosion, and also to increase the time of concentration, reduce the peak discharge and velocity, and permit the water to percolate into the soil.

- *Deed restrictions may be required on property (ies) containing drainage swales and/or perennial streams. When required, these deed restrictions shall specify that no property owner obstruct or alter any drainage swale or perennial stream identified in the stormwater management plan.*
- *Minimum storm sewer diameter or equivalent diameter shall be 15 inches.*
- *Inlets shall, at a minimum, be located at the lowest point of street intersections to intercept the stormwater before it reaches pedestrian crossings; or at sag points of*

vertical curves in the street alignment that provide a natural point of ponding of surface stormwater.

Where the Municipality deems it necessary because of special land requirements, special inlets may be approved.

The interval between inlets collecting stormwater runoff shall be determined in accordance with the Pennsylvania Department of Transportation Design Manual Part 2, DM-2, Chapter 10, Section 5 "Capacity of Waterway Areas," or Urban Drainage Design Manual (HEC22, US DOT, FHA).

In curbed sections, the maximum encroachment of water on the roadway pavement shall not exceed half of a through traffic lane or one (1) inch less than the depth of curb during the 10 year design storm of five (5) minute duration. Inlets shall be provided to limit the encroachment of water on the pavement. When inlets are used in a storm system within the right-of-way limits of a street in lieu of manholes, the spacing of such inlets shall not exceed the maximum distance of four hundred fifty (450) feet.

The design of storm inlets shall be in accordance with Drainage of Highway Pavements, Hydraulic Engineering Circular Number 12, (US DOT, FHA).

- *Bridges and culverts*

  Bridges and culverts shall have ample waterway to carry expected flows based on the following minimum storm frequencies: 10 year for driveways; 25 year for local streets; 50 year for collector streets; and 100 year for arterials; or as required by the Municipal Engineer.

  Bridge and/or culvert construction shall be in accordance with the Pennsylvania Department of Transportation specifications.

  The design criteria contained in this Article are intended for use in conjunction with the Chapter 105 Regulations of the Pennsylvania Department of Environmental Protection entitled, "Water Obstructions and Encroachments".

  A PA DEP permit in accordance with Chapter 105 shall be required for any obstruction or encroachment in the regulated waters of the Commonwealth, prior to the approval of the SWM Plan. All areas of the Municipality shall be classified as rural, suburban, or urban, as determined by the Municipality (See PA DEP Section 105.161) for bridge and culvert designs. In the event any question or conflict arises between this Article and the PA DEP Chapter 105 Regulations, the design criteria contained in the PA DEP regulations shall govern.

- *Stormwater Management Facilities:*

  Any Stormwater management facility (e.g., detention basin) designed to store runoff and requiring a berm or earthen embankment required or regulated by this Ordinance shall be designed to provide an emergency spillway to handle flow up to and including

the 100-year proposed conditions and may be subject to PA DEP Chapter 105 regulations. Facilities requiring berms or earthen embankments shall include the construction of anti-seep collars along the length of the outlet barrel and containing the proposed phreatic line. Anti-seep collars should be designed in accordance with the PA DEP Erosion Control Manual.

Stormwater management facilities shall be installed prior to or concurrent with any earthmoving or land disturbances which they will serve. Earthen embankments and berms shall be constructed using 6" soil lifts and compacted with the use of sheepsfoot roller equipment.

The design of all Stormwater management facilities over limestone formations shall include measures to prevent groundwater contamination and, where required, sinkhole formation. Soils used for the construction of Stormwater management facilities shall have moderate to low erodibility factors (i.e. "K" factors of 0.32 or less).

Outlet structures within detention/retention/wet basins shall incorporate childproof, non-clogging trash racks or grates over all horizontally oriented openings. All vertically oriented openings over twelve (12) inches or larger in any dimension where entry by a child could cause injury or death shall be covered with childproof, non-clogging trash racks, except where such openings carry perennial stream flows. Design openings less than six (6) inches in any dimension shall be covered with a pipe screen. Measures to completely drain detention/retention basins in the event of clogging of the primary design opening(s) shall be incorporated into the design of basin outlet structures. Basin outlet pipes shall have a minimum inside diameter of fifteen (15) inches or a cross-sectional area of one hundred seventy-six (176) square inches, except that pipes under a twenty-five foot or greater fill shall not be less than twenty-four (24) inches or a cross-sectional area of four hundred fifty-three (453) square inches, and shall consist of reinforced concrete.

Outlet aprons shall be designed and shall extend at a minimum to the toe of the basin slope. Where spillways will be used to manage peak discharges in excess of the 10-year storm, such spillways shall be constructed to withstand the pressures of impounded waters and convey flows at computed outlet velocities without erosion.

Energy dissipaters and/or level spreaders shall be installed at points where pipes or drainageways discharge to or from Stormwater management facilities. Stormwater management facilities shall be constructed with an appropriate sedimentation forebay and a low-flow channel at a minimum slope of 1%

Stormwater management facilities shall be designed to release their total volumes detained within the following maximum time periods:

Roofs and Parking Lots - 24 hours.
Detention Basin - 48 hours.

Infiltration Facilities - 72 hours.

The intermittent treatment of wetlands/wet basins with commercially available products designed to curtail the breeding habitats of mosquitoes and other invasive insects may be permitted at the discretion of the Municipality.

Publications from the PA Department of Health and the Penn State Cooperative Extension concerning West Nile Virus identify aggressive public education about the risks posed by standing water in artificial containers (tires, trash cans, rain gutters, bird baths) as the most effective method to control vector mosquitoes.

- *Stream Buffers*

  Stream Buffers shall be provided for new development sites using the following requirements:

  A minimum stream buffer width of 50 feet landward in each direction from the top of stream banks is required for all waterways having both a defined bank and a contributing watershed area of greater than 100 acres.

  A minimum stream buffer width of 35 feet landward in each direction from the centerline of the waterway is required for smaller waterways having a contributing watershed area of less than 100 acres and greater than 10 acres.

  The stream buffer area shall be maintained in a natural state.

  When wetland(s) extend beyond the edge of the required buffer width, the buffer shall be adjusted so that the buffer consists of the extent of the wetland plus a 25-foot zone extending beyond the wetland edge.

  Stream buffer averaging may be applied to account for encroachments such as road crossings. The following criteria must be met in order to use buffer averaging on a development site:

  Buffer averaging is required for water quality buffers that have stream crossings.

  An overall average buffer width of at least 50 feet must be achieved within the boundaries of the property to be developed. Stream buffer corridors on adjoining properties cannot be included with buffer averaging on a separate property, even if owned by the same property owner.

  The average width must be calculated based upon the entire length of stream bank that is located within the boundaries of the property to be developed. When calculating the buffer length, the natural stream channel shall be followed.

  Stream buffer averaging shall be applied to each side of a stream independently. If the property being developed encompasses both sides of a stream, buffer averaging can be applied to both sides of the stream, but must be applied to both sides of the stream independently.

  The total width of the buffer shall not be less than 25 feet at any location, except at approved stream crossings. Those areas of the buffer having a minimum width of 25 feet (or less at approved stream crossings) can comprise no more than 50 percent of the buffer length.

  Stream buffer locations and widths shall be shown on all subdivision plans with notations requiring that they be maintained in a natural state.

Stream buffers shall be shown on all grading and erosion and sedimentation control plans. The defined stream buffer location shall be properly recorded. The recording shall provide a plan illustrating the stream buffer location, width and the requirement that it be maintained in a natural state.

When there is a conflict between the buffer requirements in this ordinance and any other municipal ordinance, the more restrictive standard shall apply.

In order to promote overland flow and infiltration, roof drains shall not discharge directly to streets or storm sewers. Roof drains may discharge directly to streets or storm sewers when deemed necessary by the Municipality. Under no circumstances shall roof drains discharge directly to sanitary sewer systems.

Stormwater drainage systems shall be provided to permit unimpeded flow along natural watercourses, except as modified by stormwater management facilities or open channels consistent with this Ordinance.

Areas of existing diffused drainage discharge shall be subject to any applicable discharge criteria in the general direction of existing discharge, whether proposed to be concentrated or maintained as diffused drainage areas, except as otherwise provided by this ordinance. If diffused flow is proposed to be concentrated and discharged onto adjacent property, the Applicant must document 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.

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. In addition, maintenance, including mowing of vegetation within the easement shall be required, except as approved by the appropriate governing authority.

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

- *Sinkhole Protection:*

  Stormwater from roadways, parking lots, storm sewers, roof drains, or other concentrated stormwater runoff paths shall not be discharged directly into sinkholes.

  To protect sensitive Karst areas, the Municipal Engineer may require basins to contain an impervious liner. The liner may be of the impervious membrane type, placed in accordance with the manufacturer's recommendations, or an approved alternative as approved by the Municipal Engineer.

Article IV

Municipalities or the County may wish to include a requirement for SWM Permit application and issuance that is integrated with their Building Permit process.

Article VI

It is recommended that the Municipalities and/or the County institute the use of a Developers Agreement or similar mechanism that incorporates an obligation for the Applicant/Developer to reimburse Municipal/County Qualified Professional Review costs.

APPENDIX C TECHNICAL ANALYSIS

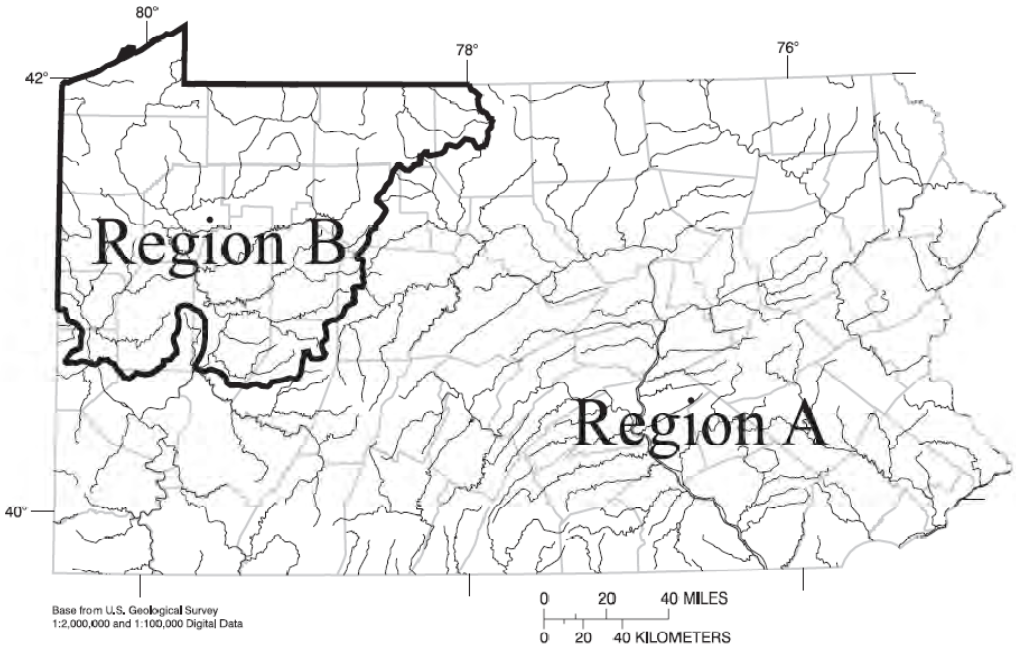
A. Technical Summary

The plan was developed from data collected on the physical features of the watershed, such as soils, wetlands, topography, floodplains, dams and reservoirs, stream dimensions, and obstructions.

The computer model used for the project was the US Army Corps of Engineers Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS). This model was chosen for the project because it can be easily adapted to an urban and/or rural area, it has the ability to analyze reservoir or detention basin-routing effects, and it is accepted by the Department of Environmental Protection.

In order to calibrate the watersheds, a validated flow result within the watershed would need to be known for each event. In this event, reliable stream gage data was unavailable. For this reason, the watersheds were calibrated by comparing the un-calibrated model results to a regression analysis. The regression analysis that was used was "Techniques for estimating magnitude and frequency of peak flows for Pennsylvania streams" (Stuckey and Reed 2000). This regression analysis presents equations that predict flood frequencies with return intervals or 10, 25, 50, 100, and 500 years for un-gauged streams in Pennsylvania.

Specific basin characteristics were used in the regression analysis depending upon where the watershed falls within one of two regions, Region A and Region B. These areas were designated as the flooding within Region A seems unrelated to the flooding in Region B (see Figure below).



The County falls within region B. Regression equations developed by Stuckey and Reed for Region B were developed from 54 streamflow-gaging station records and have two variables, drainage area and the percentage of basin controlled by lakes, swamps, and reservoirs. They surmised that the area of the State that comprises

Region B does not contain any carbonate surface rocks. They also determined that the urban area percentage is consistently low for streamflow-gaging stations in Region B without enough stations with high urban area percentages, and that the percentage of forest was not a significant variable. Therefore, this variable was dropped from the analysis. Using the land use information, each subcatchment area was analyzed using the equations shown in the figure below. Based upon the land use data available, it was assumed that CA, or the percentage of basin controlled by lakes, swaps or reservoirs was zero.

Q_T return flow (ft^3/s)	Basin characteristic coefficients						Residual standard error		Coefficient of determination (R^2)
	Intercept (A)	Drainage area (b)	Percentage forested area (c)	Percentage urban development (d)	Percentage carbonate area (e)	Percentage controlled area (f)	Log units	Percent	
Region A									
Q_{10}	2.5243	0.7770	-0.9712	1.0217	-1.7184	-0.5719	0.18	43	0.93
Q_{25}	2.7145	.7556	-1.0324	.7608	-1.5302	-.5302	.19	45	.91
Q_{50}	2.8441	.7414	-1.0821	.5785	-1.3955	-.4980	.21	50	.89
Q_{100}	2.9665	.7278	-1.1342	.4040	-1.2691	-.4637	.23	55	.87
Q_{500}	3.2294	.6994	-1.2666	.0208	-.9877	-.3834	.27	66	.82
Region B									
Q_{10}	2.3105	.7255	---	---	---	-1.2425	.12	28	.96
Q_{25}	2.4418	.7108	---	---	---	-1.3700	.13	30	.95
Q_{50}	2.5276	.7017	---	---	---	-1.4695	.14	33	.94
Q_{100}	2.6069	.6932	---	---	---	-1.5677	.16	38	.92
Q_{500}	2.7673	.6776	---	---	---	-1.8055	.19	45	.89

OR

Region A

$$Q_{10} = 334.4\ DA^{.7770}\ (1 + .01F)^{-.9712}\ (1 + .01U)^{1.0217}\ (1 + .01C)^{-1.7184}\ (1 + .01CA)^{-.5719}$$

$$Q_{25} = 518.2\ DA^{.7556}\ (1 + .01F)^{-1.0324}\ (1 + .01U)^{.7608}\ (1 + .01C)^{-1.5302}\ (1 + .01CA)^{-.5302}$$

$$Q_{50} = 698.4\ DA^{.7414}\ (1 + .01F)^{-1.0821}\ (1 + .01U)^{.5785}\ (1 + .01C)^{-1.3955}\ (1 + .01CA)^{-.4980}$$

$$Q_{100} = 925.8\ DA^{.7278}\ (1 + .01F)^{-1.1342}\ (1 + .01U)^{.4040}\ (1 + .01C)^{-1.2691}\ (1 + .01CA)^{-.4637}$$

$$Q_{500} = 1{,}696\ DA^{.6994}\ (1 + .01F)^{-1.2666}\ (1 + .01U)^{.0208}\ (1 + .01C)^{-.9877}\ (1 + .01CA)^{-.3834}$$

Region B

$$Q_{10} = 204.4\ DA^{.7255}\ (1 + .01CA)^{-1.2425}$$

$$Q_{25} = 276.6\ DA^{.7108}\ (1 + .01CA)^{-1.3700}$$

$$Q_{50} = 337.0\ DA^{.7017}\ (1 + .01CA)^{-1.4695}$$

$$Q_{100} = 404.5\ DA^{.6932}\ (1 + .01CA)^{-1.5677}$$

$$Q_{500} = 585.2\ DA^{.6776}\ (1 + .01CA)^{-1.8055}$$

DA is drainage area, in square miles;

F is percentage of forest cover, in percent;

U is percentage of urban development, in percent;

C is percentage of basin underlain by carbonate rock, in percent;

CA is percentage of basin controlled by lakes, swamps, or reservoirs, in percent; and

b, c, d, e, f are basin characteristic coefficients of regression.

These calculations were then compared to the uncalibrated model, and the muskingum values for the stream reaches between subcatchments were altered in order to provide a reach discharge (in CFS) which was within reasonable proximity to the reach discharge from the regression analysis. The regression analysis was initially completed for the 100-year event. Additional events, including the 10 and 50-year events were then completed

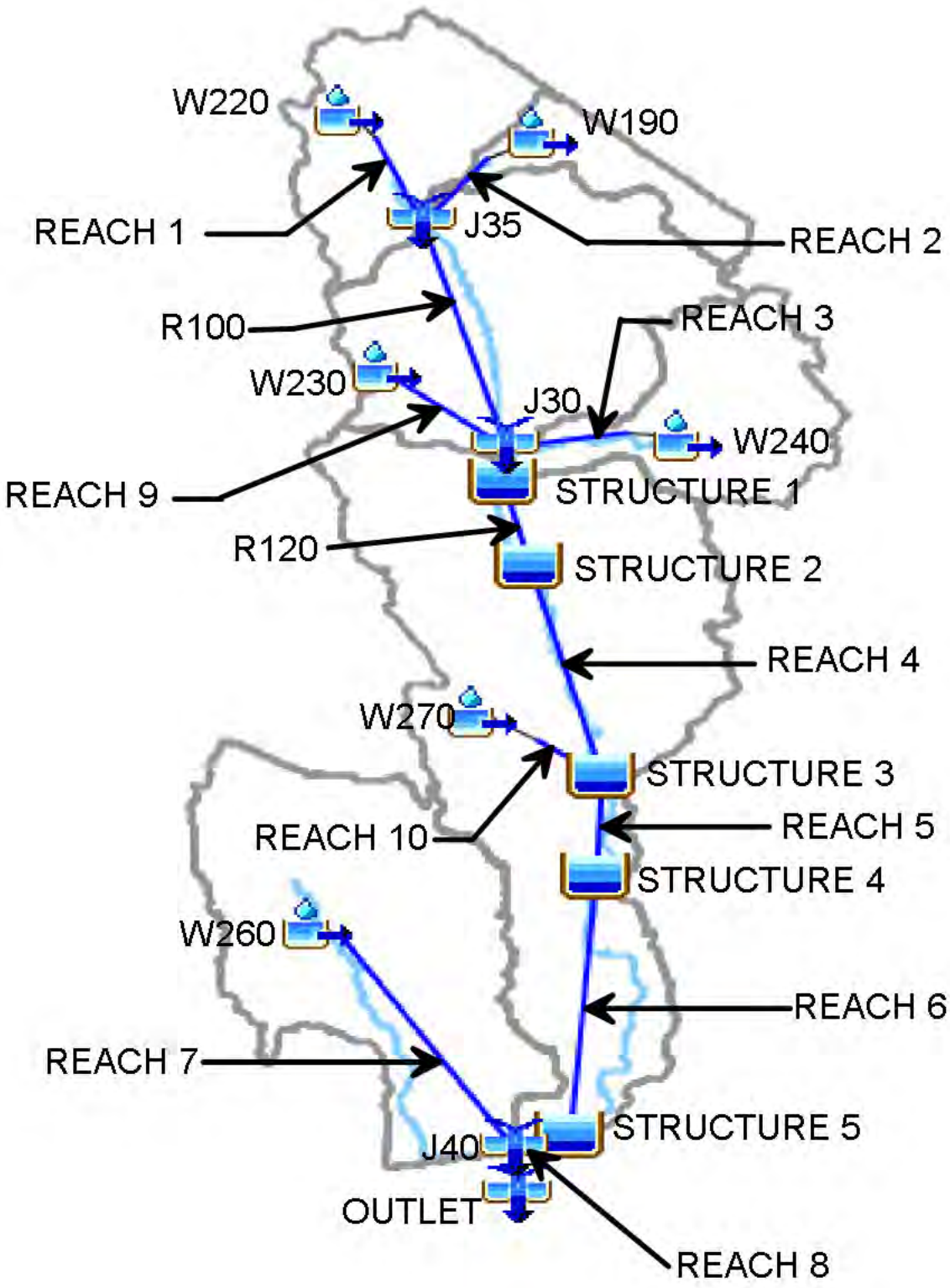
and compared to the regression analysis as well. Refer to section G or the results of the calibration of the model.

The process of determining how runoff flows throughout the watershed is a complex one. It involves running numerous scenarios through the model taking into account the location of obstructions and tributary confluences. This process produced a few large sub-basins, which were then further sub-divided. 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. Within the models, each point of interest is noted as the "outlet". A further description is graphically represented in the schematic provided for each watershed.

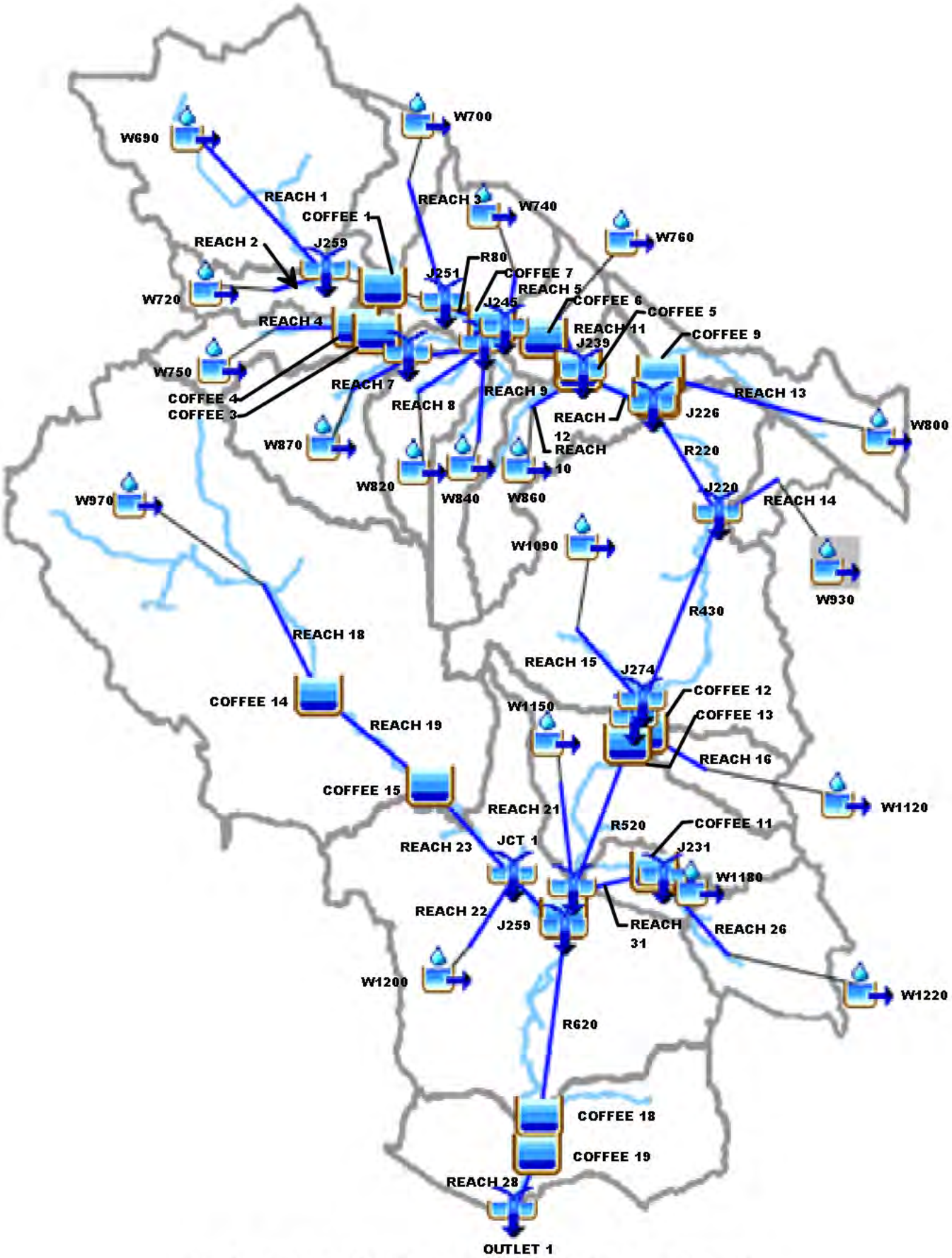
Another aspect of the analysis involves meteorology and the modeling of design storms. "Design Storms" is a term used to assign a frequency to a storm based on the amount of rain that falls over a 24-hour period. As the amount of rain falling over a 24-hour period increases, the frequency or chance of that storm occurring decreases. For this study, the 2-, 10-, 25-, 50-, and 100-year storms were modeled. This meteorological data was gathered using the National Oceanic and Atmospheric Administration's National Weather Service Precipitation Data. In order to use this data, the latitude and longitude of each watershed subcatchment centroid was calculated. The latitude and longitude of this point was inserted into the NOAA website, and precipitation values were garnished. These precipitation values were mathematically averaged across the overall watershed within the County, in order to provide a more adequate representation of the rainfall in that portion of the County. The specific rainfall data used for each overall watershed is provided in the section entitled "Meteorological Data".

B. Watershed Schematics

Schematics for each watershed model (or portion of model) are shown on the following pages.



HEC-HMS SCHEMATIC- MARSHALL RUN
LAWRENCE COUNTY, PENNSYLVANIA



HEC-HMS SCHEMATIC- COFFEE RUN
LAWRENCE COUNTY, PENNSYLVANIA

C. Subcatchment Data

Each subcatchment within the HEC-HMS model was created using the output from HEC-geoHMS. This data relied on a composite curve number grid that was weighted based upon area. Once all of the subcatchments were created, a composite curve number was assigned to the overall subcatchment area. Other data calculations completed in HEC-geoHMS included subcatchment area, average basin slope, and the basin lag time.

A number of decisions and assumptions were made regarding the most efficient and appropriate way to process the subcatchment data parameters. A loss method, transform method and baseflow method needed to be selected for the subcatchments for use in the HEC-GeoHMS preprocessing. While a subcatchment element conceptually represents infiltration, surface runoff, and subsurface processes interacting together, the actual infiltration calculations are performed by a loss method contained within the subcatchment. The method chosen for Lawrence County was the SCS method. The SCS method implements the curve numbers created by HEC-geoHMS and allows for incremental losses. Each subcatchment was analyzed assuming no baseflow. The transform method selected was the SCS unit Hydrograph Transform. This method was selected as it was a best approximate dimensionless unit hydrograph.

The following table was created for use within HEC-HMS. The output from HEC-geoHMS did not provide for the initial abstraction to be automatically processed during the initial HEC-HMS file creation. Therefore, it was manually calculated and entered as shown below. The formulas used for calculating the Initial abstraction were taken directly from the HEC-HMS Technical Reference Manual. An excerpt from this section is shown below the calculation tables.

Marshall Run			
Component ID	Input variable not obtained from HEC-GeoHMS	Composite Curve Number	Manually Calculated IA Value*
W190	Initial Abstraction (IA)	83.324	0.40027
W220	Initial Abstraction (IA)	83.86	0.38493
W230	Initial Abstraction (IA)	81.338	0.45888
W240	Initial Abstraction (IA)	73.094	0.7362
W260	Initial Abstraction (IA)	78.802	0.53801
W270	Initial Abstraction (IA)	81.618	0.45044

Coffee Run			
Component ID	Input variable not obtained from HEC-GeoHMS	Composite Curve Number	Manually Calculated IA Value*
W1090	Initial Abstraction (IA)	80.798	0.475308795
W1100	Initial Abstraction (IA)	80.716	0.47782348
W1140	Initial Abstraction (IA)	77.355	0.585482516
W1160	Initial Abstraction (IA)	80.144	0.495508085
W1170	Initial Abstraction (IA)	77.332	0.586251487
W1220	Initial Abstraction (IA)	83.303	0.400873918
W1250	Initial Abstraction (IA)	79.702	0.509347319
W1280	Initial Abstraction (IA)	83.486	0.39561124
W1290	Initial Abstraction (IA)	80.835	0.47417579
W1300	Initial Abstraction (IA)	78.273	0.555159506
w1310	Initial Abstraction (IA)	83.117	0.406246616
w1320	Initial Abstraction (IA)	81.514	0.453566259
w1330	Initial Abstraction (IA)	84.272	0.373267515
W1340	Initial Abstraction (IA)	82.593	0.421512719
W1350	Initial Abstraction (IA)	83.676	0.390171614
W1370	Initial Abstraction (IA)	80.685	0.478775485
W1390	Initial Abstraction (IA)	79.84	0.50501002
W1400	Initial Abstraction (IA)	81.963	0.440125422
W1420	Initial Abstraction (IA)	84.168	0.376199981
w1450	Initial Abstraction (IA)	84	0.380952381
w1480	Initial Abstraction (IA)	82.343	0.428864627
w1510	Initial Abstraction (IA)	83.819	0.386093845
w1530	Initial Abstraction (IA)	82.617	0.420809277
w1550	Initial Abstraction (IA)	83.703	0.389400619
w1560	Initial Abstraction (IA)	77.637	0.576091297
w1570	Initial Abstraction (IA)	74.326	0.690848425
w1580	Initial Abstraction (IA)	73.759	0.711533508

Coffee Run			
Component ID	Input variable not obtained from HEC-GeoHMS	Composite Curve Number	Manually Calculated IA Value*
w1590	Initial Abstraction (IA)	73.048	0.737925747
w1600	Initial Abstraction (IA)	82.65	0.41984271
w1610	Initial Abstraction (IA)	63.44	1.15258512
w1620	Initial Abstraction (IA)	82.175	0.43383024
w1630	Initial Abstraction (IA)	88.019	0.272236676
w1640	Initial Abstraction (IA)	83.736	0.388458966
w1650	Initial Abstraction (IA)	85.011	0.352636718
w1680	Initial Abstraction (IA)	79.666	0.510481259
w1690	Initial Abstraction (IA)	78.997	0.531741712
w1720	Initial Abstraction (IA)	75.196	0.659715942
w1730	Initial Abstraction (IA)	78.236	0.556367912
w1740	Initial Abstraction (IA)	85.382	0.342414092
w1750	Initial Abstraction (IA)	85.798	0.331056668
w1760	Initial Abstraction (IA)	81.422	0.456338582
w1770	Initial Abstraction (IA)	80.147	0.495414676
w1780	Initial Abstraction (IA)	76.298	0.621300689
w1790	Initial Abstraction (IA)	77.656	0.575461008
w1800	Initial Abstraction (IA)	80.053	0.498344847
w1810	Initial Abstraction (IA)	67.912	0.944987631
w1820	Initial Abstraction (IA)	84.357	0.370876157
w1830	Initial Abstraction (IA)	79	0.53164557
w1840	Initial Abstraction (IA)	82.152	0.434511637
w1850	Initial Abstraction (IA)	75.873	0.635983815
w1860	Initial Abstraction (IA)	76.209	0.624361952
w1870	Initial Abstraction (IA)	84	0.380952381
w1880	Initial Abstraction (IA)	73.03	0.738600575
w1890	Initial Abstraction (IA)	81.295	0.460175903
w1900	Initial Abstraction (IA)	72.327	0.765219074

Coffee Run			
Component ID	Input variable not obtained from HEC-GeoHMS	Composite Curve Number	Manually Calculated IA Value*
w1910	Initial Abstraction (IA)	75.069	0.664215588
w1920	Initial Abstraction (IA)	77.979	0.564793085
w1930	Initial Abstraction (IA)	85.296	0.344775839
w1940	Initial Abstraction (IA)	74.261	0.6932037
w1950	Initial Abstraction (IA)	73.087	0.736464761
w1960	Initial Abstraction (IA)	71.152	0.810883742
w1970	Initial Abstraction (IA)	65.093	1.072527
w1980	Initial Abstraction (IA)	49.01	2.080799837
w1990	Initial Abstraction (IA)	90.182	0.217737464
w2000	Initial Abstraction (IA)	79.723	0.508686326
w2010	Initial Abstraction (IA)	92.704	0.157404211
w2020	Initial Abstraction (IA)	70.941	0.819244161
w2030	Initial Abstraction (IA)	74.119	0.698363443
w2040	Initial Abstraction (IA)	75.967	0.632722103
w2050	Initial Abstraction (IA)	74.287	0.692261095
w2060	Initial Abstraction (IA)	78.121	0.560131079
w2080	Initial Abstraction (IA)	79	0.53164557
w2090	Initial Abstraction (IA)	75.541	0.64756887
w2100	Initial Abstraction (IA)	84	0.380952381
w2110	Initial Abstraction (IA)	70.364	0.842362572
w2150	Initial Abstraction (IA)	91.102	0.195341485

Basic Concepts and Equations

The Soil Conservation Service (SCS) Curve Number (CN) model estimates precipitation excess as a function of cumulative precipitation, soil cover, land use, and antecedent moisture, using the following equation:

$$P_e = \frac{(P - I_a)^2}{P - I_a + S} \qquad (3)$$

where P_e = accumulated precipitation excess at time t; P = accumulated rainfall depth at time t; I_a = the initial abstraction (initial loss); and S = potential maximum retention, a measure of the ability of a watershed to abstract and retain storm precipitation. Until the accumulated rainfall exceeds the initial abstraction, the precipitation excess, and hence the runoff, will be zero.

From analysis of results from many small experimental watersheds, the SCS developed an empirical relationship of I_a and S:

$$I_a = 0.2\,S \qquad (4)$$

Therefore, the cumulative excess at time t is:

$$P_e = \frac{(P - 0.2\,S)^2}{P + 0.8\,S} \qquad (5)$$

Incremental excess for a time interval is computed as the difference between the accumulated excess at the end of and beginning of the period.

The maximum retention, S, and watershed characteristics are related through an intermediate parameter, the curve number (commonly abbreviated *CN*) as:

$$S = \left\{ \begin{array}{ll} \dfrac{1000 - 10\,CN}{CN} & \text{(foot - pound system)} \\ \dfrac{25400 - 254\,CN}{CN} & \text{(SI)} \end{array} \right\} \qquad (6)$$

CN values range from 100 (for water bodies) to approximately 30 for permeable soils with high infiltration rates.

Publications from the Soil Conservation Service (1971, 1986) provide further background and details on use of the CN model.

Coffee Run- Subcatchment Input Data

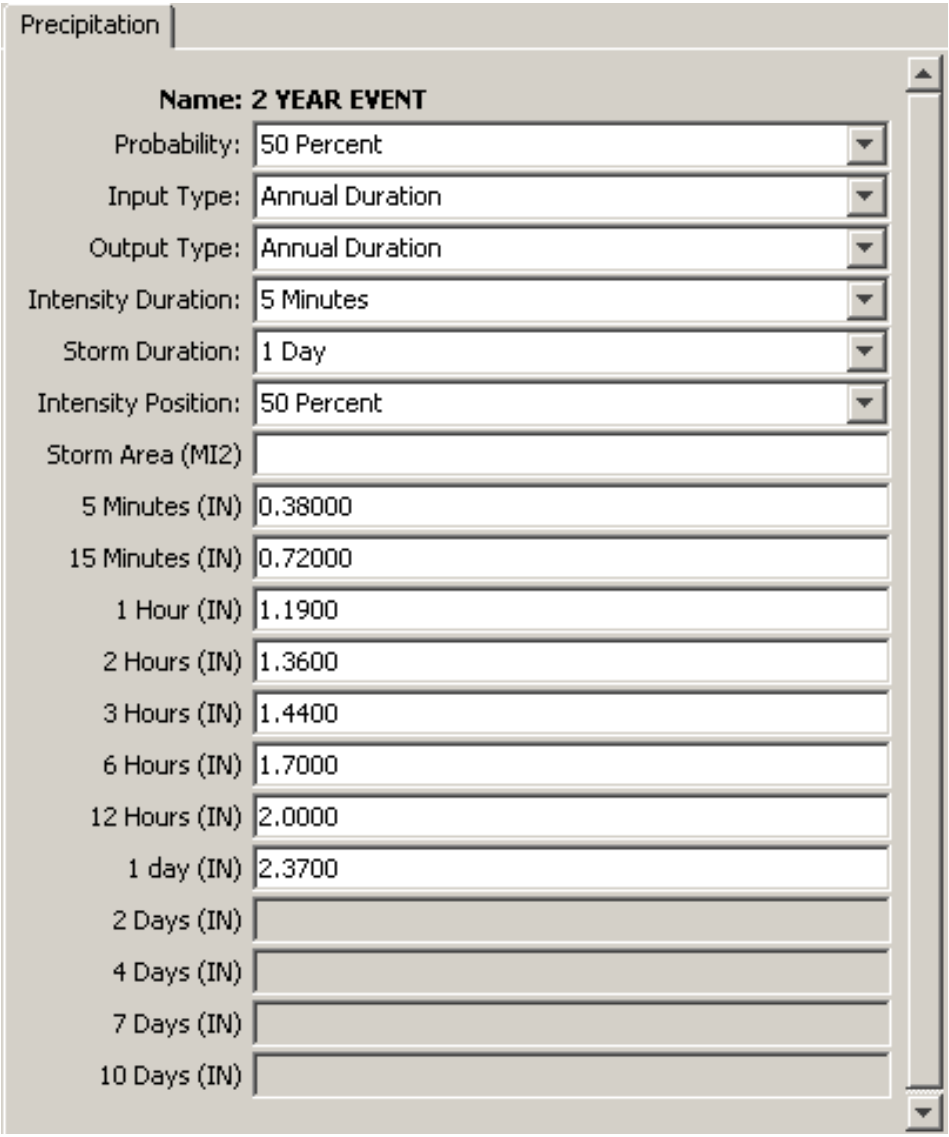
Component ID	Area- Square Miles	Basin Slope	Basin Lag Time (minutes)
W690	0.85472665123	6.21124315262	55.87169777934
W700	0.16165574304	7.04196023941	30.52435790502
W720	0.17017956042	8.01208496094	38.38083918528
W740	0.33453650803	9.68682289124	28.85362467744
W750	0.20823113595	6.31205987930	43.59451537656
W760	0.16028383673	8.69783210754	20.15724242046
W800	0.31164826220	6.78497791290	39.83282747268
W820	0.20500026904	6.42282581329	39.13351843098
W840	0.19291941263	6.54836034775	38.53775355504
W860	0.34311982978	8.19357395172	34.99132375980
W870	0.37710600796	6.71714544296	41.75307921186
W930	0.10938225571	6.83608770370	20.24395124610
W970	2.17621733663	7.12094449997	72.62272461780
W1090	1.28682792049	7.88551616669	53.31963665784
W1120	0.15382540869	7.29338598251	24.10407249918
W1150	0.46883823899	11.24579524990	33.38836088898
W1180	0.10854882722	13.30525112150	17.14108989882
W1200	1.34077487641	14.24117946620	50.95664930844
W1220	0.29186342641	8.90187168121	23.18997302634
W1310	0.55063140363	16.16344261170	32.20274347752

Marshall Run- Subcatchment Input Data

Component ID	Area- Square Miles	Basin Slope	Basin Lag Time (minutes)
W190	0.10846434570	8.54612731934	29.64914624226
W220	0.26645395838	6.06227731705	26.27216667828
W230	0.51406890660	8.98346138000	32.40400508922
W240	0.25652591132	6.71763420105	36.87032675322
W260	0.61752753898	16.30194664000	35.45392424196
W270	1.03967908984	13.65554809570	51.74649612744

D. Meteorological Data

The following meteorological data was obtained by averaging the precipitation results from each centroid within each watershed. The following data is applicable to both Coffee and Marshall Runs.

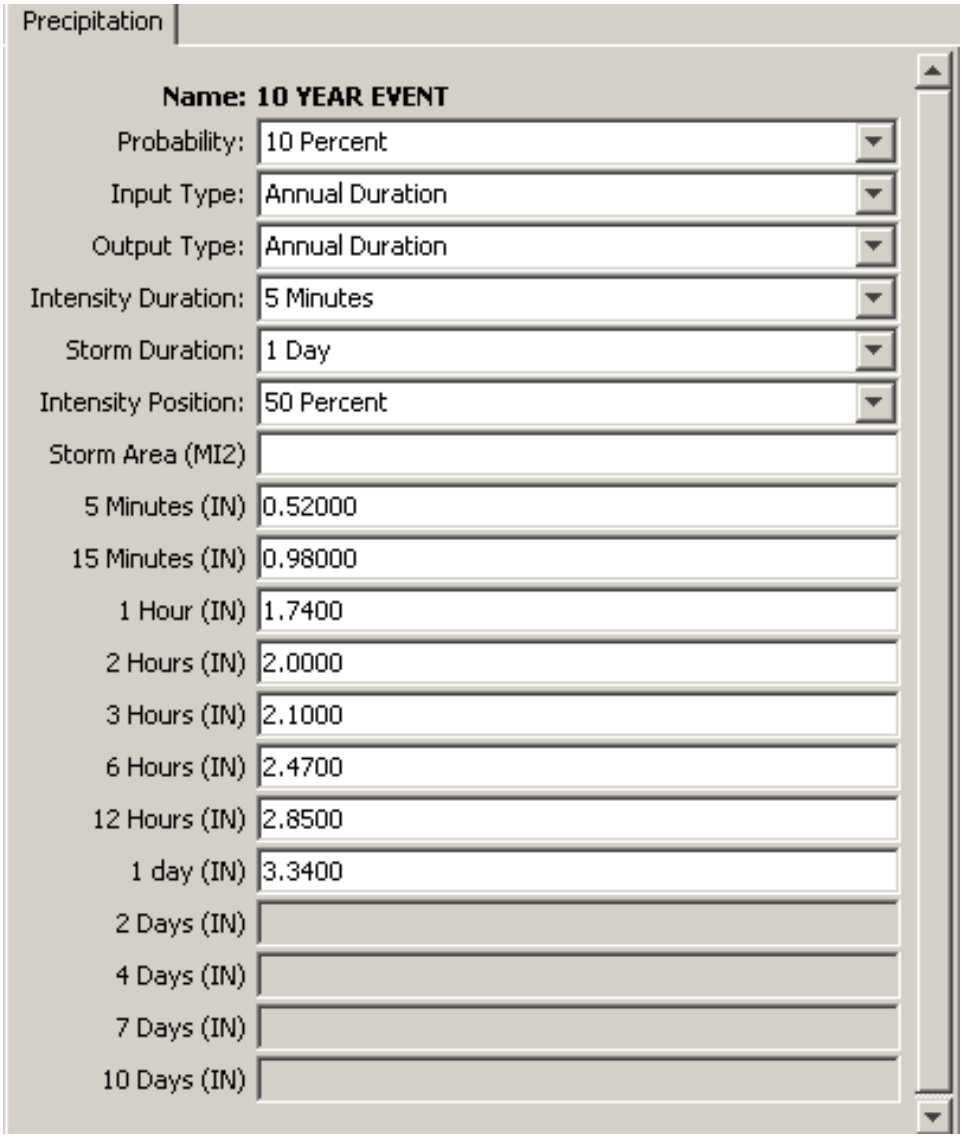


Precipitation

Name: 2 YEAR EVENT

Probability:	50 Percent
Input Type:	Annual Duration
Output Type:	Annual Duration
Intensity Duration:	5 Minutes
Storm Duration:	1 Day
Intensity Position:	50 Percent
Storm Area (MI2)	
5 Minutes (IN)	0.38000
15 Minutes (IN)	0.72000
1 Hour (IN)	1.1900
2 Hours (IN)	1.3600
3 Hours (IN)	1.4400
6 Hours (IN)	1.7000
12 Hours (IN)	2.0000
1 day (IN)	2.3700
2 Days (IN)	
4 Days (IN)	
7 Days (IN)	
10 Days (IN)	

2 Year Storm Event (http://dipper.nws.noaa.gov/hdsc/pfds/orb/pa_pfds.html)



Precipitation

Name: 10 YEAR EVENT

Probability:	10 Percent
Input Type:	Annual Duration
Output Type:	Annual Duration
Intensity Duration:	5 Minutes
Storm Duration:	1 Day
Intensity Position:	50 Percent
Storm Area (MI2)	
5 Minutes (IN)	0.52000
15 Minutes (IN)	0.98000
1 Hour (IN)	1.7400
2 Hours (IN)	2.0000
3 Hours (IN)	2.1000
6 Hours (IN)	2.4700
12 Hours (IN)	2.8500
1 day (IN)	3.3400
2 Days (IN)	
4 Days (IN)	
7 Days (IN)	
10 Days (IN)	

10 Year Storm Event (http://dipper.nws.noaa.gov/hdsc/pfds/orb/pa_pfds.html)

Precipitation

Name: 25 YEAR EVENT

Probability:	4 Percent
Input Type:	Annual Duration
Output Type:	Annual Duration
Intensity Duration:	5 Minutes
Storm Duration:	1 Day
Intensity Position:	50 Percent
Storm Area (MI2)	
5 Minutes (IN)	0.60000
15 Minutes (IN)	1.1300
1 Hour (IN)	2.0600
2 Hours (IN)	2.3800
3 Hours (IN)	2.5100
6 Hours (IN)	2.9500
12 Hours (IN)	3.4000
1 day (IN)	3.9500
2 Days (IN)	
4 Days (IN)	
7 Days (IN)	
10 Days (IN)	

25 Year Event (http://dipper.nws.noaa.gov/hdsc/pfds/orb/pa_pfds.html)

Precipitation

Name: 50 YEAR EVENT

Probability:	2 Percent
Input Type:	Annual Duration
Output Type:	Annual Duration
Intensity Duration:	5 Minutes
Storm Duration:	1 Day
Intensity Position:	50 Percent
Storm Area (MI2)	
5 Minutes (IN)	0.66000
15 Minutes (IN)	1.2300
1 Hour (IN)	2.3200
2 Hours (IN)	2.6700
3 Hours (IN)	2.8300
6 Hours (IN)	3.3300
12 Hours (IN)	3.8500
1 day (IN)	4.4400
2 Days (IN)	
4 Days (IN)	
7 Days (IN)	
10 Days (IN)	

50 Year Storm Event (http://dipper.nws.noaa.gov/hdsc/pfds/orb/pa_pfds.html)

Precipitation

Name: 100 YEAR EVENT

Probability:	1 Percent
Input Type:	Partial Duration
Output Type:	Annual Duration
Intensity Duration:	5 Minutes
Storm Duration:	1 Day
Intensity Position:	50 Percent
Storm Area (MI2)	
5 Minutes (IN)	0.71000
15 Minutes (IN)	1.3300
1 Hour (IN)	2.5800
2 Hours (IN)	2.9800
3 Hours (IN)	3.1700
6 Hours (IN)	3.7400
12 Hours (IN)	4.3300
1 day (IN)	4.9600
2 Days (IN)	
4 Days (IN)	
7 Days (IN)	
10 Days (IN)	

100 Year Storm Event (http://dipper.nws.noaa.gov/hdsc/pfds/orb/pa_pfds.html)

E. Stream Reach Routing Data

The Muskingum Method was used when modeling the streams within Lawrence County. The Muskingum routing method uses a simple conservation of mass approach to route flow through the stream reach. However, it does not assume that the water surface is level. By assuming a linear, but non-level, water surface, it is possible to account for increased storage during the rising side of a flood wave and decreased storage during the falling side. By adding a travel time for the reach and a weighting between the influence of inflow and outflow, it is possible to approximate attenuation. (*HEC-HMS Users Manual*)

The Muskingum K coefficient is essentially the travel time through the reach. It can be estimated from knowledge of the cross section properties and flow properties. It may be a calibration parameter in some cases. The Muskingum X coefficient is the weighting between inflow and outflow influence; it ranges from 0.0 up to 0.5. In practical application, a value of 0.0 results in maximum attenuation and 0.5 results in no attenuation. Most stream reaches require an intermediate value found through calibration.

Muskingum K is determined by dividing the mean velocity by the reach length. Velocity can be determined from a hydraulic model, or can be assumed in conjunction with calibration. Muskingum X is the only means to represent storage for this routing procedure. Muskingum X ranges between 0 to 0.5. A value between 0.2 and 0.45 is normally used for natural stream channels. (http://people.smu.edu/mfarahma/Blank_files/HEC-HMS%20Tutorial%20Rice%20Univ-1.pdf).

The tables below identify the routing coefficients that were used in the modeling of Marshall Run and Coffee Run.

Marshall Run		
Component ID	Muskingum K (HR)	Muskingum X
R100	1.65	0.25
R120	0.25	0.25
REACH 1	2.2	0.25
REACH 2	1.2	0.25
REACH 3	0.7	0.25
REACH 4	0.35	0.25
REACH 5	0.55	0.25
REACH 6	0.25	0.25
REACH 7	2.25	0.25
REACH 8	0.5	0.25
REACH 9	2.2	0.25
REACH 10	2.65	0.25

Coffee Run		
Component ID	Muskingum K (HR)	Muskingum X
R110	0.5	0.25
R150	0.25	0.25
R200	0.15	0.25
R430	1.15	0.25
R440	0.5	0.25
R480	0.5	0.25
R520	0.15	0.25
R530	0.5	0.25
R560	1.5	0.25
R620	0.1	0.25
R80	1	0.25
REACH-1	1.85	0.25
REACH-2	0.505	0.25
REACH-3	1	0.25
REACH-4	0.7	0.25
REACH-5	1.65	0.25
REACH-6	0.65	0.25
REACH-7	1.4	0.25
REACH-8	0.7	0.25
REACH-9	1.1	0.25
REACH-10	2	0.25
REACH-11	1.2	0.25
REACH-12	0.3	0.25
REACH-13	1.7	0.25
REACH-14	1.25	0.25
REACH-15	3.15	0.25
REACH-16	1.5	0.25
REACH-18	1.5	0.25
REACH-19	1	0.25

Coffee Run		
Component ID	Muskingum K (HR)	Muskingum X
REACH-21	2.1	0.25
REACH-22	1.8	0.25
REACH-23	1.05	0.25
REACH-24	0.5	0.25
REACH-25	1.2	0.25
REACH-26	2.2	0.25
REACH-28	0.1	0.25
REACH-29	0.1	0.25
REACH-30	0.85	0.25
REACH-31	0.65	0.25

F. Obstruction Routing Data

Once all of the data was added for the watershed analysis, the obstruction data was entered into HEC-HMS and the flow was routed through each obstruction. The obstructions chosen were all greater than 18 inches in diameter and were field verified. All of the applicable data was entered in as a reservoir containing and outlet and a spillway, and the glow was routed through each structure. The table on the following sheet lists all input data used for the structures and the field verification data can be found in Appendix E. The storage area behind each culvert was then determined using the average end area method. The storage elevation tables in this section are representative of the data gathered in this process.

MARSHALL RUN STRUCTURE PARAMETERS

Component ID	Storage Method	Initial Condition	Culvert Length	Culvert Dia/Span (ft)	Culvert Shape	Inlet Elevation	Outlet Elevation	Entrance Coefficient	Exit Coefficient	Mannings N	Spillway Method	Spillway Elevation (Road)	Storage Elevation Table
STRUCTURE #1	Elevation Storage	Inflow =outflow	40	6	Circular	998.3	997.9	0.5	1	0.013	Broad Crested Spillway	1001.9	Figure 1
STRUCTURE #2	Elevation Storage	Inflow =outflow	40	6	Circular	976.3	975.9	0.5	1	0.013	Broad Crested Spillway	978.9	Figure 2
STRUCTURE #3	Elevation Storage	Inflow =outflow	40	6	Circular	961.3	959.9	0.5	1	0.013	Broad Crested Spillway	963	Figure 3
STRUCTURE #4	Elevation Storage	Inflow =outflow	40	5	Low profile arch	940.4	939.9	0.5	1	0.04	Broad Crested Spillway	945.9	Figure 4
STRUCTURE #5	Elevation Storage	Inflow =outflow	40	6	Low profile arch	800.4	799.9	0.5	1	0.04	Broad Crested Spillway	808	Figure 5

COFFEE RUN STRUCTURE PARAMETERS

Component ID	Storage Method	Initial Condition	Culvert Length	Culvert Dia/Span (ft)	Culvert Shape	Inlet Elevation	Outlet Elevation	Entrance Coefficient	Exit Coefficient	Mannings N	Spillway Method	Spillway Elevation (Road)
COFFEE 1	Elevation Storage	Inflow =outflow	40	6/15	elliptical	1066.18	1065.9	0.5	1	0.012	Broad Crested Spillway	1079.4
COFFEE 11	Elevation Storage	Inflow =outflow	40	5/3	elliptical	1063.59	1061.9	0.5	1	0.012	Broad Crested Spillway	1067.4
COFFEE 12	Elevation Storage	Inflow =outflow	40	2.67	circular	1050.64	1049.9	0.5	1	0.012	Broad Crested Spillway	1052.9
COFFEE 13	Elevation Storage	Inflow =outflow	40	6/30	box	980.81	979.9	0.5	1	0.035	Broad Crested Spillway	978.9
COFFEE 14	Elevation Storage	Inflow =outflow	40	7	circular	1044.49	1043.9	0.5	1	0.013	Broad Crested Spillway	1053.9
COFFEE 15	Elevation Storage	Inflow =outflow	40	16/19	box	1022.49	1021.9	0.5	1	0.04	Broad Crested Spillway	1037.9
COFFEE 17	Elevation Storage	Inflow =outflow	40	40/10	w profile ar	884.52	883.9	0.5	1	0.04	Broad Crested Spillway	895.9
COFFEE 18	Elevation Storage	Inflow =outflow	40	9/22.5	box	822.3	821.9	0.5	1	0.04	Broad Crested Spillway	831.9
COFFEE 19	Elevation Storage	Inflow =outflow	40	7/22.5	box	804.15	803.9	0.5	1	0.04	Broad Crested Spillway	811.9
COFFEE 3	Elevation Storage	Inflow =outflow	40	3	circular	1075.29	1069.9	0.5	1	0.013	Broad Crested Spillway	1075.6
COFFEE 4	Elevation Storage	Inflow =outflow	40	4/2.5	box	1078.44	1077.9	0.5	1	0.04	Broad Crested Spillway	1084.6
COFFEE 5	Elevation Storage	Inflow =outflow	40	6/19	box	1022.04	1021.9	0.5	1	0.04	Broad Crested Spillway	1028.9
COFFEE 6	Elevation Storage	Inflow =outflow	40	2.5	circular	1030.04	1029.9	0.5	1	0.012	Broad Crested Spillway	1032.9
COFFEE 7	Elevation Storage	Inflow =outflow	40	2	circular	1032.19	1031.9	0.5	1	0.012	Broad Crested Spillway	1034.4
COFFEE 8	Elevation Storage	Inflow =outflow	40	5/25	box	1010.23	1009.9	0.5	1	0.04	Broad Crested Spillway	1015.4

Paired Data | Table | Graph

Elevation (FT)	Storage (AC-FT)
997.9	0.00
998.0	0.00
1000.0	0.66
1002.0	2.78
1004.0	6.89
1006.0	13.80
1008.0	24.52
1010.0	39.21
1020.0	60.00

Marshall Run, Structure #1 Storage- Elevation Table

Paired Data | Table | Graph

Elevation (FT)	Storage (AC-FT)
975.9	0.00
976.0	0.00
978.0	0.12
980.0	1.78
982.0	6.58
984.0	14.70
986.0	26.22
988.0	41.29

Marshall Run, Structure #2 Storage- Elevation Table

Paired Data | Table | Graph

Elevation (FT)	Storage (AC-FT)
959.9	0.00
960.0	0.01
962.0	1.68
964.0	7.51
966.0	18.36
968.0	34.48
970.0	56.95
972.0	86.32

Marshall Run, Structure #3 Storage- Elevation Table

Paired Data | Table | Graph

Elevation (FT)	Storage (AC-FT)
939.9	0.00
940.0	0.00
942.0	0.13
944.0	0.77
946.0	2.56
948.0	6.08
950.0	11.78
952.0	19.79
960.0	40.00

Marshall Run, Structure #4 Storage- Elevation Table

Paired Data | Table | Graph

Elevation (FT)	Storage (AC-FT)
799.9	0.00
800.0	0.00
802.0	0.11
804.0	0.69
806.0	1.90
808.0	3.54
810.0	5.66
812.0	8.10
830.0	60.00

Marshall Run, Structure #5 Storage- Elevation Table

Select a Paired Data

Select | Table | Graph

Elevation (FT)	Storage (AC-FT)
1065.9	0.00000
1066.0	0.00297
1068.0	0.77000
1070.0	3.75000
1072.0	9.68000
1074.0	18.22000
1076.0	29.34000
1078.0	43.46000
1080.0	60.85000
1082.0	81.59000

Select | Apply | Cancel

Coffee Run, Structure #1 Storage- Elevation Table

Select a Paired Data

Select | Table | Graph

Elevation (FT)	Storage (AC-FT)
1061.9	0.00000
1062.0	0.00098
1064.0	0.11000
1066.0	0.37000
1068.0	0.85000
1070.0	1.88000
1072.0	3.86000
1074.0	6.95000
1076.0	11.76000
1078.0	18.88000

Select Apply Cancel

Coffee Run, Structure #11 Storage- Elevation Table

Select a Paired Data

Select | Table | Graph

Elevation (FT)	Storage (AC-FT)
1049.9	0.00000
1050.0	0.00197
1052.0	0.23000
1054.0	0.76000
1056.0	1.59000
1058.0	2.74000
1060.0	4.25000
1062.0	6.16000
1064.0	8.56000
1066.0	11.49000

Select Apply Cancel

Coffee Run, Structure #12 Storage- Elevation Table

Select a Paired Data

Select | Table | Graph

Elevation (FT)	Storage (AC-FT)
979.9	0.00000
980.0	0.00032
982.0	0.02000
984.0	0.07000
986.0	1.64000
988.0	5.59000
990.0	12.51000
992.0	24.65000
994.0	43.20000
996.0	70.08000

Select | Apply | Cancel

Coffee Run, Structure #13 Storage- Elevation Table

Select a Paired Data

Select | Table | Graph

Elevation (FT)	Storage (AC-FT)
1043.9	0.00000
1044.0	0.02449
1046.0	1.77000
1048.0	5.30000
1050.0	10.97000
1052.0	18.92000
1054.0	29.03000
1056.0	41.35000
1058.0	56.30000
1060.0	74.01000

Select | Apply | Cancel

Coffee Run, Structure #14 Storage- Elevation Table

Select a Paired Data

Select | Table | Graph

Elevation (FT)	Storage (AC-FT)
1021.9	0.00000
1022.0	0.00111
1024.0	0.09000
1026.0	0.30000
1028.0	0.76000
1030.0	1.64000
1032.0	3.26000
1034.0	5.78000
1036.0	9.14000
1038.0	13.49000

Select | Apply | Cancel

Coffee Run, Structure #15 Storage- Elevation Table

Select a Paired Data

Select | Table | Graph

Elevation (FT)	Storage (AC-FT)
883.9	0.00
884.0	0.00
886.0	0.34
888.0	1.13
890.0	2.55
892.0	5.43
894.0	10.90
896.0	19.37
900.0	30.00
910.0	85.00

Select | Apply | Cancel

Coffee Run, Structure #17 Storage- Elevation Table

Select a Paired Data

Select | Table | Graph

Elevation (FT)	Storage (AC-FT)
821.9	0.00
822.0	0.00
824.0	0.16
826.0	0.56
828.0	1.39
830.0	2.92
832.0	5.51
834.0	9.86

Select | Apply | Cancel

Coffee Run, Structure #18 Storage- Elevation Table

Select a Paired Data

Select | Table | Graph

Elevation (FT)	Storage (AC-FT)
803.9	0.00
804.0	0.00
806.0	0.13
808.0	0.38
810.0	1.02
812.0	2.60
814.0	5.74
816.0	11.30

Select | Apply | Cancel

Coffee Run, Structure #19 Storage- Elevation Table

Select a Paired Data

Select | Table | Graph

Elevation (FT)	Storage (AC-FT)
1069.9	0.00000
1070.0	0.00251
1072.0	0.50000
1074.0	1.84000
1076.0	4.33000
1078.0	8.08000
1080.0	16.74000
1082.0	33.03000
1084.0	53.73000
1086.0	83.47000

Select | Apply | Cancel

Coffee Run, Structure #3 Storage- Elevation Table

Select a Paired Data

Select | Table | Graph

Elevation (FT)	Storage (AC-FT)
1077.9	0.00000
1078.0	0.00094
1080.0	0.19000
1082.0	2.06000
1084.0	6.85000
1088.0	27.42000
1090.0	43.87000
1092.0	64.08000
1094.0	90.70000

Select | Apply | Cancel

Coffee Run, Structure #4 Storage- Elevation Table

Select a Paired Data

Select | Table | Graph

Elevation (FT)	Storage (AC-FT)
1021.9	0.00000
1022.0	0.00071
1024.0	0.16000
1026.0	2.12000
1028.0	9.14000
1030.0	25.71000
1032.0	56.62000
1034.0	109.77000
1036.0	193.97000
1038.0	309.26999

Select | Apply | Cancel

Coffee Run, Structure #5 Storage- Elevation Table

Select a Paired Data

Select | Table | Graph

Elevation (FT)	Storage (AC-FT)
1029.9	0.00000
1030.0	0.00245
1032.0	4.04000
1036.0	12.54000
1038.0	25.62000
1040.0	41.87000
1042.0	61.44000
1044.0	88.94000
1046.0	125.39000

Select | Apply | Cancel

Coffee Run, Structure #6 Storage- Elevation Table

Select a Paired Data

Select | Table | Graph

Elevation (FT)	Storage (AC-FT)
1031.9	0.00000
1032.0	0.00245
1034.0	0.47000
1036.0	3.74000
1038.0	10.15000
1040.0	18.50000
1042.0	29.62000
1044.0	44.28000
1046.0	62.72000
1048.0	84.34000

Select Apply Cancel

Coffee Run, Structure #7 Storage- Elevation Table

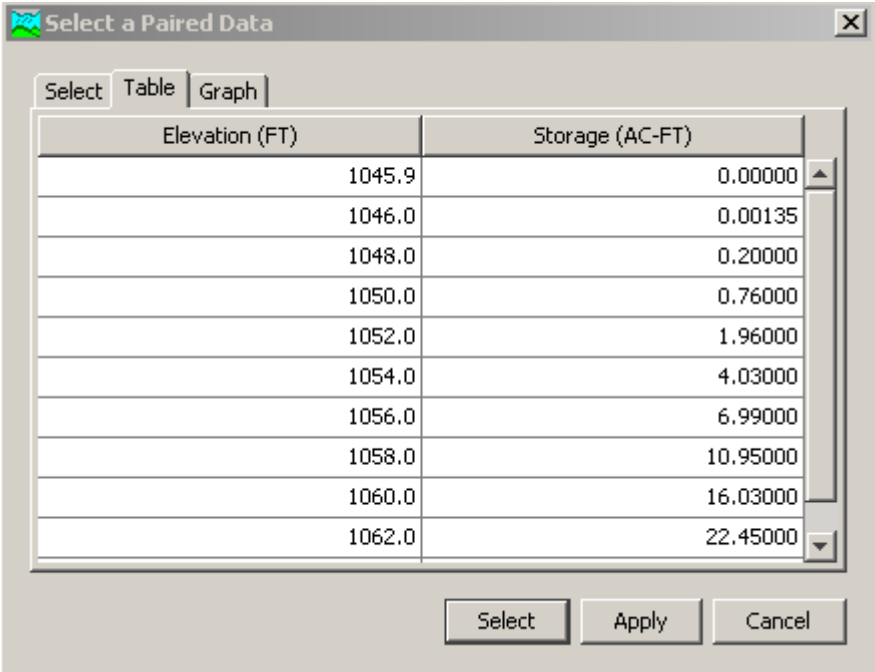
Select a Paired Data

Select | Table | Graph

Elevation (FT)	Storage (AC-FT)
1009.9	0.00000
1010.0	0.00109
1012.0	0.39000
1014.0	3.76000
1016.0	13.85000
1018.0	33.09000
1020.0	63.23000
1022.0	106.05000
1024.0	163.55000
1026.0	237.60001

Select Apply Cancel

Coffee Run, Structure #8 Storage- Elevation Table



Elevation (FT)	Storage (AC-FT)
1045.9	0.00000
1046.0	0.00135
1048.0	0.20000
1050.0	0.76000
1052.0	1.96000
1054.0	4.03000
1056.0	6.99000
1058.0	10.95000
1060.0	16.03000
1062.0	22.45000

Coffee Run, Structure #9 Storage- Elevation Table

G. Regression Analysis

As was discussed in the executive summary, the regression analysis methodology used comes from Stuckey and Reed's "Techniques for estimating magnitude and frequency of peak flows for Pennsylvania streams". Both Coffee Run and Marshall Run were each analyzed and calibrated using this data.

MARSHALL RUN- LAWRENCE COUNTY

ID	Tributary Drainage area	10 yr regression	10 year HMS calibration (outflow of reaches)	% change	25 yr regression	25 year HMS calibration (outflow of reaches)	% change	100 yr regression	100 year HMS calibration (outflow of reaches)	% change
W190/reach 2	0.10846	40.79	45.7	12%	57.03	59.9	5%	86.73	83.6	4%
W220/reach 1	0.26645	78.30	85.1	9%	108.04	111.3	3%	161.72	155.2	4%
J35	0.37491	100.31	129.8	29%	137.72	169.8	23%	204.91	237	16%
W230/reach 9	0.51407	126.13	138.8	10%	172.36	185.3	8%	255.03	264.1	4%
W240/reach 3	0.25653	76.17	71.8	6%	105.16	103.2	2%	157.52	159	1%
J30	1.14551	225.57	224	1%	304.64	303.4	0%	444.44	440.2	1%
W270/reach 10	1.0397	210.26	224.8	7%	284.36	300.6	6%	415.57	429.7	3%
W260/reach 7	0.61753	144.08	140.7	2%	196.36	192.1	2%	289.60	280.6	3%
outlet	2.80274	431.72	424.8	2%	575.43	577.8	0%	826.39	836.6	1%

COFFEE RUN- LAWRENCE COUNTY

ID	Tributary Drainage area	10 yr regression	10 year HMS calibration (outflow of reaches)	% change	25 yr regression	25 year HMS calibration (outflow of reaches)	% change	100 yr regression	100 year HMS calibration (outflow of reaches)	% change
W690/reach 1	0.85473	182.40	181.5	0%	247.40	250.2	1%	362.80	369.2	2%
W720/reach 2	0.17018	56.56	51.1	10%	78.56	73.6	6%	118.52	113.9	4%
J259	1.02491	208.08	207	1%	281.48	286.8	2%	411.46	426.2	4%
W700/reach 3	0.16166	54.49	59.8	10%	75.74	81.1	7%	114.37	117.4	3%
J251	1.18657	231.41	237	2%	312.36	315.8	1%	455.43	469.1	3%
W740/reach 5	0.33454	92.36	93.6	1%	127.01	128.3	1%	189.35	187.9	1%
W750/reach 4	0.20823	65.48	63.4	3%	90.67	89	2%	136.31	133.5	2%
W870/reach 7	0.37711	100.74	98.3	2%	138.29	136	2%	205.74	201.1	2%
J242	0.58534	138.59	133.1	4%	189.03	178.8	5%	279.05	256.9	8%
W820/reach 8	0.205	64.74	66.1	2%	89.67	92.4	3%	134.84	138.3	3%
W840/reach 9	0.19292	61.95	67.8	9%	85.88	91	6%	129.28	130.7	1%
J229	0.98326	201.91	200.9	1%	273.30	275.3	1%	399.79	403.6	1%
J245	2.50437	397.87	390.5	2%	531.19	533.3	0%	764.36	773.6	1%
W760/reach 11	0.16028	54.15	56.3	4%	75.28	77.1	2%	113.69	113.11	1%
W860/reach 10	0.34312	94.07	108	15%	129.31	142	10%	192.70	198.3	3%
J239	3.00777	454.41	450.1	1%	605.05	597.4	1%	867.84	842.8	3%
W800/reach 13	0.31165	87.73	93.8	7%	120.77	125.2	4%	180.27	178	1%
J226	3.31942	488.10	494.5	1%	648.97	651.8	0%	929.22	917.3	1%
W930/reach 14	0.10938	41.04	46.8	14%	57.38	61.8	8%	87.24	87.2	0%
J220	3.4288	499.72	504.1	1%	664.10	663.6	0%	950.34	932.9	2%
W1090/reach 15	1.2868	245.43	249.7	2%	330.90	334.5	1%	481.76	479.1	1%
J274	4.7156	629.70	639.2	2%	832.92	848.4	2%	1185.26	1199.4	1%
W1120/reach 16	0.15383	52.56	62.7	19%	73.11	81.8	12%	110.50	113.8	3%
J212	4.86943	644.53	644.4	0%	852.14	856	0%	1211.93	1209.5	0%
W1150/reach 21	0.46884	117.98	124.4	5%	161.44	167.6	4%	239.26	240.7	1%
W1180/reach 25	0.10855	40.82	46.5	14%	57.07	61.8	8%	86.78	88	1%
W1220/reach 26	0.29186	83.65	96	15%	115.27	125.7	9%	172.26	175	2%
J254	5.73868	726.10	714.3	2%	957.67	947.7	1%	1358.09	1338.3	1%
W970/reach 23	2.1762	359.32	342.5	5%	480.72	460.5	4%	693.44	690.5	0%
W1200/reach 22	1.3408	252.86	219	13%	340.71	317	7%	495.69	493.3	0%
outlet	9.25568	1027.09	967.4	6%	1345.16	1295.3	4%	1891.62	1878.5	1%

H. Results

The following tables present the overall global summary table provided by HEC-HMS for each watershed. These tables summarize the peak flow, time of peak flow and volume for each element analyzed within the watershed.

Marshall Run- Global Summary 2 Year Event

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
J30	1.14551	110.2	23-Feb-10	14:20	51.2
J35	0.37491	68.2	23-Feb-10	13:25	20
J40	2.80274	206.5	23-Feb-10	17:25	126.3
Outlet1	2.80274	206.5	23-Feb-10	17:25	126.3
R100	0.37491	48.3	23-Feb-10	15:15	20.6
R120	1.14551	108.5	23-Feb-10	14:55	52.1
Reach-1	0.26645	44.7	23-Feb-10	13:30	14.3
Reach-10	1.0397	112.4	23-Feb-10	14:20	48.8
REACH 2	0.10846	24	23-Feb-10	13:15	5.7
Reach-3	0.25653	28.7	23-Feb-10	13:20	6.9
Reach-4	1.14551	106.9	23-Feb-10	15:25	52
Reach-5	2.18521	192.5	23-Feb-10	16:10	102.4
Reach-6	2.18521	186.5	23-Feb-10	16:55	102.2
Reach-7	0.61753	65.6	23-Feb-10	13:50	24.4
Reach-8	2.18521	183.2	23-Feb-10	17:35	101.9
Reach-9	0.51407	68.9	23-Feb-10	13:40	23.8
Structure #1	1.14551	109.1	23-Feb-10	14:40	52.1
Structure #2	1.14551	108.4	23-Feb-10	15:00	52
Structure #3	2.18521	198.8	23-Feb-10	15:30	102.4
Structure #4	2.18521	187.2	23-Feb-10	16:40	102.2
Structure #5	2.18521	186.2	23-Feb-10	17:00	101.9
W190	0.10846	45.2	23-Feb-10	12:35	5.7
W220	0.26645	123.3	23-Feb-10	12:30	14.3
W230	0.51407	175.3	23-Feb-10	12:40	23.8
W240	0.25653	39.9	23-Feb-10	12:45	6.9
W260	0.61753	163.6	23-Feb-10	12:45	24.4
W270	1.0397	259.6	23-Feb-10	13:00	48.8

Marshall Run- Global Summary 10 Year Event

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
J30	1.14551	224	23-Feb-10	13:55	95.1
J35	0.37491	129.8	23-Feb-10	13:25	35.5
J40	2.80274	424.8	23-Feb-10	16:55	235.3
Outlet1	2.80274	424.8	23-Feb-10	16:55	235.3
R100	0.37491	91.4	23-Feb-10	15:10	36.5
R120	1.14551	220.6	23-Feb-10	14:30	96.4
Reach-1	0.26645	85.1	23-Feb-10	13:30	25.4
Reach-10	1.0397	224.8	23-Feb-10	14:15	89.8
REACH 2	0.10846	45.7	23-Feb-10	13:15	10.1
Reach-3	0.25653	71.8	23-Feb-10	13:15	14.7
Reach-4	1.14551	215.8	23-Feb-10	15:10	96.3
Reach-5	2.18521	393.4	23-Feb-10	15:50	188.7
Reach-6	2.18521	389.1	23-Feb-10	16:20	188.5
Reach-7	0.61753	140.7	23-Feb-10	13:45	47
Reach-8	2.18521	374.7	23-Feb-10	17:05	188.3
Reach-9	0.51407	138.8	23-Feb-10	13:40	43.9
Structure #1	1.14551	222.5	23-Feb-10	14:10	96.4
Structure #2	1.14551	219	23-Feb-10	14:45	96.3
Structure #3	2.18521	409.2	23-Feb-10	15:10	188.7
Structure #4	2.18521	391.9	23-Feb-10	16:00	188.5
Structure #5	2.18521	388.1	23-Feb-10	16:25	188.3
W190	0.10846	84	23-Feb-10	12:35	10.1
W220	0.26645	226.4	23-Feb-10	12:30	25.4
W230	0.51407	341	23-Feb-10	12:40	43.9
W240	0.25653	99.8	23-Feb-10	12:45	14.7
W260	0.61753	340.1	23-Feb-10	12:40	47
W270	1.0397	508.7	23-Feb-10	13:00	89.8

Marshall Run- Global Summary 25 Year Event

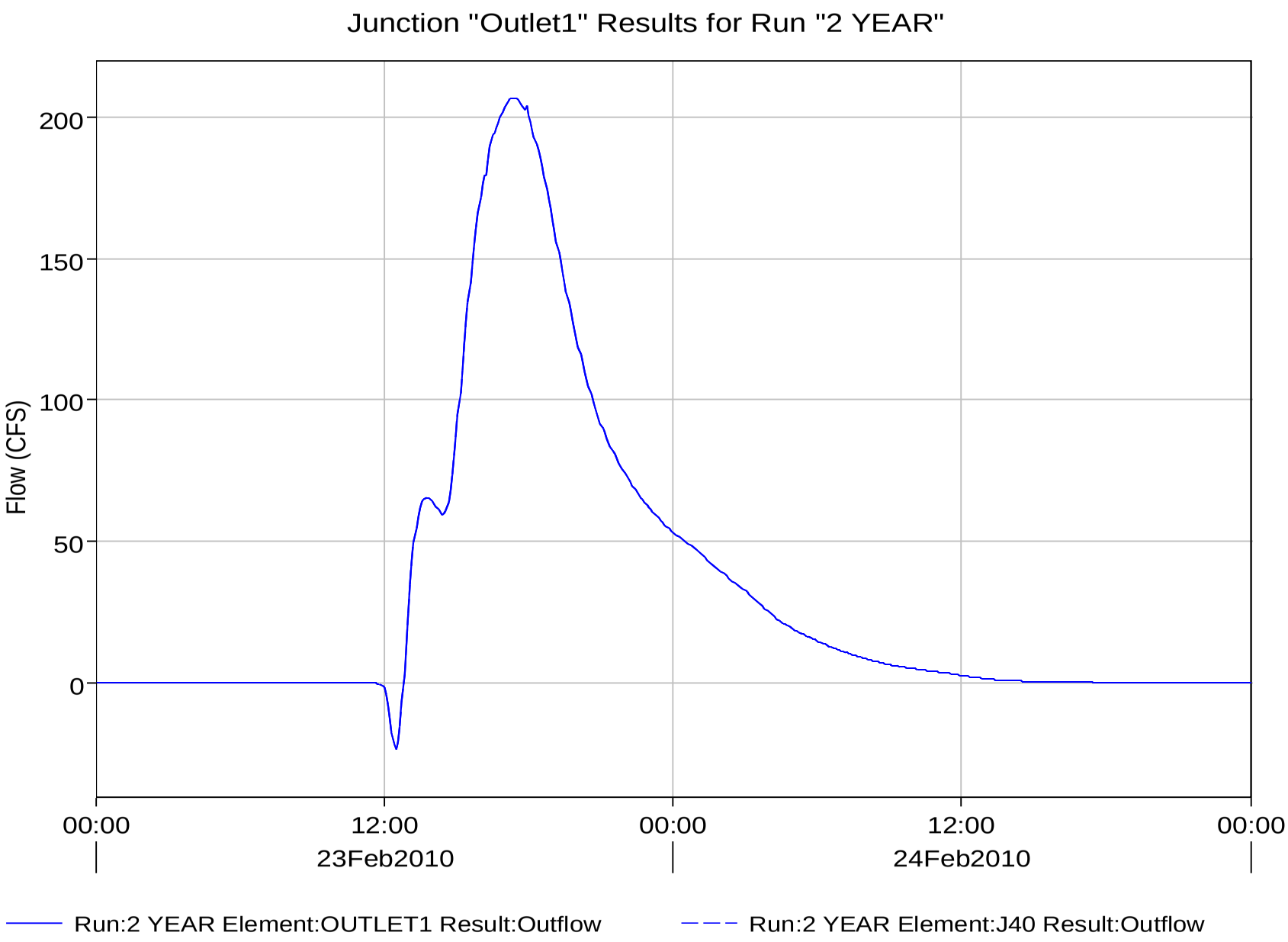
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
J30	1.14551	303.4	23-Feb-10	13:50	125.3
J35	0.37491	169.8	23-Feb-10	13:25	46
J40	2.80274	577.8	23-Feb-10	16:50	309.6
Outlet1	2.80274	577.8	23-Feb-10	16:50	309.6
R100	0.37491	120	23-Feb-10	15:10	47.1
R120	1.14551	298.7	23-Feb-10	14:25	126.5
Reach-1	0.26645	111.3	23-Feb-10	13:30	32.9
Reach-10	1.0397	300.6	23-Feb-10	14:15	117.8
REACH 2	0.10846	59.9	23-Feb-10	13:15	13.1
Reach-3	0.25653	103.2	23-Feb-10	13:15	20.5
Reach-4	1.14551	291.7	23-Feb-10	15:00	126.4
Reach-5	2.18521	529.8	23-Feb-10	15:50	247.2
Reach-6	2.18521	523.4	23-Feb-10	16:20	247
Reach-7	0.61753	192.1	23-Feb-10	13:45	62.7
Reach-8	2.18521	509.6	23-Feb-10	17:00	246.8
Reach-9	0.51407	185.3	23-Feb-10	13:40	57.7
Structure #1	1.14551	301.7	23-Feb-10	14:05	126.5
Structure #2	1.14551	296.9	23-Feb-10	14:35	126.4
Structure #3	2.18521	548.2	23-Feb-10	15:10	247.2
Structure #4	2.18521	526.3	23-Feb-10	16:05	247
Structure #5	2.18521	522.9	23-Feb-10	16:25	246.8
W190	0.10846	108.8	23-Feb-10	12:35	13.1
W220	0.26645	291.7	23-Feb-10	12:30	32.9
W230	0.51407	448.3	23-Feb-10	12:40	57.7
W240	0.25653	142.3	23-Feb-10	12:45	20.5
W260	0.61753	458.6	23-Feb-10	12:40	62.7
W270	1.0397	671.7	23-Feb-10	13:00	117.8

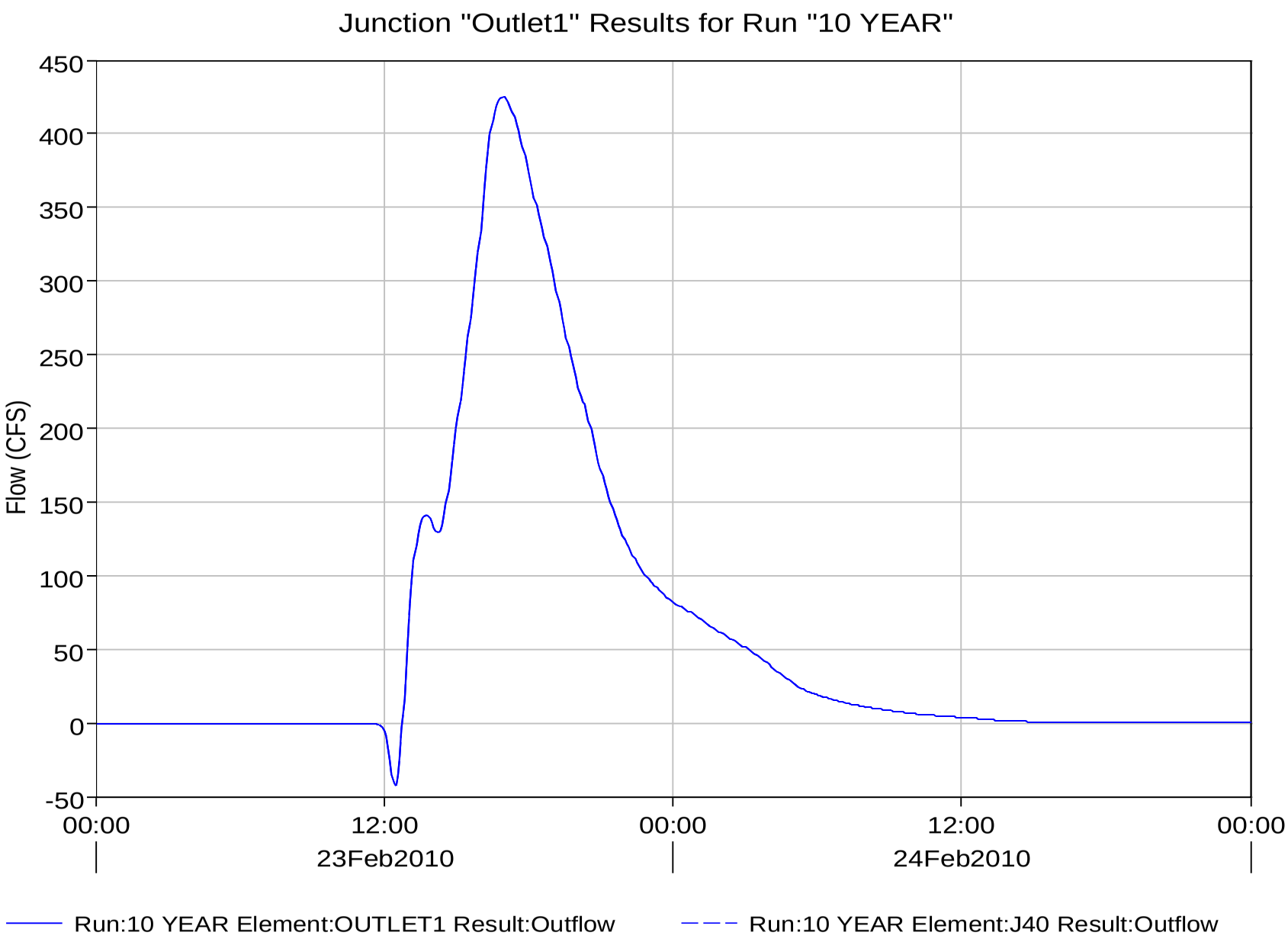
Marshall Run- Global Summary 50 Year Event

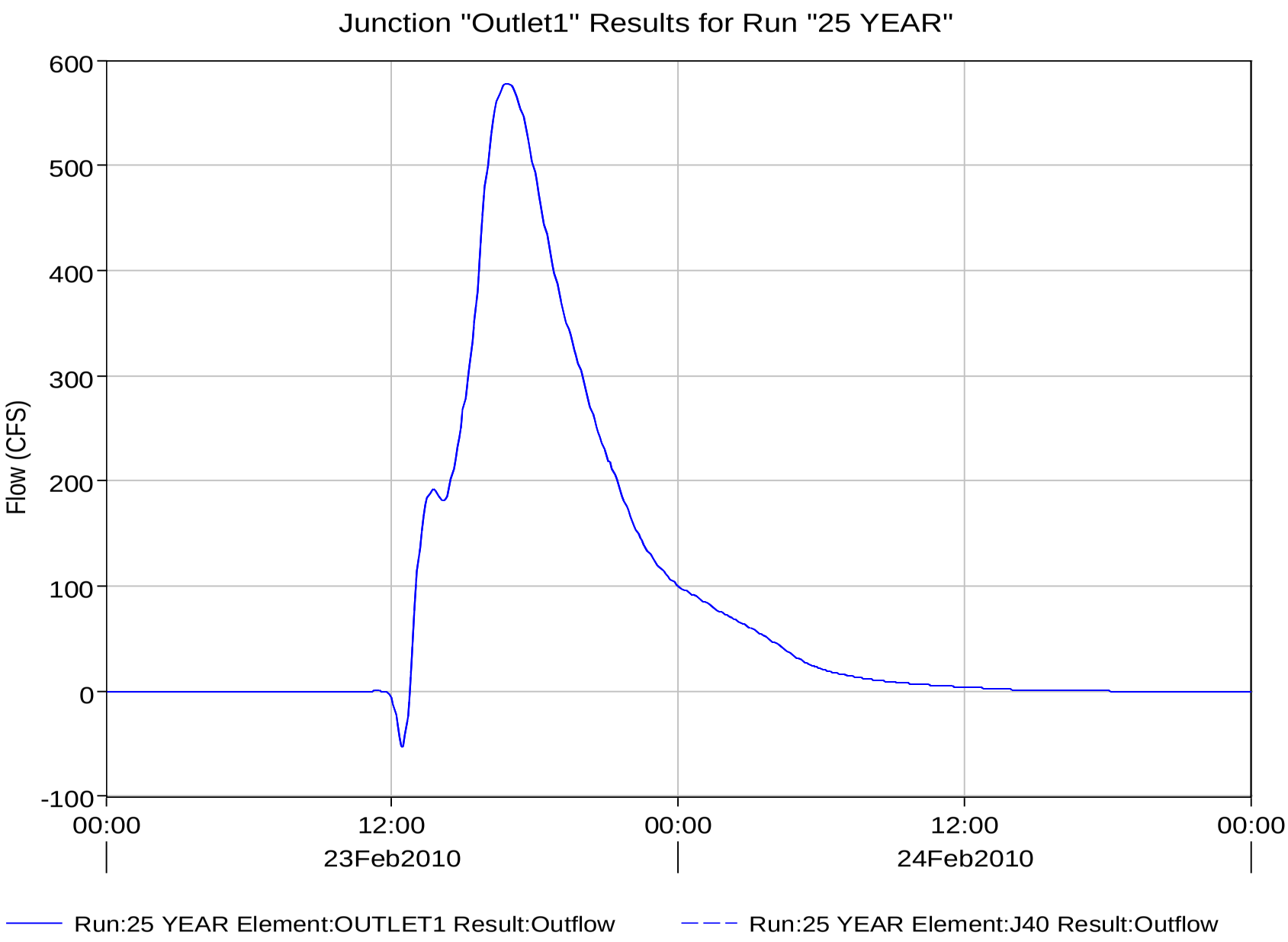
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
J30	1.14551	368.9	23-Feb-10	13:50	150.4
J35	0.37491	202.4	23-Feb-10	13:20	54.7
J40	2.80274	700.6	23-Feb-10	16:45	371
Outlet1	2.80274	700.6	23-Feb-10	16:45	371
R100	0.37491	143.2	23-Feb-10	15:10	55.8
R120	1.14551	363.4	23-Feb-10	14:20	151.6
Reach-1	0.26645	132.6	23-Feb-10	13:25	39.1
Reach-10	1.0397	362.6	23-Feb-10	14:15	141.1
REACH 2	0.10846	71.5	23-Feb-10	13:15	15.6
Reach-3	0.25653	130	23-Feb-10	13:15	25.4
Reach-4	1.14551	354.5	23-Feb-10	15:00	151.5
Reach-5	2.18521	641.3	23-Feb-10	15:50	295.6
Reach-6	2.18521	633.7	23-Feb-10	16:15	295.4
Reach-7	0.61753	234.5	23-Feb-10	13:45	76
Reach-8	2.18521	616.5	23-Feb-10	16:55	295.1
Reach-9	0.51407	223.2	23-Feb-10	13:40	69.2
Structure #1	1.14551	367.2	23-Feb-10	14:00	151.6
Structure #2	1.14551	361.3	23-Feb-10	14:30	151.5
Structure #3	2.18521	665	23-Feb-10	15:10	295.6
Structure #4	2.18521	637.6	23-Feb-10	16:00	295.4
Structure #5	2.18521	633	23-Feb-10	16:20	295.1
W190	0.10846	128.5	23-Feb-10	12:35	15.6
W220	0.26645	343.5	23-Feb-10	12:30	39.1
W230	0.51407	535.2	23-Feb-10	12:40	69.2
W240	0.25653	178.2	23-Feb-10	12:45	25.4
W260	0.61753	555.9	23-Feb-10	12:40	76
W270	1.0397	804.5	23-Feb-10	13:00	141.1

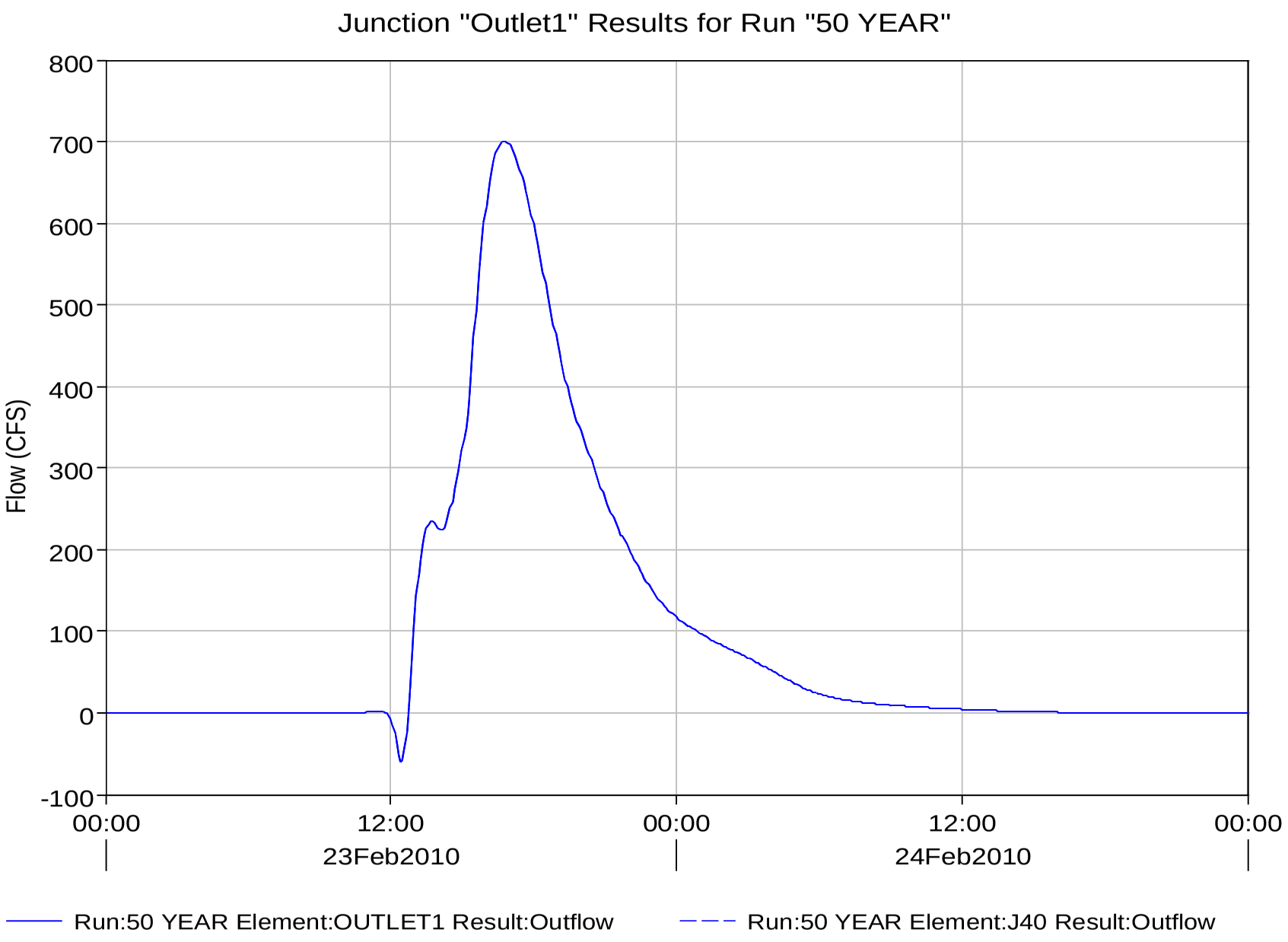
Marshall Run- Global Summary 100 Year Event

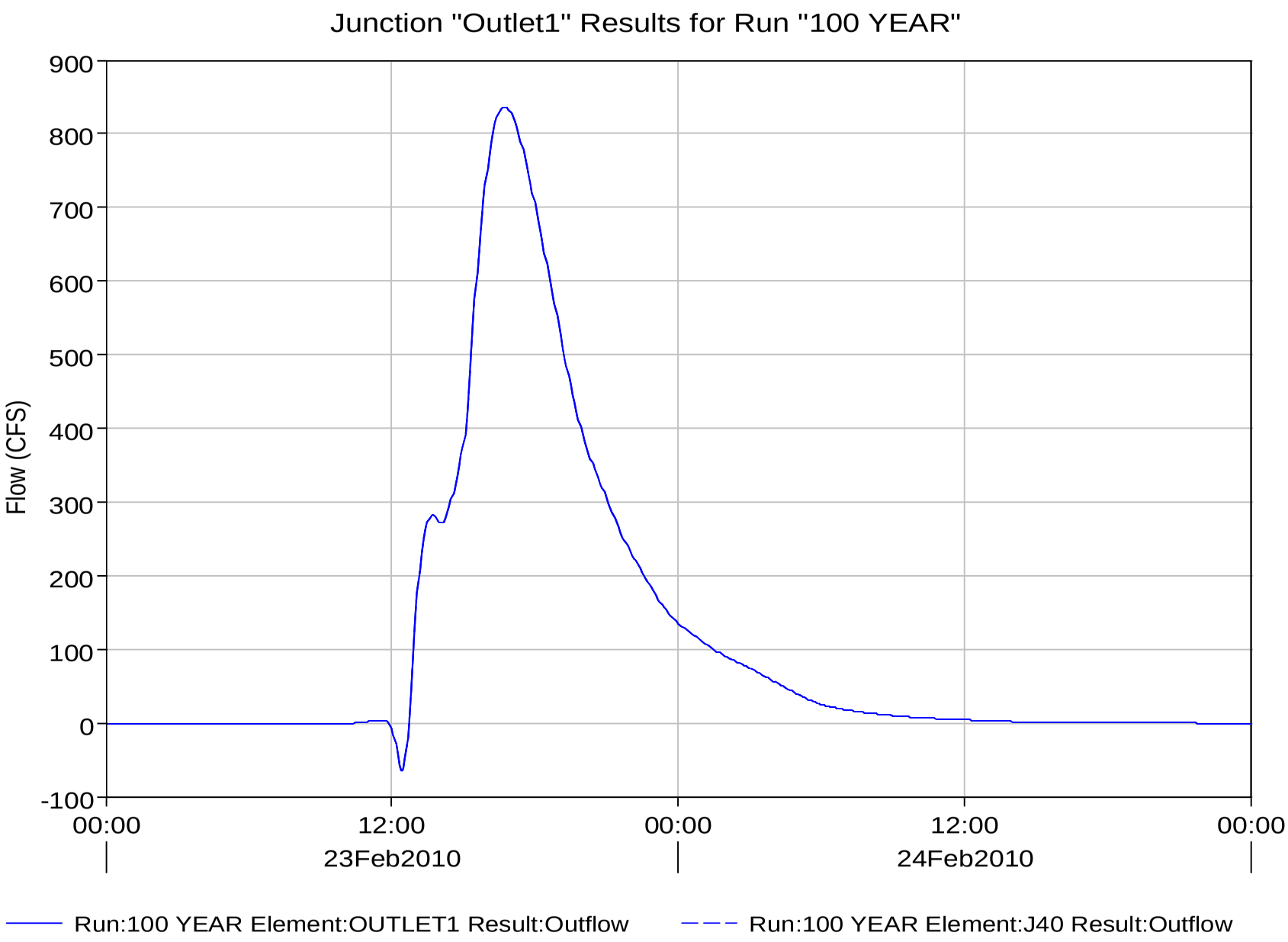
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
J30	1.14551	440.2	23-Feb-10	13:50	177.8
J35	0.37491	237	23-Feb-10	13:20	64.1
J40	2.80274	836.6	23-Feb-10	16:45	437.9
Outlet1	2.80274	836.6	23-Feb-10	16:45	437.9
R100	0.37491	168	23-Feb-10	15:10	65.2
R120	1.14551	431.7	23-Feb-10	14:20	178.8
Reach-1	0.26645	155.2	23-Feb-10	13:25	45.7
Reach-10	1.0397	429.7	23-Feb-10	14:15	166.4
REACH 2	0.10846	83.6	23-Feb-10	13:15	18.3
Reach-3	0.25653	159	23-Feb-10	13:15	30.9
Reach-4	1.14551	422.5	23-Feb-10	15:00	178.7
Reach-5	2.18521	764	23-Feb-10	15:45	348.1
Reach-6	2.18521	755.5	23-Feb-10	16:15	347.9
Reach-7	0.61753	280.6	23-Feb-10	13:45	90.4
Reach-8	2.18521	734.6	23-Feb-10	16:55	347.5
Reach-9	0.51407	264.1	23-Feb-10	13:40	81.7
Structure #1	1.14551	435.3	23-Feb-10	14:05	178.8
Structure #2	1.14551	429.8	23-Feb-10	14:30	178.7
Structure #3	2.18521	792.7	23-Feb-10	15:10	348.2
Structure #4	2.18521	760.1	23-Feb-10	16:00	347.9
Structure #5	2.18521	754.8	23-Feb-10	16:20	347.5
W190	0.10846	148.9	23-Feb-10	12:35	18.3
W220	0.26645	396.6	23-Feb-10	12:30	45.7
W230	0.51407	625.3	23-Feb-10	12:40	81.7
W240	0.25653	216.6	23-Feb-10	12:45	30.9
W260	0.61753	658	23-Feb-10	12:40	90.4
W270	1.0397	944.1	23-Feb-10	13:00	166.4


Junction "Outlet1" Results for Run "2 YEAR"
Flow (CFS)
200
150
100
50
0
00:00
12:00
23Feb2010
00:00
12:00
24Feb2010
00:00
Run:2 YEAR Element:OUTLET1 Result:Outflow
Run:2 YEAR Element:J40 Result:Outflow


Junction "Outlet1" Results for Run "10 YEAR"
Flow (CFS)
450
400
350
300
250
200
150
100
50
0
-50
00:00
12:00
00:00
12:00
00:00
23Feb2010
24Feb2010
Run:10 YEAR Element:OUTLET1 Result:Outflow
Run:10 YEAR Element:J40 Result:Outflow


Junction "Outlet1" Results for Run "25 YEAR"
Flow (CFS)
600
500
400
300
200
100
0
-100
00:00
12:00
00:00
12:00
00:00
23Feb2010
24Feb2010
Run:25 YEAR Element:OUTLET1 Result:Outflow
Run:25 YEAR Element:J40 Result:Outflow


Junction "Outlet1" Results for Run "50 YEAR"
Flow (CFS)
800
700
600
500
400
300
200
100
0
-100
00:00
12:00
00:00
12:00
00:00
23Feb2010
24Feb2010
Run:50 YEAR Element:OUTLET1 Result:Outflow
Run:50 YEAR Element:J40 Result:Outflow


Junction "Outlet1" Results for Run "100 YEAR"
Flow (CFS)
900
800
700
600
500
400
300
200
100
0
-100
00:00
12:00
00:00
12:00
00:00
23Feb2010
24Feb2010
Run:100 YEAR Element:OUTLET1 Result:Outflow
Run:100 YEAR Element:J40 Result:Outflow

Coffee Run- Global Summary 2 Year Event

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
coffee 1	1.02491	91.2	14-Feb-10	10:20	38.8
coffee 11	0.40041	63.3	14-Feb-10	09:50	22.3
coffee 12	0.15383	32.9	14-Feb-10	09:15	8.9
coffee 13	4.86943	310.5	14-Feb-10	13:35	196.8
coffee14	2.1762	204.7	14-Feb-10	11:15	93.5
coffee 15	2.1762	186.1	14-Feb-10	12:20	90.7
coffee 17	5.73868	332.1	14-Feb-10	14:55	229.4
coffee 18	9.25568	494.8	14-Feb-10	14:55	345.2
coffee 19	9.25568	494.7	14-Feb-10	15:00	342.7
coffee 3	0.20823	19.7	14-Feb-10	10:15	6.8
coffee 4	0.20823	20	14-Feb-10	10:00	7.2
coffee 5	2.66465	190.2	14-Feb-10	11:35	94.7
coffee 6	2.50437	183.7	14-Feb-10	11:30	88.3
coffee 7	1.18657	87.6	14-Feb-10	11:50	43.7
coffee 8	0.31165	46.6	14-Feb-10	09:50	15.7
coffee 9	0.31165	46.7	14-Feb-10	09:45	15.7
J212	4.86943	313.8	14-Feb-10	13:00	200.4
J220	3.4288	246.5	14-Feb-10	11:50	134.1
J226	3.31942	241.8	14-Feb-10	11:40	129
J229	0.98326	92.1	14-Feb-10	10:00	37.6
J236	0.40041	70.9	14-Feb-10	09:15	21.8
J239	3.00777	220.3	14-Feb-10	11:30	113.7
J242	0.58534	61.6	14-Feb-10	09:50	21.4
J245	2.50437	187.2	14-Feb-10	11:00	94.7
J251	1.18657	106.3	14-Feb-10	10:10	45.9
J254	5.73868	351.8	14-Feb-10	13:25	239.7
J259	1.02491	94.2	14-Feb-10	10:00	38.8
J274	4.7156	311.4	14-Feb-10	12:35	191.6
J281	9.25568	494.9	14-Feb-10	14:45	347.6
Junction-1	3.517	208.3	14-Feb-10	13:10	126.1
Outlet1	9.25568	494.6	14-Feb-10	15:05	341.6
R110	0.98326	87.9	14-Feb-10	10:35	37.2
R150	2.50437	185.2	14-Feb-10	11:20	94.4
R200	3.31942	241.3	14-Feb-10	11:50	128.4
R430	3.4288	225	14-Feb-10	12:55	130
R440	4.7156	307.6	14-Feb-10	13:05	191.5
R480	4.86943	310.5	14-Feb-10	13:30	197.6
R520	4.86943	310.2	14-Feb-10	13:40	195.9

Coffee Run- Global Summary 2 Year Event

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
R530	0.40041	63.4	14-Feb-10	09:45	22.4
R560	5.73868	332.3	14-Feb-10	14:45	229.6
R620	9.25568	494.8	14-Feb-10	14:55	346.4
R80	1.18657	92.5	14-Feb-10	11:15	44.8
Reach-1	0.85473	83.9	14-Feb-10	10:10	33.9
Reach-10	0.34312	56.7	14-Feb-10	09:35	19
Reach-11	0.16028	25.7	14-Feb-10	09:00	6.5
Reach-12	3.00777	217.9	14-Feb-10	11:50	113.3
Reach-13	0.31165	47.2	14-Feb-10	09:40	15.5
Reach-14	0.10938	23.7	14-Feb-10	09:00	5.7
Reach-15	1.2868	125.2	14-Feb-10	10:25	61.6
Reach-16	0.15383	33	14-Feb-10	09:10	8.8
Reach-18	2.1762	241.3	14-Feb-10	10:20	95.1
Reach-19	2.1762	186.1	14-Feb-10	12:20	91.1
Reach-2	0.17018	20.3	14-Feb-10	09:10	5
Reach-21	0.46884	61	14-Feb-10	09:35	21.8
Reach-22	1.3408	87.7	14-Feb-10	10:05	38
Reach-23	2.1762	170.7	14-Feb-10	13:25	88.2
Reach-24	3.517	205.3	14-Feb-10	13:40	124.9
Reach-25	0.10855	23	14-Feb-10	08:55	5.3
Reach-26	0.29186	50.7	14-Feb-10	09:20	16.5
Reach-28	9.25568	494.6	14-Feb-10	15:05	341.6
Reach-29	9.25568	494.7	14-Feb-10	15:00	344
Reach-3	0.16166	28.3	14-Feb-10	09:10	7.1
Reach-30	5.73868	326.1	14-Feb-10	15:45	222.6
Reach-31	0.40041	54.9	14-Feb-10	10:35	22
Reach-4	0.20823	27.3	14-Feb-10	09:20	7.3
Reach-5	0.33454	43.6	14-Feb-10	09:25	13.8
Reach-6	0.58534	54.6	14-Feb-10	10:35	21.3
Reach-7	0.37711	44.7	14-Feb-10	09:40	14.6
Reach-8	0.205	28.6	14-Feb-10	09:15	7.3
Reach-9	0.19292	33.2	14-Feb-10	09:25	9
W1090	1.2868	317.6	14-Feb-10	08:55	66.2
W1120	0.15383	76.2	14-Feb-10	08:25	9
W1150	0.46884	149.6	14-Feb-10	08:35	22.8
W1180	0.10855	53.2	14-Feb-10	08:15	5.4
W1200	1.3408	164.1	14-Feb-10	09:00	39.9
W1220	0.29186	148.6	14-Feb-10	08:25	17.2

Coffee Run- Global Summary 2 Year Event

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
W690	0.85473	154.2	14-Feb-10	09:00	35.4
W700	0.16166	48.6	14-Feb-10	08:35	7.2
W720	0.17018	25.2	14-Feb-10	08:45	5
W740	0.33454	99.1	14-Feb-10	08:30	14.3
W750	0.20823	36.5	14-Feb-10	08:50	7.4
W760	0.16028	57.1	14-Feb-10	08:20	6.7
W800	0.31165	94.6	14-Feb-10	08:40	16.1
W820	0.205	39.4	14-Feb-10	08:45	7.4
W840	0.19292	54.9	14-Feb-10	08:40	9.2
W860	0.34312	131.2	14-Feb-10	08:35	19.8
W870	0.37711	80.3	14-Feb-10	08:45	15.1
W930	0.10938	53.4	14-Feb-10	08:20	5.8
W970	2.1762	362.4	14-Feb-10	09:20	98.4

Coffee Run- Global Summary 10 Year Event

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
coffee 1	1.02491	202.3	14-Feb-10	10:10	75.5
coffee 11	0.40041	121.7	14-Feb-10	09:45	39.3
coffee 12	0.15383	62.7	14-Feb-10	09:10	15.5
coffee 13	4.86943	638.4	14-Feb-10	13:25	377.2
coffee14	2.1762	405.8	14-Feb-10	11:15	175.6
coffee 15	2.1762	370.8	14-Feb-10	12:20	171.4
coffee 17	5.73868	655.7	14-Feb-10	15:20	439.7
coffee 18	9.25568	967.8	14-Feb-10	15:00	671.5
coffee 19	9.25568	967.6	14-Feb-10	15:05	667.1
coffee 3	0.20823	40.7	14-Feb-10	10:20	13.9
coffee 4	0.20823	41.1	14-Feb-10	10:05	14.4
coffee 5	2.66465	396.4	14-Feb-10	11:40	189.9
coffee 6	2.50437	387.4	14-Feb-10	11:25	177.6
coffee 7	1.18657	187.3	14-Feb-10	11:40	85.6
coffee 8	0.31165	91.9	14-Feb-10	09:50	28.3
coffee 9	0.31165	91.9	14-Feb-10	09:50	28.4
J212	4.86943	644.4	14-Feb-10	12:45	382.7
J220	3.4288	504.1	14-Feb-10	11:30	260.4
J226	3.31942	494.5	14-Feb-10	11:25	251
J229	0.98326	200.9	14-Feb-10	09:55	73
J236	0.40041	137.2	14-Feb-10	09:10	38.5
J239	3.00777	450.1	14-Feb-10	11:25	223.3
J242	0.58534	133.1	14-Feb-10	09:45	42.2
J245	2.50437	390.5	14-Feb-10	11:00	184.3
J251	1.18657	237	14-Feb-10	10:00	88.7
J254	5.73868	714.3	14-Feb-10	13:15	454.9
J259	1.02491	207	14-Feb-10	09:55	75.3
J274	4.7156	639.2	14-Feb-10	12:20	366.4
J281	9.25568	968	14-Feb-10	14:50	675.8
Junction-1	3.517	418.3	14-Feb-10	13:10	247.6
Outlet1	9.25568	967.4	14-Feb-10	15:10	665.3
R110	0.98326	190.4	14-Feb-10	10:25	72.4
R150	2.50437	388.5	14-Feb-10	11:15	184.1
R200	3.31942	493.9	14-Feb-10	11:35	250.3
R430	3.4288	471	14-Feb-10	12:50	254.4
R440	4.7156	632.8	14-Feb-10	12:50	367.2
R480	4.86943	638.5	14-Feb-10	13:20	378.6

Coffee Run- Global Summary 10 Year Event

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
R520	4.86943	637.9	14-Feb-10	13:30	376
R530	0.40041	121.9	14-Feb-10	09:45	39.4
R560	5.73868	671.9	14-Feb-10	14:40	440
R620	9.25568	967.7	14-Feb-10	15:00	674
R80	1.18657	200.4	14-Feb-10	11:05	87.1
Reach-1	0.85473	181.5	14-Feb-10	10:05	64.9
Reach-10	0.34312	108	14-Feb-10	09:35	33.3
Reach-11	0.16028	56.3	14-Feb-10	09:00	12.4
Reach-12	3.00777	448.2	14-Feb-10	11:45	222.7
Reach-13	0.31165	93.8	14-Feb-10	09:35	28
Reach-14	0.10938	46.8	14-Feb-10	09:00	10.1
Reach-15	1.2868	249.7	14-Feb-10	10:25	112
Reach-16	0.15383	62.7	14-Feb-10	09:10	15.3
Reach-18	2.1762	500.9	14-Feb-10	10:20	177.5
Reach-19	2.1762	370.7	14-Feb-10	12:20	172.2
Reach-2	0.17018	51.1	14-Feb-10	09:05	10.4
Reach-21	0.46884	124.4	14-Feb-10	09:35	40
Reach-22	1.3408	219	14-Feb-10	10:00	79.9
Reach-23	2.1762	342.5	14-Feb-10	13:30	167.7
Reach-24	3.517	413.2	14-Feb-10	13:35	246.4
Reach-25	0.10855	46.5	14-Feb-10	08:55	9.6
Reach-26	0.29186	96	14-Feb-10	09:20	28.8
Reach-28	9.25568	967.4	14-Feb-10	15:10	665.3
Reach-29	9.25568	967.6	14-Feb-10	15:05	669.6
Reach-3	0.16166	59.8	14-Feb-10	09:10	13.2
Reach-30	5.73868	647.1	14-Feb-10	16:10	429.4
Reach-31	0.40041	106.4	14-Feb-10	10:30	38.8
Reach-4	0.20823	63.4	14-Feb-10	09:20	14.5
Reach-5	0.33454	93.6	14-Feb-10	09:20	26.2
Reach-6	0.58534	118.1	14-Feb-10	10:30	42.1
Reach-7	0.37711	98.3	14-Feb-10	09:35	28.3
Reach-8	0.205	66.1	14-Feb-10	09:15	14.4
Reach-9	0.19292	67.8	14-Feb-10	09:25	16.6
W1090	1.2868	625.6	14-Feb-10	08:55	118.6
W1120	0.15383	140.1	14-Feb-10	08:25	15.6
W1150	0.46884	299.7	14-Feb-10	08:35	41.5
W1180	0.10855	103.9	14-Feb-10	08:15	9.8

Coffee Run- Global Summary 10 Year Event

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
W1200	1.3408	411.7	14-Feb-10	08:55	82.9
W1220	0.29186	271.6	14-Feb-10	08:25	29.8
W690	0.85473	332.5	14-Feb-10	09:00	67.2
W700	0.16166	101	14-Feb-10	08:30	13.4
W720	0.17018	63.6	14-Feb-10	08:40	10.5
W740	0.33454	209.8	14-Feb-10	08:30	27
W750	0.20823	84.1	14-Feb-10	08:45	14.6
W760	0.16028	121.2	14-Feb-10	08:20	12.7
W800	0.31165	186.2	14-Feb-10	08:40	28.8
W820	0.205	90.2	14-Feb-10	08:40	14.6
W840	0.19292	111.1	14-Feb-10	08:40	16.9
W860	0.34312	245.9	14-Feb-10	08:35	34.4
W870	0.37711	175.6	14-Feb-10	08:45	29
W930	0.10938	101.7	14-Feb-10	08:20	10.3
W970	2.1762	748.6	14-Feb-10	09:15	182.3

Coffee Run- Global Summary 25 Year Event

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
coffee 1	1.02491	273	14-Feb-10	10:15	101
coffee 11	0.40041	160.6	14-Feb-10	09:45	50.5
coffee 12	0.15383	81.9	14-Feb-10	09:10	19.8
coffee 13	4.86943	848.7	14-Feb-10	13:20	501
coffee14	2.1762	589.6	14-Feb-10	11:00	231.7
coffee 15	2.1762	511.2	14-Feb-10	12:05	227.4
coffee 17	5.73868	892.2	14-Feb-10	14:50	583.8
coffee 18	9.25568	1296.3	14-Feb-10	15:10	898
coffee 19	9.25568	1295.8	14-Feb-10	15:15	892.6
coffee 3	0.20823	52.2	14-Feb-10	10:25	18.9
coffee 4	0.20823	52.7	14-Feb-10	10:10	19.4
coffee 5	2.66465	531.4	14-Feb-10	11:45	256
coffee 6	2.50437	519.3	14-Feb-10	11:35	239.5
coffee 7	1.18657	257.8	14-Feb-10	11:45	114.9
coffee 8	0.31165	122.6	14-Feb-10	09:50	36.7
coffee 9	0.31165	122.5	14-Feb-10	09:50	36.9
J212	4.86943	856	14-Feb-10	12:45	507.3
J220	3.4288	663.6	14-Feb-10	11:40	347.2
J226	3.31942	651.8	14-Feb-10	11:35	334.9
J229	0.98326	275.3	14-Feb-10	09:50	97.7
J236	0.40041	180.6	14-Feb-10	09:10	49.6
J239	3.00777	597.4	14-Feb-10	11:35	299
J242	0.58534	178.8	14-Feb-10	09:45	56.7
J245	2.50437	533.3	14-Feb-10	10:55	246.6
J251	1.18657	315.8	14-Feb-10	10:05	118.4
J254	5.73868	947.7	14-Feb-10	13:05	602
J259	1.02491	286.8	14-Feb-10	09:55	100.8
J274	4.7156	848.4	14-Feb-10	12:20	486.2
J281	9.25568	1296.7	14-Feb-10	15:00	903.2
Junction-1	3.517	574.2	14-Feb-10	12:50	333.2
Outlet1	9.25568	1295.3	14-Feb-10	15:20	890.4
R110	0.98326	260.4	14-Feb-10	10:25	96.9
R150	2.50437	529.4	14-Feb-10	11:10	246.4
R200	3.31942	651.5	14-Feb-10	11:45	334.1
R430	3.4288	627.7	14-Feb-10	12:55	340
R440	4.7156	841.3	14-Feb-10	12:50	487.5
R480	4.86943	848.7	14-Feb-10	13:15	502.4

Coffee Run- Global Summary 25 Year Event

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
R520	4.86943	848.1	14-Feb-10	13:30	499.5
R530	0.40041	160.7	14-Feb-10	09:45	50.7
R560	5.73868	893.4	14-Feb-10	14:40	584.1
R620	9.25568	1296.3	14-Feb-10	15:10	901.1
R80	1.18657	275	14-Feb-10	11:10	116.5
Reach-1	0.85473	250.2	14-Feb-10	10:05	86.5
Reach-10	0.34312	142	14-Feb-10	09:35	42.9
Reach-11	0.16028	77.1	14-Feb-10	09:00	16.5
Reach-12	3.00777	595	14-Feb-10	11:50	298.2
Reach-13	0.31165	125.2	14-Feb-10	09:35	36.4
Reach-14	0.10938	61.8	14-Feb-10	09:00	13.1
Reach-15	1.2868	334.5	14-Feb-10	10:20	146.2
Reach-16	0.15383	81.8	14-Feb-10	09:10	19.6
Reach-18	2.1762	679.8	14-Feb-10	10:20	234.1
Reach-19	2.1762	511.2	14-Feb-10	12:00	227.7
Reach-2	0.17018	73.6	14-Feb-10	09:05	14.3
Reach-21	0.46884	167.6	14-Feb-10	09:35	52.5
Reach-22	1.3408	317	14-Feb-10	10:00	110.2
Reach-23	2.1762	460.5	14-Feb-10	13:15	223
Reach-24	3.517	565.3	14-Feb-10	13:25	332
Reach-25	0.10855	61.8	14-Feb-10	08:55	12.6
Reach-26	0.29186	125.7	14-Feb-10	09:20	37
Reach-28	9.25568	1295.3	14-Feb-10	15:20	890.4
Reach-29	9.25568	1295.9	14-Feb-10	15:15	895.8
Reach-3	0.16166	81.1	14-Feb-10	09:10	17.4
Reach-30	5.73868	867.7	14-Feb-10	15:50	571.2
Reach-31	0.40041	140.9	14-Feb-10	10:30	50
Reach-4	0.20823	89	14-Feb-10	09:20	19.5
Reach-5	0.33454	128.3	14-Feb-10	09:20	34.8
Reach-6	0.58534	159.5	14-Feb-10	10:30	56.5
Reach-7	0.37711	136	14-Feb-10	09:35	37.8
Reach-8	0.205	92.4	14-Feb-10	09:15	19.4
Reach-9	0.19292	91	14-Feb-10	09:20	21.7
W1090	1.2868	826.5	14-Feb-10	08:55	154
W1120	0.15383	179.4	14-Feb-10	08:25	20
W1150	0.46884	396.3	14-Feb-10	08:35	54.2
W1180	0.10855	135.6	14-Feb-10	08:15	12.8

Coffee Run- Global Summary 25 Year Event

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
W1200	1.3408	591.6	14-Feb-10	08:55	113.8
W1220	0.29186	346.7	14-Feb-10	08:25	38.2
W690	0.85473	453.7	14-Feb-10	09:00	89.2
W700	0.16166	135.4	14-Feb-10	08:30	17.7
W720	0.17018	91.2	14-Feb-10	08:40	14.4
W740	0.33454	282.2	14-Feb-10	08:30	35.7
W750	0.20823	117.4	14-Feb-10	08:45	19.7
W760	0.16028	162.7	14-Feb-10	08:20	16.8
W800	0.31165	245.1	14-Feb-10	08:40	37.4
W820	0.205	125.5	14-Feb-10	08:40	19.6
W840	0.19292	147.6	14-Feb-10	08:40	22.1
W860	0.34312	317.8	14-Feb-10	08:35	44.2
W870	0.37711	239.8	14-Feb-10	08:45	38.6
W930	0.10938	131.7	14-Feb-10	08:20	13.4
W970	2.1762	1011.4	14-Feb-10	09:15	239.8

Coffee Run- Global Summary 50 Year Event

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
coffee 1	1.02491	336.7	14-Feb-10	10:15	122.8
coffee 11	0.40041	192	14-Feb-10	09:45	59.9
coffee 12	0.15383	97.7	14-Feb-10	09:10	23.5
coffee 13	4.86943	1021.1	14-Feb-10	13:25	605.9
coffee14	2.1762	748.8	14-Feb-10	10:55	279.4
coffee 15	2.1762	638.3	14-Feb-10	11:55	274.4
coffee 17	5.73868	1073.5	14-Feb-10	14:50	705.8
coffee 18	9.25568	1579.6	14-Feb-10	14:55	1091.4
coffee 19	9.25568	1579.3	14-Feb-10	15:00	1085.1
coffee 3	0.20823	60.2	14-Feb-10	10:30	23.3
coffee 4	0.20823	60.6	14-Feb-10	10:15	23.8
coffee 5	2.66465	646.8	14-Feb-10	11:45	312.4
coffee 6	2.50437	632.5	14-Feb-10	11:35	292.5
coffee 7	1.18657	316	14-Feb-10	11:45	139.8
coffee 8	0.31165	146.4	14-Feb-10	09:55	43.8
coffee 9	0.31165	147.8	14-Feb-10	09:45	44.1
J212	4.86943	1029.7	14-Feb-10	12:45	612.8
J220	3.4288	800.3	14-Feb-10	11:45	421
J226	3.31942	787.1	14-Feb-10	11:40	406.3
J229	0.98326	337.3	14-Feb-10	09:50	118.7
J236	0.40041	216.3	14-Feb-10	09:10	59
J239	3.00777	724.6	14-Feb-10	11:35	363.4
J242	0.58534	217.1	14-Feb-10	09:40	69.2
J245	2.50437	647.4	14-Feb-10	10:55	299.8
J251	1.18657	389.1	14-Feb-10	10:05	143.8
J254	5.73868	1135.9	14-Feb-10	13:10	726.7
J259	1.02491	353.8	14-Feb-10	09:55	122.7
J274	4.7156	1021	14-Feb-10	12:20	588
J281	9.25568	1580.1	14-Feb-10	14:45	1095.9
Junction-1	3.517	717.2	14-Feb-10	12:45	406
Outlet1	9.25568	1578.9	14-Feb-10	15:05	1082.5
R110	0.98326	318.9	14-Feb-10	10:25	117.8
R150	2.50437	644.4	14-Feb-10	11:10	299.5
R200	3.31942	786.4	14-Feb-10	11:50	405.3
R430	3.4288	758	14-Feb-10	12:55	412.9
R440	4.7156	1013	14-Feb-10	12:50	589.3
R480	4.86943	1021.6	14-Feb-10	13:20	607.2
R520	4.86943	1020.4	14-Feb-10	13:30	604.2

Coffee Run- Global Summary 50 Year Event

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
R530	0.40041	192	14-Feb-10	09:45	60.2
R560	5.73868	1074.2	14-Feb-10	14:40	706
R620	9.25568	1579.7	14-Feb-10	14:50	1093.5
R80	1.18657	337.8	14-Feb-10	11:05	141.6
Reach-1	0.85473	307.6	14-Feb-10	10:05	105
Reach-10	0.34312	169.3	14-Feb-10	09:35	51
Reach-11	0.16028	94.8	14-Feb-10	09:00	20
Reach-12	3.00777	720.9	14-Feb-10	11:55	362.5
Reach-13	0.31165	150.8	14-Feb-10	09:35	43.6
Reach-14	0.10938	74.4	14-Feb-10	09:00	15.7
Reach-15	1.2868	404.6	14-Feb-10	10:20	175.1
Reach-16	0.15383	97.6	14-Feb-10	09:10	23.3
Reach-18	2.1762	828.7	14-Feb-10	10:15	282.3
Reach-19	2.1762	638.5	14-Feb-10	11:55	274.8
Reach-2	0.17018	93.1	14-Feb-10	09:05	17.7
Reach-21	0.46884	202.9	14-Feb-10	09:35	63.1
Reach-22	1.3408	401	14-Feb-10	10:00	136.6
Reach-23	2.1762	569.4	14-Feb-10	13:05	269.4
Reach-24	3.517	705	14-Feb-10	13:15	404.7
Reach-25	0.10855	74.8	14-Feb-10	08:50	15.1
Reach-26	0.29186	149.8	14-Feb-10	09:15	43.9
Reach-28	9.25568	1578.9	14-Feb-10	15:05	1082.5
Reach-29	9.25568	1579.3	14-Feb-10	15:00	1088.8
Reach-3	0.16166	98.9	14-Feb-10	09:10	21
Reach-30	5.73868	1052.1	14-Feb-10	15:45	691.2
Reach-31	0.40041	168.7	14-Feb-10	10:30	59.4
Reach-4	0.20823	110.5	14-Feb-10	09:20	23.9
Reach-5	0.33454	157.2	14-Feb-10	09:20	42.1
Reach-6	0.58534	193.5	14-Feb-10	10:25	68.9
Reach-7	0.37711	167.4	14-Feb-10	09:35	45.9
Reach-8	0.205	114.6	14-Feb-10	09:15	23.7
Reach-9	0.19292	110.4	14-Feb-10	09:20	26.1
W1090	1.2868	991.8	14-Feb-10	08:55	183.9
W1120	0.15383	211.3	14-Feb-10	08:25	23.7
W1150	0.46884	476.4	14-Feb-10	08:35	65
W1180	0.10855	161.6	14-Feb-10	08:15	15.3
W1200	1.3408	746	14-Feb-10	08:55	140.7
W1220	0.29186	407.9	14-Feb-10	08:25	45.2

Coffee Run- Global Summary 50 Year Event

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
W690	0.85473	554.8	14-Feb-10	09:00	108
W700	0.16166	164.1	14-Feb-10	08:30	21.3
W720	0.17018	115.1	14-Feb-10	08:40	17.9
W740	0.33454	342.7	14-Feb-10	08:30	43.1
W750	0.20823	145.7	14-Feb-10	08:45	24.1
W760	0.16028	197.2	14-Feb-10	08:20	20.4
W800	0.31165	293.8	14-Feb-10	08:40	44.6
W820	0.205	155.4	14-Feb-10	08:40	24
W840	0.19292	177.9	14-Feb-10	08:40	26.5
W860	0.34312	376.7	14-Feb-10	08:35	52.4
W870	0.37711	293.7	14-Feb-10	08:45	46.8
W930	0.10938	156.1	14-Feb-10	08:20	16
W970	2.1762	1228.8	14-Feb-10	09:15	288.7

Coffee Run- Global Summary 100 Year Event

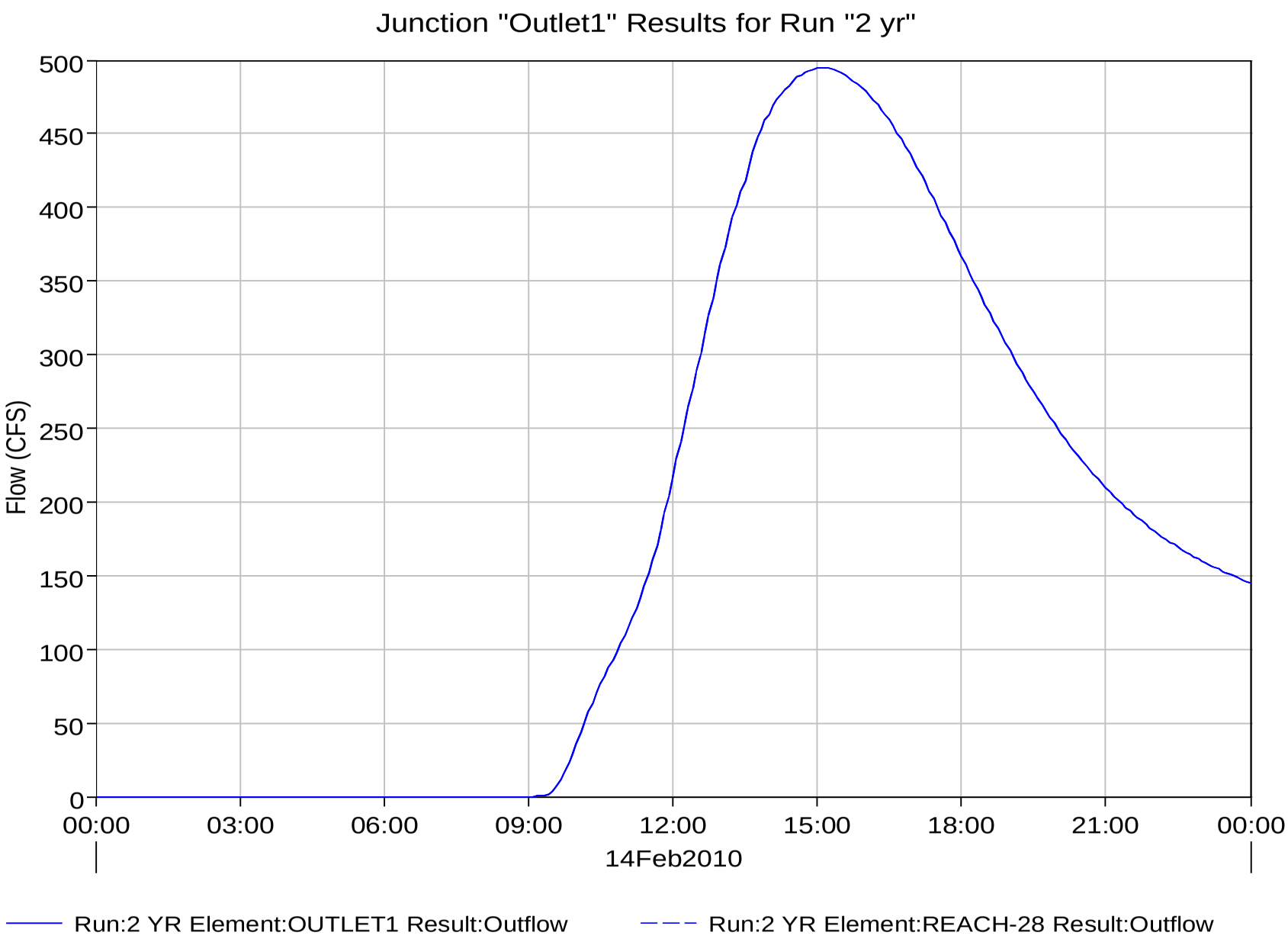
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
coffee 1	1.02491	405.8	14-Feb-10	10:15	146.1
coffee 11	0.40041	225.3	14-Feb-10	09:45	69.9
coffee 12	0.15383	113.9	14-Feb-10	09:10	27.3
coffee 13	4.86943	1200.5	14-Feb-10	13:20	718.5
coffee14	2.1762	906.3	14-Feb-10	10:50	330.5
coffee 15	2.1762	775.8	14-Feb-10	11:55	325.4
coffee 17	5.73868	1264.9	14-Feb-10	14:50	836.8
coffee 18	9.25568	1879.5	14-Feb-10	14:40	1298.3
coffee 19	9.25568	1879	14-Feb-10	14:45	1290.7
coffee 3	0.20823	66	14-Feb-10	10:35	28
coffee 4	0.20823	66.2	14-Feb-10	10:20	28.5
coffee 5	2.66465	758.5	14-Feb-10	12:00	373.1
coffee 6	2.50437	757	14-Feb-10	11:35	349.4
coffee 7	1.18657	380.7	14-Feb-10	11:45	166.7
coffee 8	0.31165	171.5	14-Feb-10	10:00	51.4
coffee 9	0.31165	173.6	14-Feb-10	09:50	51.7
J212	4.86943	1209.5	14-Feb-10	12:45	726
J220	3.4288	932.9	14-Feb-10	11:45	500.3
J226	3.31942	917.3	14-Feb-10	11:45	483
J229	0.98326	403.6	14-Feb-10	09:50	141.4
J236	0.40041	253.3	14-Feb-10	09:10	69
J239	3.00777	842.8	14-Feb-10	11:45	432.7
J242	0.58534	256.9	14-Feb-10	09:40	82.6
J245	2.50437	773.6	14-Feb-10	10:55	357.1
J251	1.18657	469.1	14-Feb-10	10:05	171
J254	5.73868	1338.3	14-Feb-10	13:05	860.3
J259	1.02491	426.2	14-Feb-10	09:50	146.3
J274	4.7156	1199.4	14-Feb-10	12:15	697.4
J281	9.25568	1880	14-Feb-10	14:30	1304.2
Junction-1	3.517	874.2	14-Feb-10	12:40	485.2
Outlet1	9.25568	1878.5	14-Feb-10	14:50	1287.7
R110	0.98326	381.2	14-Feb-10	10:20	140.4
R150	2.50437	770	14-Feb-10	11:10	356.6
R200	3.31942	916.8	14-Feb-10	11:50	481.9
R430	3.4288	890.2	14-Feb-10	13:00	491.3
R440	4.7156	1190.5	14-Feb-10	12:50	698.7
R480	4.86943	1200.9	14-Feb-10	13:15	719.8
R520	4.86943	1199.8	14-Feb-10	13:30	716.6

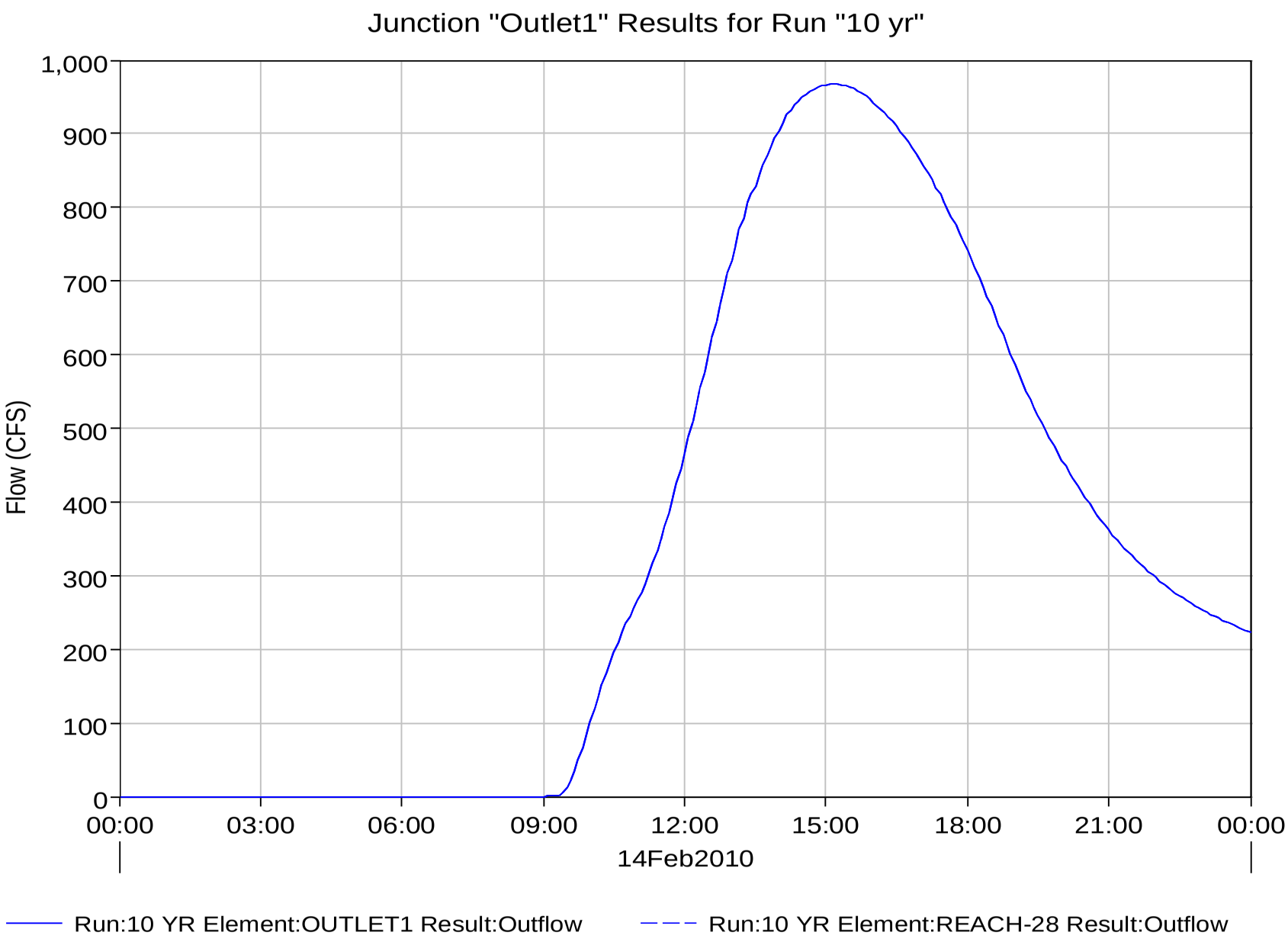
Coffee Run- Global Summary 100 Year Event

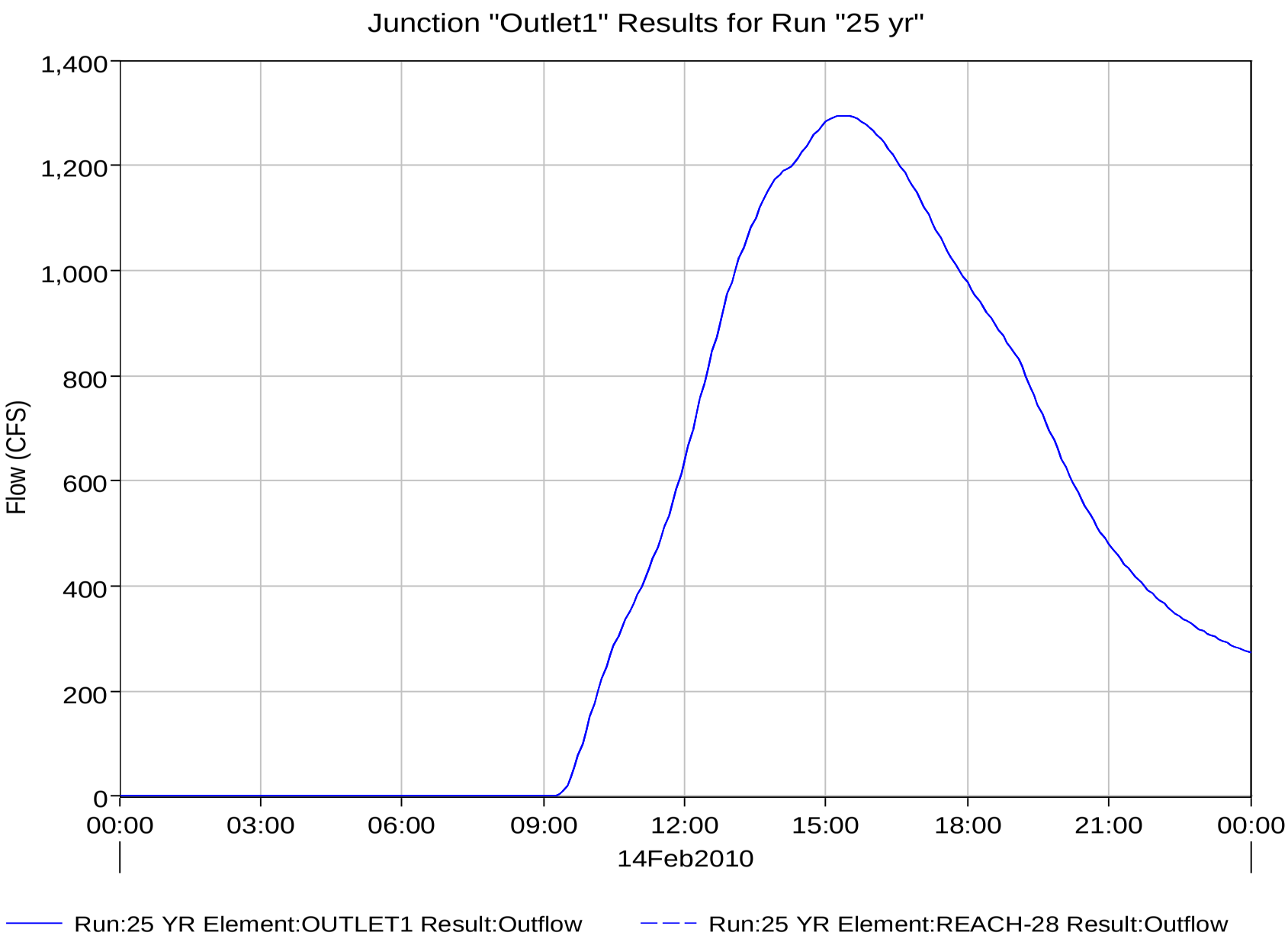
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
R530	0.40041	225.3	14-Feb-10	09:45	70.2
R560	5.73868	1265.4	14-Feb-10	14:45	837.1
R620	9.25568	1879.4	14-Feb-10	14:35	1301.4
R80	1.18657	406	14-Feb-10	11:05	168.5
Reach-1	0.85473	369.2	14-Feb-10	10:05	124.9
Reach-10	0.34312	198.3	14-Feb-10	09:35	59.6
Reach-11	0.16028	113.1	14-Feb-10	09:00	23.8
Reach-12	3.00777	840	14-Feb-10	12:00	431.5
Reach-13	0.31165	178	14-Feb-10	09:35	51.2
Reach-14	0.10938	87.2	14-Feb-10	09:00	18.4
Reach-15	1.2868	479.1	14-Feb-10	10:20	206.1
Reach-16	0.15383	113.8	14-Feb-10	09:10	27.1
Reach-18	2.1762	987.7	14-Feb-10	10:15	334
Reach-19	2.1762	776.2	14-Feb-10	11:50	325.5
Reach-2	0.17018	113.9	14-Feb-10	09:05	21.4
Reach-21	0.46884	240.7	14-Feb-10	09:35	74.4
Reach-22	1.3408	493.3	14-Feb-10	09:55	165.4
Reach-23	2.1762	690.5	14-Feb-10	13:00	319.9
Reach-24	3.517	859.4	14-Feb-10	13:10	483.9
Reach-25	0.10855	88	14-Feb-10	08:50	17.7
Reach-26	0.29186	175	14-Feb-10	09:15	51.3
Reach-28	9.25568	1878.5	14-Feb-10	14:50	1287.7
Reach-29	9.25568	1879.1	14-Feb-10	14:45	1295.4
Reach-3	0.16166	117.4	14-Feb-10	09:10	24.9
Reach-30	5.73868	1242.5	14-Feb-10	15:45	820.4
Reach-31	0.40041	198.1	14-Feb-10	10:30	69.3
Reach-4	0.20823	133.5	14-Feb-10	09:20	28.6
Reach-5	0.33454	187.9	14-Feb-10	09:20	50
Reach-6	0.58534	228.2	14-Feb-10	10:25	82.2
Reach-7	0.37711	201.1	14-Feb-10	09:35	54.6
Reach-8	0.205	138.3	14-Feb-10	09:10	28.4
Reach-9	0.19292	130.7	14-Feb-10	09:20	30.8
W1090	1.2868	1161.9	14-Feb-10	08:55	215.8
W1120	0.15383	242.9	14-Feb-10	08:25	27.6
W1150	0.46884	557.3	14-Feb-10	08:35	76.5
W1180	0.10855	187.3	14-Feb-10	08:15	18
W1200	1.3408	910.3	14-Feb-10	08:55	170
W1220	0.29186	469.1	14-Feb-10	08:20	52.7

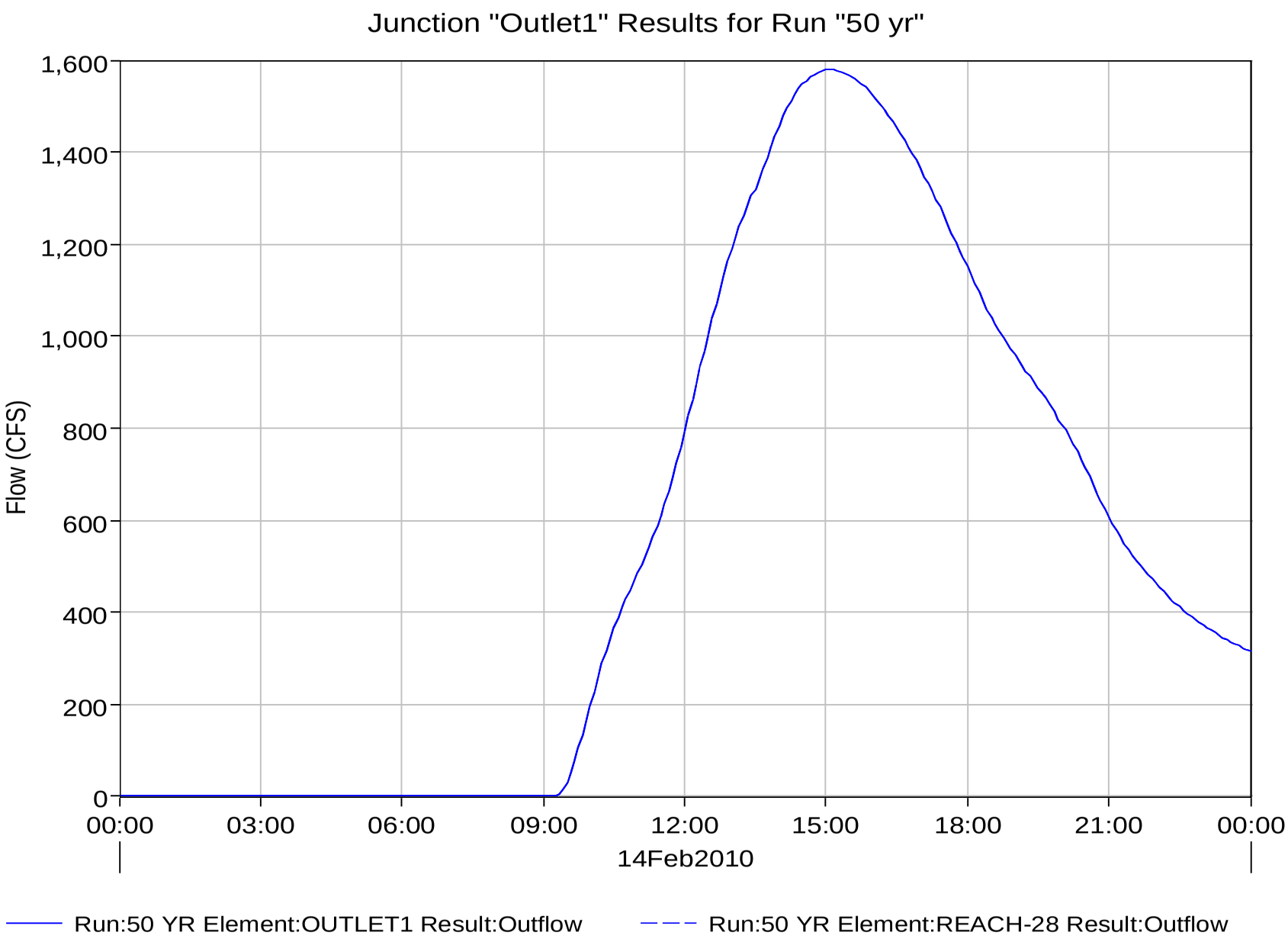
Coffee Run- Global Summary 100 Year Event

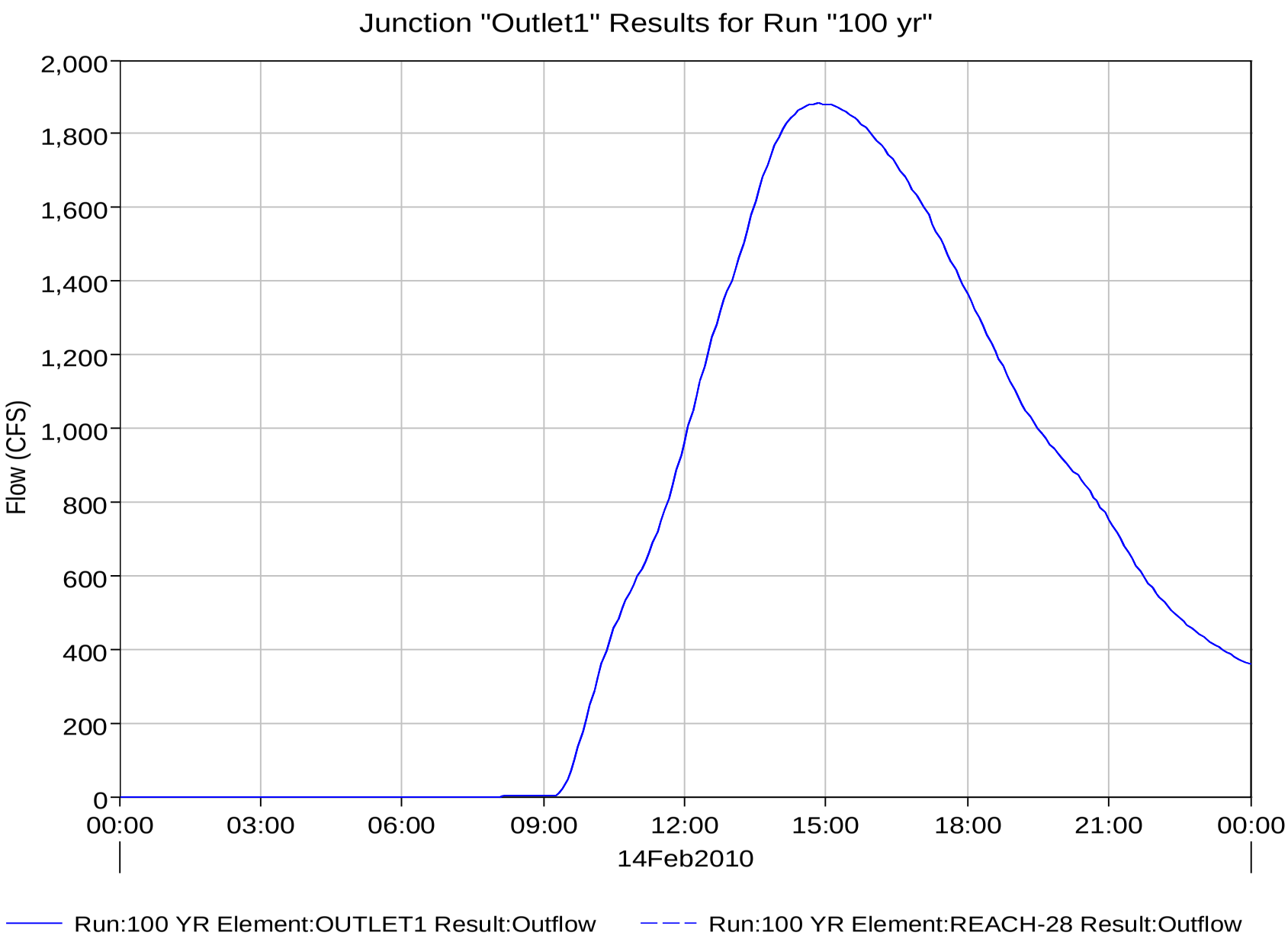
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak		Volume (AC-FT)
W690	0.85473	660.6	14-Feb-10	09:00	128.1
W700	0.16166	193.2	14-Feb-10	08:30	25.2
W720	0.17018	140.2	14-Feb-10	08:40	21.6
W740	0.33454	404.1	14-Feb-10	08:30	51.1
W750	0.20823	175.2	14-Feb-10	08:45	28.9
W760	0.16028	232	14-Feb-10	08:20	24.2
W800	0.31165	343.2	14-Feb-10	08:40	52.4
W820	0.205	186.5	14-Feb-10	08:40	28.7
W840	0.19292	208.8	14-Feb-10	08:40	31.2
W860	0.34312	435.7	14-Feb-10	08:35	61.1
W870	0.37711	349.4	14-Feb-10	08:45	55.7
W930	0.10938	180.4	14-Feb-10	08:20	18.7
W970	2.1762	1457.5	14-Feb-10	09:15	340.9


Junction "Outlet1" Results for Run "2 yr"
Flow (CFS)
500
450
400
350
300
250
200
150
100
50
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
14Feb2010
Run:2 YR Element:OUTLET1 Result:Outflow
Run:2 YR Element:REACH-28 Result:Outflow


Junction "Outlet1" Results for Run "10 yr"
Flow (CFS)
1,000
900
800
700
600
500
400
300
200
100
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
14Feb2010
Run:10 YR Element:OUTLET1 Result:Outflow
Run:10 YR Element:REACH-28 Result:Outflow


Junction "Outlet1" Results for Run "25 yr"
Flow (CFS)
1,400
1,200
1,000
800
600
400
200
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
14Feb2010
Run:25 YR Element:OUTLET1 Result:Outflow
Run:25 YR Element:REACH-28 Result:Outflow


Junction "Outlet1" Results for Run "50 yr"
Flow (CFS)
1,600
1,400
1,200
1,000
800
600
400
200
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
14Feb2010
Run:50 YR Element:OUTLET1 Result:Outflow
Run:50 YR Element:REACH-28 Result:Outflow


Junction "Outlet1" Results for Run "100 yr"
Flow (CFS)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
14Feb2010
Run:100 YR Element:OUTLET1 Result:Outflow
Run:100 YR Element:REACH-28 Result:Outflow

APPENDIX D STAKEHOLDER SURVEY RESPONSES

L. Robert Kimball & Associates
Architects and Engineers

Lawrence County
Act 167 Stormwater Management Planning Effort
Phase I Municipal Survey

Municipal Stormwater Problem Survey

Municipality: Neshannock
Person Completing Form: J.D. Cola W.N. Humphey
Phone Number: 724-658-4972
Email Address: JD.Cola@Neshannock.org

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☒	☐	
Zoning Ordinance	☒	☐	
Subdivision/Land Development Ordinance	☒	☐	
FEMA Flood Insurance Study	☒	☐	
Floodplain Regulations *	☒	☐	SO
Stormwater Management Regulations *	☒	☐	SO
Erosion Control Regulations *	☐	☐	
Drainage Regulations *	☐	☐	

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

L. Robert Kimball & Associates
Architects and Engineers

Lawrence County
Act 167 Stormwater Management Planning Effort
Phase I Municipal Survey

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

☐ Yes ☒ No

If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				Not Important
Peak Flow Rates	(5)	4	3	2	1
Water Quality	5	4	(3)	2	1
Groundwater Recharge	5	4	3	2	(1)
Stream Bank Protection	5	4	3	(2)	1
Flooding	5	4	(3)	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				Strongly Oppose
5	(4)	3	2	1

Kimball
L. Robert Kimball & Associates
Architects and Engineers

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

☒ Yes ☐ No

If Yes, please list your meeting representative's contact information below:

Name: _____

Address: _____

Phone Number: _____

Email Address: _____

6. Do you know of any existing or proposed flood control projects in your Municipality?

☐ Yes ☒ No

If yes, please describe the project(s) below:

_____

_____

_____

_____

_____

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

Name: _____

Organization: _____

Address: _____

Phone Number: _____

Email Address: _____

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

☒ Yes ☒ No

If No, please describe the location/problem(s) below:

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

We have a current Storm water ordinance as well as many Detention systems -

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

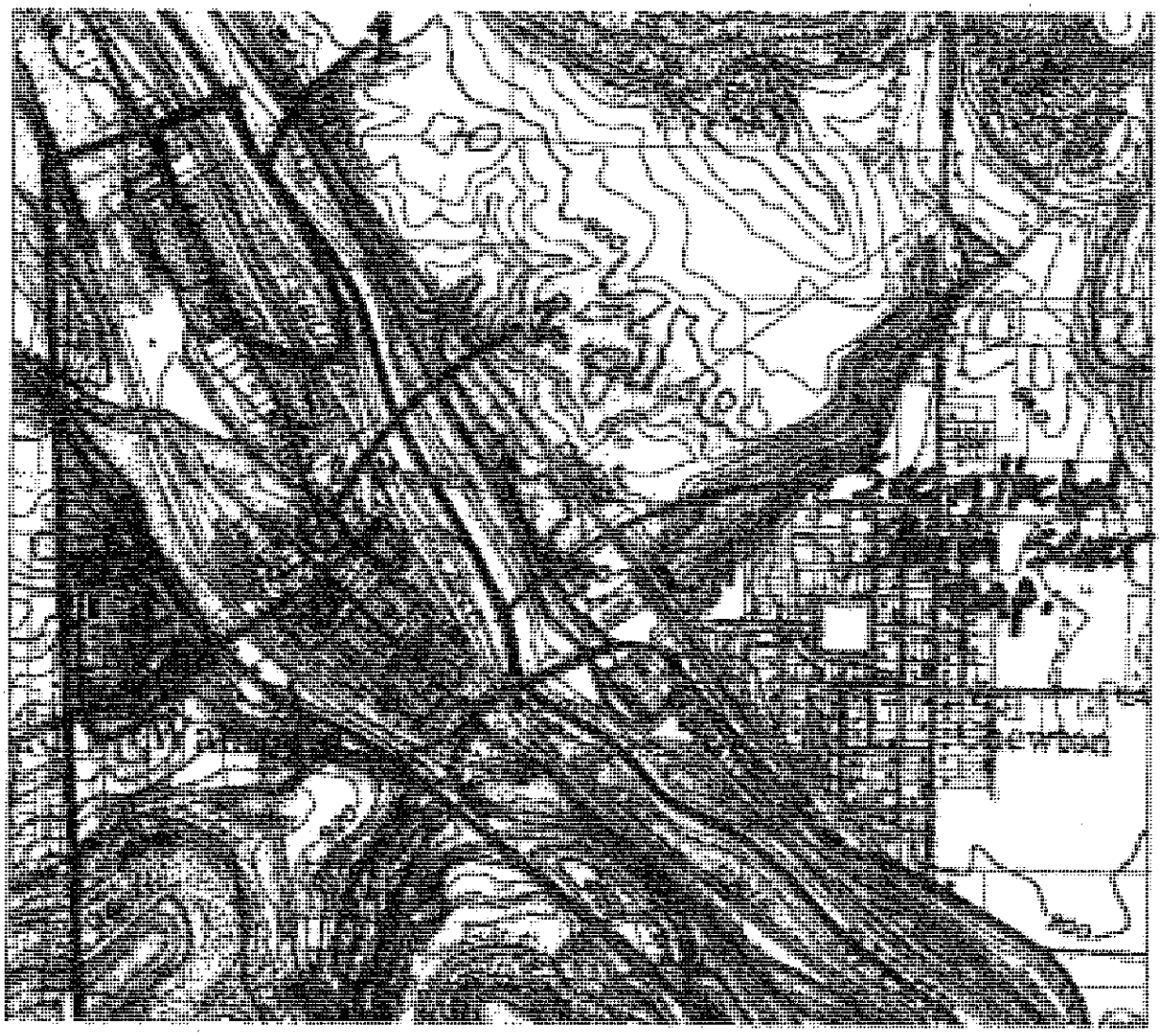
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Kimball
L. Robert Kimball & Associates
Architects and Engineers

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-1907

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by May 15, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

Kimball
L. Robert Kimball & Associates
Architects and Engineers

Lawrence County
Act 167 Stormwater Management Planning Effort

ATTACHMENT A

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	2, 3	3	3	3
MANOR AVE AREA	Optional Description:			
2	2, 3	3	3	3
MISSION MEADE AREA	Optional Description:			
3	2, 6	2	2	3
CHAPIN	Optional Description:			
4	2	3	2	3
Cunningham Lane	Optional Description:			
5				
	Optional Description:			
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

L. Robert Kimball & Associates
Architects and Engineers

Lawrence County
Act 167 Stormwater Management Planning Effort

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Kimball
L. Robert Kimball & Associates
Architects and Engineers

Lawrence County
Act 167 Stormwater Management Planning Effort

ATTACHMENT A

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
✓ A	Liberty Mutual
✓ B	Kaeski Bldg
✓ C	Carbis Walker
✓ D	Medical Arts Bldg
✓ E	Law Cty Medicine
✓ F	Law Cty Imaging
✓ G	AID Complex
✓ H	Camelot Woods
✓ I	Tech office Complex
✓ J	ABC Pediatrics
✓ K	Flores Complex
✓ L	Nobel House
✓ M	Law Cty Orthopedics
✓ N	DR Williams

Kimball
L. Robert Kimball & Associates
Architects and Engineers

Lawrence County
Act 167 Stormwater Management Planning Effort

ATTACHMENT B

Map ID	Description
✓ O	Preston Motors
✓ P	Enclave
✓ Q	Tuscany
✓ R	Sheetz
✓ S	Sawsone Bldg
✓ T	Tender Care
✓ U	Nesh. Trails Dev
✓ V	Hearthstone Dev
✓ W	Highland Field
✓ X	Autumn Hills
✓ Y	Nesh. Mun. Complex
✓ Z	Cambridge Apts
✓ A-1	Greer House
✓ A-2	Highland Terrace
✓ A-3	Adams Grove
✓ A-4	Bradfords

L. Robert Kimball & Associates
Architects and Engineers

Lawrence County
Act 167 Stormwater Management Planning Effort

ATTACHMENT B

	Map ID	Description
✓	A-5	Rose Hill
✓	A-6	P.F Environmental
✓	A-7	Blackhawk NeFF
✓	A-8	Jameson Care Ctr
✓	A-9	Mamaril office
✓	A-10	Jameson Rehab
✓	A-11	Erzurum Office
✓	A-12	ESB
✓	A-13	PSP Barracks
✓	A-14	RIDC
✓	A-15	Millenium
✓	A-16	Hampton Court
✓	A-17	Haven Point

Municipal Stormwater Problem Survey

Municipality: New Beaver Boro
Person Completing Form: Lorraine Leslie/David Hairhoger
Phone Number: 724-535-8868
Email Address: newbeaverboro@access995.com

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater-related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☒	☐	
Zoning Ordinance	☐	☐	
Subdivision/Land Development Ordinance	☒	☐	
FEMA Flood Insurance Study	☐	☐	
Floodplain Regulations *	☒	☐	SO
Stormwater Management Regulations *	☒	☐	SO
Erosion Control Regulations *	☐	☐	
Drainage Regulations *	☐	☐	

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

RECEIVED
JUL 25 2007
BY:

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☐ Yes ☒ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				**Not Important**
Peak Flow Rates	(5)	4	3	2	1
Water Quality	(5)	4	3	2	1
Groundwater Recharge	(5)	4	3	2	1
Stream Bank Protection	(5)	4	3	2	1
Flooding	(5)	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				**Strongly Oppose**
(5)	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

☒ Yes ☐ No

If Yes, please list your meeting representative's contact information below:

Name: DAVID HAIRhoger
Address: 778 WAMPUM-NewGalilee Rd NewGalilee 16141
Phone Number: 724-535-8868
Email Address: NewbeaverboRO@access995.com

6. Do you know of any existing or proposed flood control projects in your Municipality?

☐ Yes ☒ No

If yes, please describe the project(s) below:

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

Name:
Organization:
Address:
Phone Number:
Email Address:

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☒ Yes ☐ No

   If No, please describe the location/problem(s) below:

   _____
   _____
   _____
   _____
   _____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   _____
   _____
   _____
   _____
   _____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

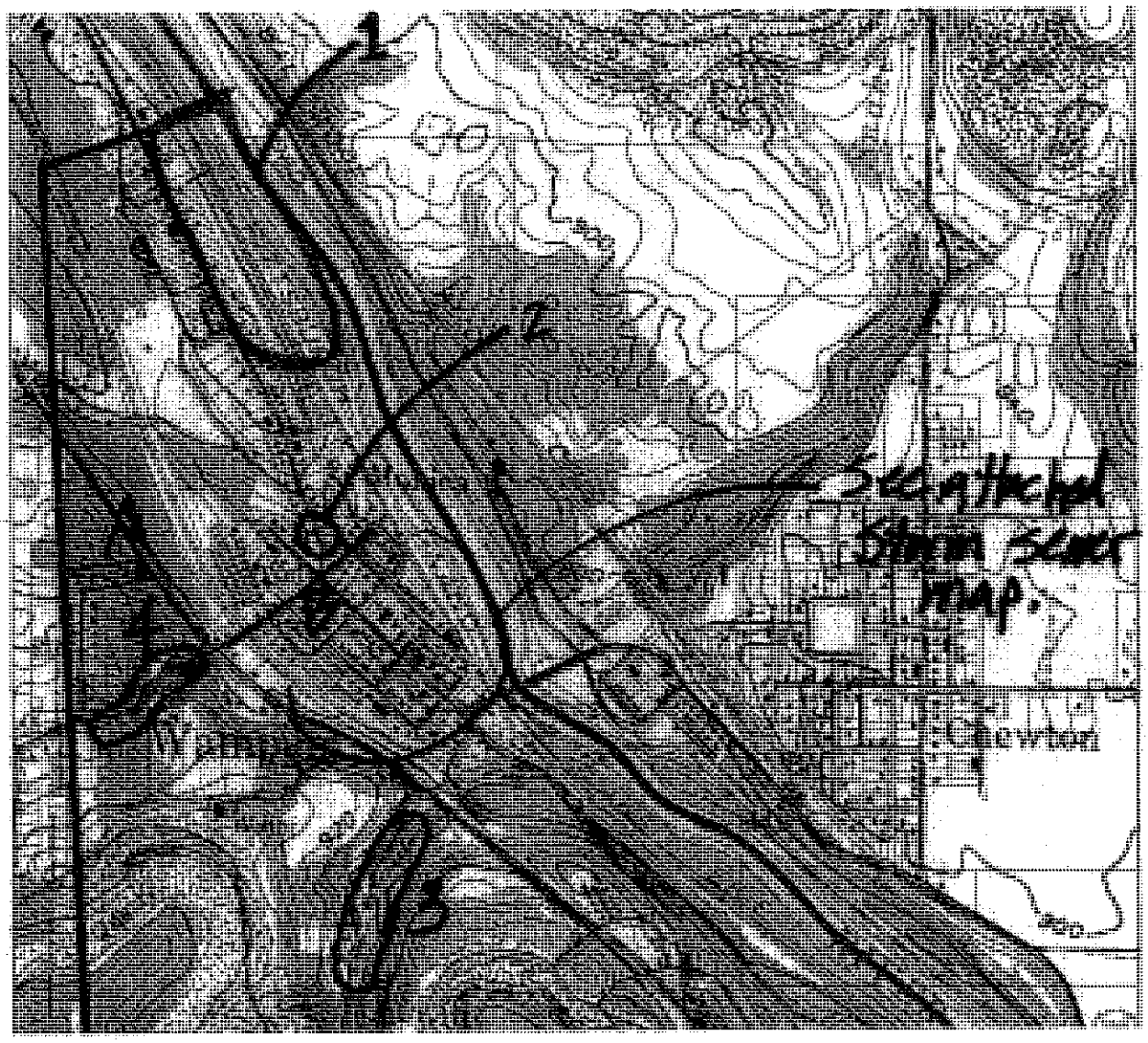
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction af flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	Optional Description:			
2	Optional Description:			
3	Optional Description:			
4	Optional Description:			
5	Optional Description:			
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
1.	Optional Description: (3) PROPERTY FLOODING - HEAVY RAIN (PRIVATE ROAD - FREED'S CAMP.)	Floodplain (6) (1)	(1) 2 X YR.	
2.	Haggerty Road Optional Description: (2) Street Flooding - HEAVY RAIN	(1)	(1) 2X YR.	
3.	Glenkirk Rd. Optional Description: (2) Street Flooding - HEAVY RAIN	(1)	(1) 2X YR.	
4.	McBride Rd Optional Description: (3) PROPERTY FLOODING - HEAVY RAIN (8) STREAM bed EROSION	(1)	(1) 2X YR.	
5.	MALLORY Rd. Optional Description: (2) Street Flooding	(1) HEAVY RAIN	(1) 2 X YR.	

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
6 (1) (2)	Optional Description: Possum Hollow Rd Street Flooding - Debris in Run	(1) Heavy Rain	(1) 2x 4R.	
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

NORTHWEST SAVINGS BANK

MAIN STREET - P. O. BOX 69 - VOLANT, PENNSYLVANIA 16156 - (724) 533-2591
FAX: (724) 533-5043

FAX COVER SHEET

DATE: 06/21/2007
TO: Lawrence County Planning Director
ATTN: Amy McKinney
FAX #: 724-656-2151
FROM: ~~Margaret Lutz~~ WASHINGTON TOWNSHIP
NORTHWEST SAVINGS BANK
VOLANT, PA
FAX: 1-724-533-5043
PHONE: 1-724-533-2591
NUMBER OF PAGES TRANSMITTED, INCLUDING THIS ONE 5

RECEIVED
JUL 25 2007
BY:

COMMENTS: RE: MUNICIPAL STORMWATER PROBLEM SURVEY

Thanks

SIGNATURE OF PERSON SENDING FAX: Peg Lutz

NOTE:

The documents included with this facsimile transmittal sheet contain information for the person named above which is confidential and/or privileged and/or exempt from disclosure under applicable laws. Note that any disclosure, copying, distribution or use of the contents of the FAXED information is prohibited. If you have received this FAX in ERROR, please notify us by phone (collect) immediately so that we can arrange for the retrieval of the original documents at not costs to you.

Kimball
L. Robert Kimball & Associates
Architects and Engineers

Lawrence County
Act 167 Stormwater Management Planning Effort
Phase I Municipal Survey

Municipal Stormwater Problem Survey

Municipality: WASHINGTON TOWNSHIP
Person Completing Form: MARGARET LUTZ / JEFFREY McCONNELL
Phone Number: 724-533-5733
Email Address:

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater-related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☐	☑	
Zoning Ordinance	☐	☑	
Subdivision/Land Development Ordinance	☐	☑	
FEMA Flood Insurance Study	☐	☑	
Floodplain Regulations * REQUIRED	☑	☐	NATIONAL FLOOD INSURANCE PROGRAM
Stormwater Management Regulations *	☐	☑	
Erosion Control Regulations *	☐	☑	
Drainage Regulations *	☐	☑	

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

Kimball
L. Robert Kimball & Associates
Architects and Engineers

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☐ Yes ☒ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				Not Important
Peak Flow Rates	5	4	3	2	1
Water Quality	5	4	3	2	1
Groundwater Recharge	5	4	3	2	1
Stream Bank Protection	5	4	3	2	1
Flooding	5	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				Strongly Oppose
5	4	3	2	1

Kimball
L. Robert Kimball & Associates
Architects and Engineers

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

☐ Yes ☒ No

If Yes, please list your meeting representative's contact information below:

Name: _____

Address: _____

Phone Number: _____

Email Address: _____

6. Do you know of any existing or proposed flood control projects in your Municipality?

☐ Yes ☒ No

If yes, please describe the project(s) below:

_____

_____

_____

_____

_____

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

Name: _____

Organization: _____

Address: _____

Phone Number: _____

Email Address: _____

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☒ Yes ☐ No

   If No, please describe the location/problem(s) below:

   _____
   _____
   _____
   _____
   _____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   _____
   _____
   _____
   _____
   _____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Municipal Stormwater Problem Survey

Municipality: New Wilmington Boro
Person Completing Form: Fred Garrett
Phone Number: 724 946 2010
Email Address: Fred@NWBoro.net.com

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater-related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☑	☐	
Zoning Ordinance	☑	☐	
Subdivision/Land Development Ordinance	☑	☐	
FEMA Flood Insurance Study	☐	☐	
Floodplain Regulations *	☐	☐	
Stormwater Management Regulations *	☑	☐	
Erosion Control Regulations *	☐	☐	
Drainage Regulations *	☐	☐	

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

RECEIVED
JUL 25 2007
BY:

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☑ Yes ☐ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				Not Important
Peak Flow Rates	5	4	3	2	1
Water Quality	5	4	3	2	1
Groundwater Recharge	5	4	3	2	1
Stream Bank Protection	5	4	3	2	1
Flooding	5	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				Strongly Oppose
5	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

   ☑ Yes ☐ No

   If Yes, please list your meeting representative's contact information below:

   Name: Fred Garrett
   Address: 134 High St New Wilmington PA 16142
   Phone Number: 724 946 8167
   Email Address:

6. Do you know of any existing or proposed flood control projects in your Municipality?

   ☐ Yes ☑ No

   If yes, please describe the project(s) below:

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name:
   Organization:
   Address:
   Phone Number:
   Email Address:

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☑ Yes ☐ No

   If No, please describe the location/problem(s) below:

   _____
   _____
   _____
   _____
   _____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   _____
   _____
   _____
   _____
   _____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

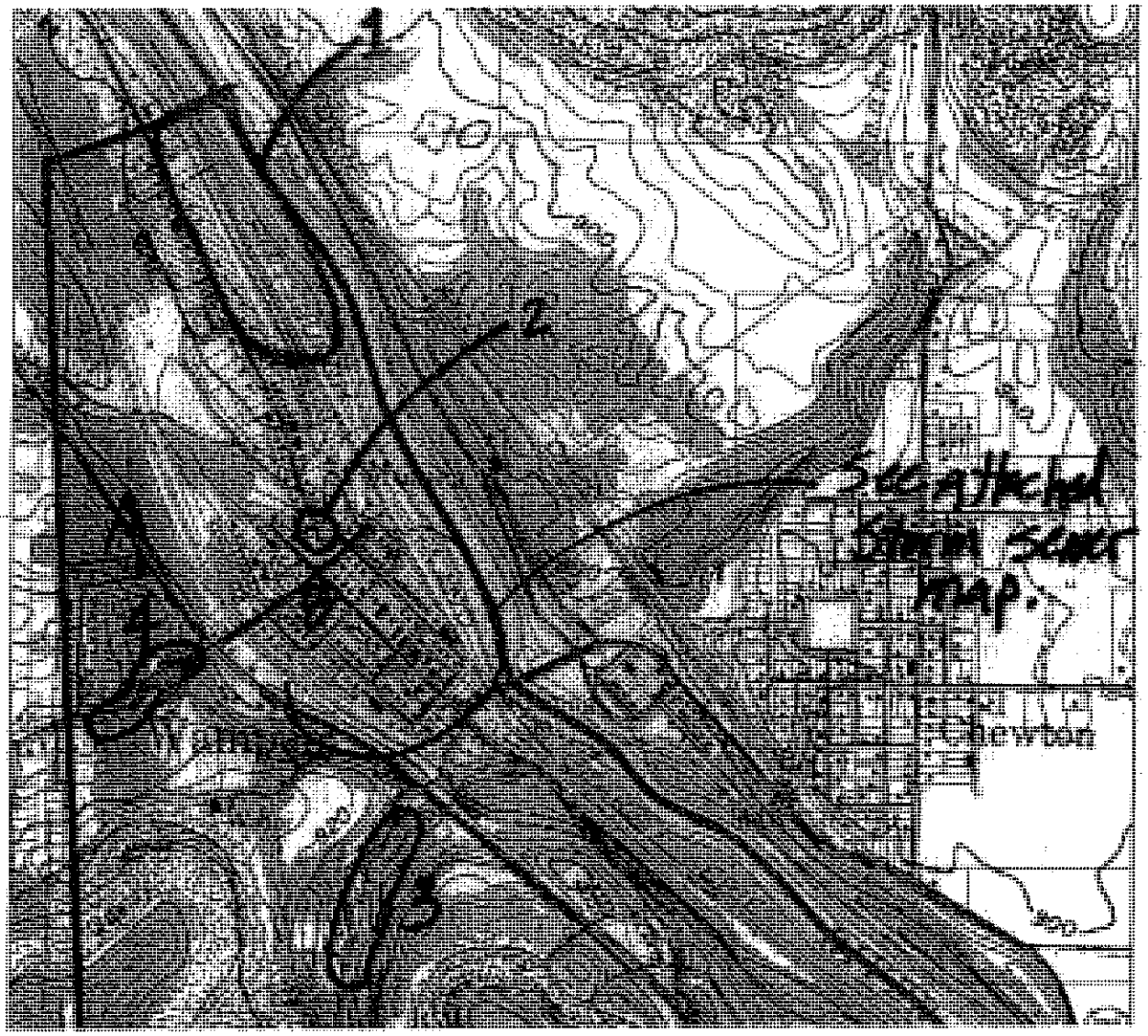
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



NO MAJOR PROBLEM AREAS

The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	Optional Description:			
2	Optional Description:			
3	Optional Description:			
4	Optional Description:			
5	Optional Description:			
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

L. Robert Kimball & Associates
Architects and Engineers

Lawrence County
Act 167 Stormwater Management Planning Effort
Phase I Municipal Survey

RECEIVED
AUG 02 2007

Municipal Stormwater Problem Survey

Municipality: Pulaski Township
Person Completing Form: Lori Sniezek
Phone Number: 724-964-8891
Email Address: pulaski@ztrain.com

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☒	☐	Draft stages of multi-municipal plan
Zoning Ordinance	☒	☐	
Subdivision/Land Development Ordinance	☒	☐	
FEMA Flood Insurance Study	☐	☐	
Floodplain Regulations *	☐	☐	
Stormwater Management Regulations *	☒	☐	
Erosion Control Regulations *	☐	☐	
Drainage Regulations *	☐	☐	

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☐ Yes ☐ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				Not Important
Peak Flow Rates	5	4	3	2	1
Water Quality	5	4	3	2	1
Groundwater Recharge	5	4	3	2	1
Stream Bank Protection	5	4	3	2	1
Flooding	5	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				Strongly Oppose
5	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?
   ☐ Yes ☐ No ? Any or all of the Supervisors or Planning Commission may be interested

   If Yes, please list your meeting representative's contact information below:

   Name: _____
   Address: _____
   Phone Number: _____
   Email Address: _____

6. Do you know of any existing or proposed flood control projects in your Municipality?
   ☒ Yes ☐ No

   If yes, please describe the project(s) below:
   Currently working with Megan Gahring of the Lawrence County Conservation District
   DEER CREEK -

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name: _____
   Organization: _____
   Address: _____
   Phone Number: _____
   Email Address: _____

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☐ Yes ☐ No

   If No, please describe the location/problem(s) below:

   _____
   _____
   _____
   _____
   _____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   _____
   _____
   _____
   _____
   _____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:

The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1				
	Optional Description:			
2				
	Optional Description:			
3				
	Optional Description:			
4				
	Optional Description:			
5				
	Optional Description:			
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

Municipal Stormwater Problem Survey

Municipality: Plain Grove Twsp
Person Completing Form: Jeff Bishop
Phone Number: 724.530.7378
Email Address:

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☒	☐	
Zoning Ordinance	☒	☐	
Subdivision/Land Development Ordinance	☒	☐	
FEMA Flood Insurance Study	☒	☐	
Floodplain Regulations *	☒	☐	
Stormwater Management Regulations *	☐	☒	
Erosion Control Regulations *	☐	☒	
Drainage Regulations *	☐	☒	

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

RECEIVED
JUL 25 2007

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☐ Yes ☒ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				Not Important
Peak Flow Rates	5	4	3	2	1
Water Quality	5	4	3	2	1
Groundwater Recharge	5	4	3	2	1
Stream Bank Protection	5	4	3	2	1
Flooding	5	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				Strongly Oppose
5	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

☐ Yes ☒ No

If Yes, please list your meeting representative's contact information below:

Name: _____

Address: _____

Phone Number: _____

Email Address: _____

6. Do you know of any existing or proposed flood control projects in your Municipality?

☐ Yes ☒ No

If yes, please describe the project(s) below:

_____

_____

_____

_____

_____

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

Name: _____

Organization: _____

Address: _____

Phone Number: _____

Email Address: _____

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

☐ Yes ☒ No

If No, please describe the location/problem(s) below:

_____

_____

_____

_____

_____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

_____

_____

_____

_____

_____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

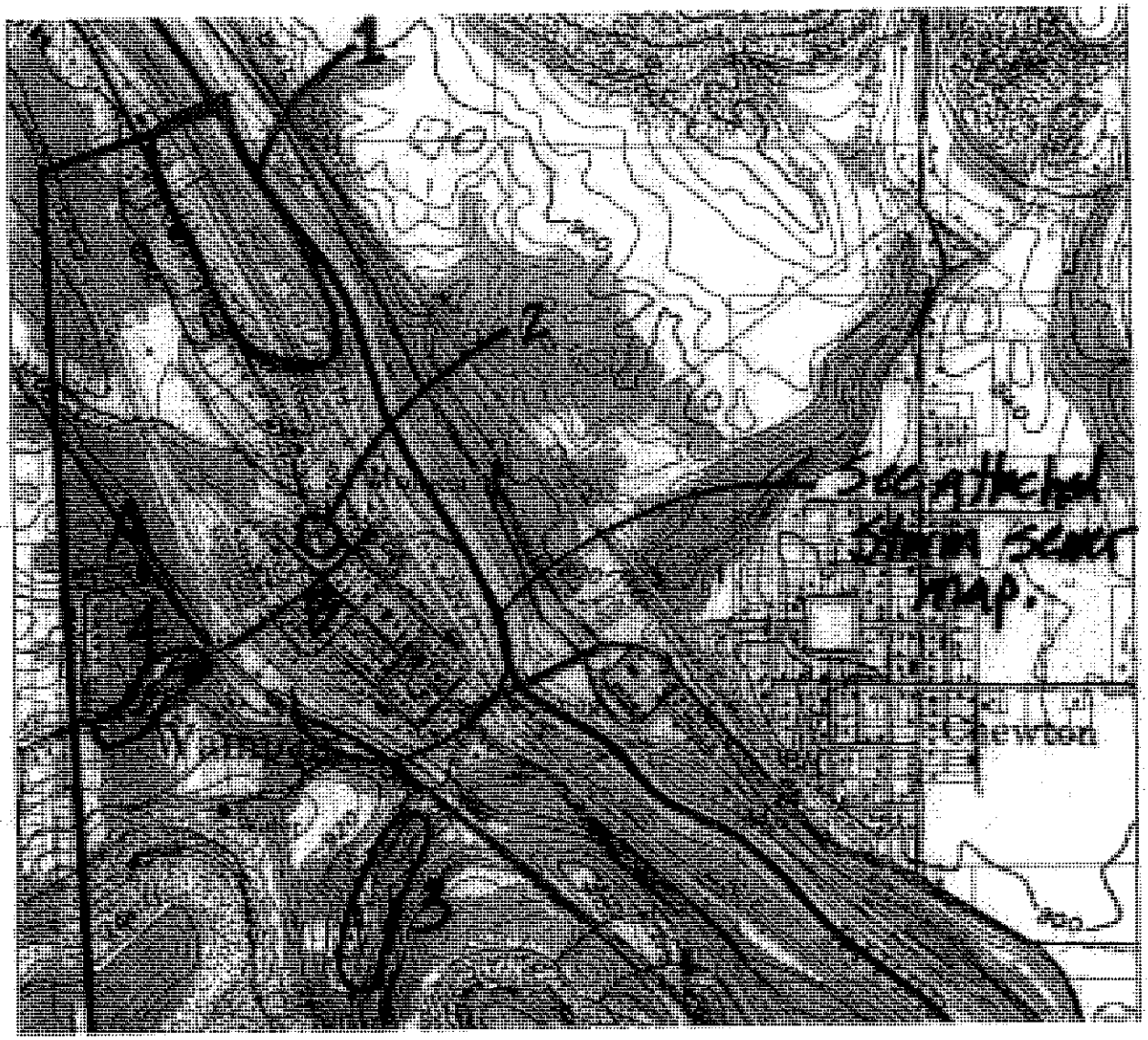
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	Optional Description:			
2	Optional Description:			
3	Optional Description:			
4	Optional Description:			
5	Optional Description:			
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

Municipal Stormwater Problem Survey

Municipality: WAYNE TWP LAW CO
Person Completing Form: DENNIS HAIL
Phone Number: 724-752-1361
Email Address:

RECEIVED
JUL 25 2007
BY:

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☐	☑	
Zoning Ordinance	☐	☑	
Subdivision/Land Development Ordinance	☑	☐	
FEMA Flood Insurance Study	☑	☐	
Floodplain Regulations *	☑	☐	
Stormwater Management Regulations *	☐	☑	
Erosion Control Regulations *	☐	☑	
Drainage Regulations *	☐	☑	

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

RECEIVED
JUN 18 2007
LAWRENCE COUNTY
PLANNING DEPARTMENT

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☐ Yes ☐ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				Not Important
Peak Flow Rates	5	4	3	2	1
Water Quality	5	4	3	2	1
Groundwater Recharge	5	4	3	2	1
Stream Bank Protection	5	4	3	2	1
Flooding	5	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				Strongly Oppose
5	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

☑ Yes ☐ No

If Yes, please list your meeting representative's contact information below:

Name: DENNIS HALL
Address: 1418 WAMPUM ROAD, Ellwood City Pa 16117
Phone Number: 724-752-1361
Email Address:

6. Do you know of any existing or proposed flood control projects in your Municipality?

☐ Yes ☑ No

If yes, please describe the project(s) below:

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

Name:
Organization:
Address:
Phone Number:
Email Address:

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☑ Yes ☐ No

   If No, please describe the location/problem(s) below:

   _____
   _____
   _____
   _____
   _____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   _____
   _____
   _____
   _____
   _____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

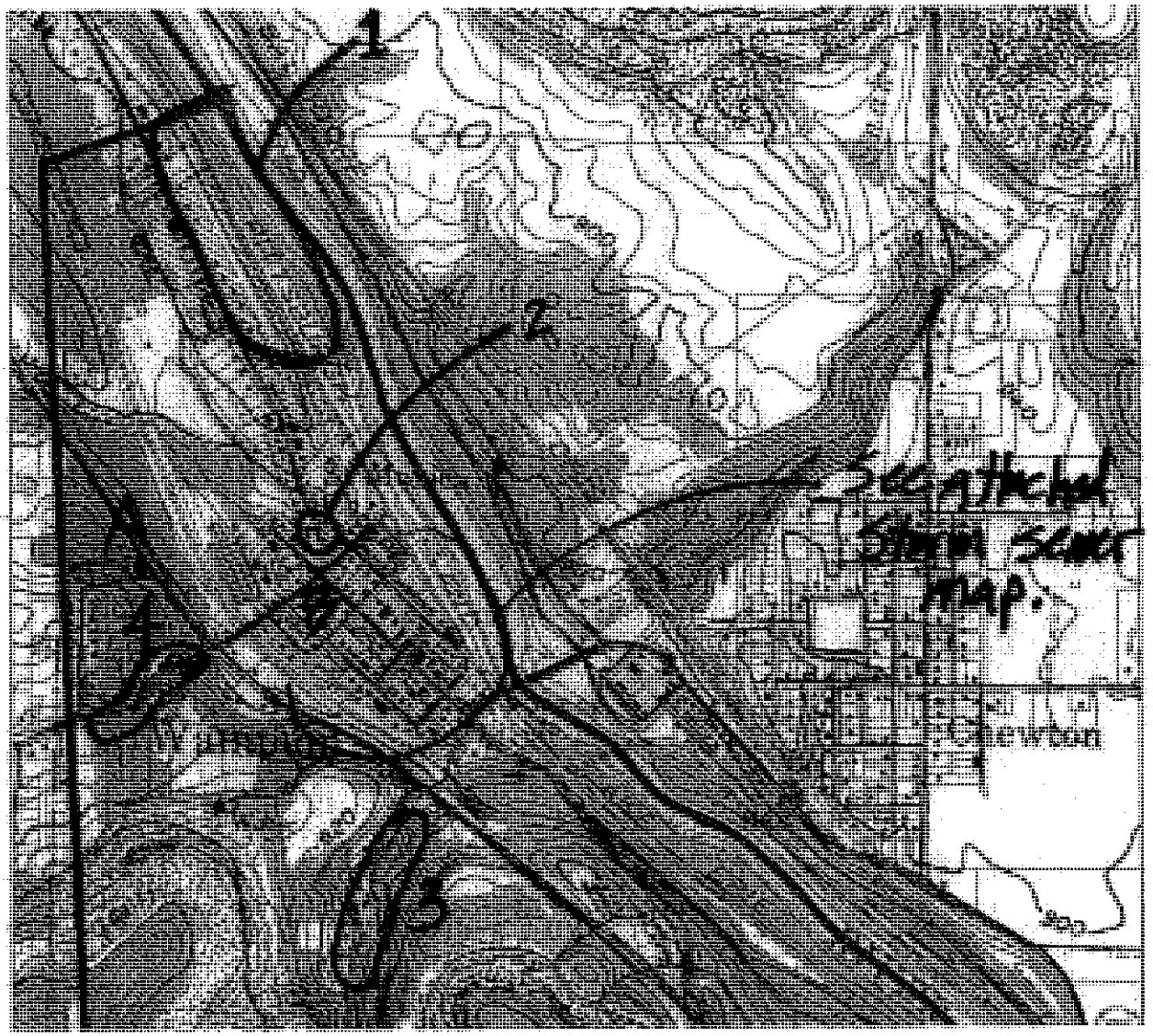
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	Optional Description:			
2	Optional Description:			
3	Optional Description:			
4	Optional Description:			
5	Optional Description:			
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description: 11	1	4	LITTLE
GREEN HOUSE ROAD				
7				
	Optional Description: 11	1	1	LITTLE
SMILLEY STOP				
8				
	Optional Description: 11	3	1	LITTLE
PRI HILL ROAD				
9				
	Optional Description:			
[illegible]				
10				
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

RECEIVED AUG 02 2007

Municipal Stormwater Problem Survey

Municipality: Pulaski Township
Person Completing Form: Lori Sniezek
Phone Number: 724-964-8891
Email Address: pulaski@ztrain.com

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☒	☐	Draft stages of multi-municipal plan
Zoning Ordinance	☒	☐	
Subdivision/Land Development Ordinance	☒	☐	
FEMA Flood Insurance Study	☐	☐	
Floodplain Regulations *	☐	☐	
Stormwater Management Regulations *	☒	☐	
Erosion Control Regulations *	☐	☐	
Drainage Regulations *	☐	☐	

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☐ Yes ☐ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				**Not Important**
Peak Flow Rates	5	4	3	2	1
Water Quality	5	4	3	2	1
Groundwater Recharge	5	4	3	2	1
Stream Bank Protection	5	4	3	2	1
Flooding	5	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				**Strongly Oppose**
5	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?
   ☐ Yes ☐ No ? Any or all of the supervisors or Planning Commission may be interested

   If Yes, please list your meeting representative's contact information below:

   Name: _____
   Address: _____
   Phone Number: _____
   Email Address: _____

6. Do you know of any existing or proposed flood control projects in your Municipality?
   ☒ Yes ☐ No

   If yes, please describe the project(s) below:
   Deer Creek - currently working with Megan Gahring of the Lawrence County Conservation District

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name: _____
   Organization: _____
   Address: _____
   Phone Number: _____
   Email Address: _____

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☐ Yes ☐ No

   If No, please describe the location/problem(s) below:

   _____
   _____
   _____
   _____
   _____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   _____
   _____
   _____
   _____
   _____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

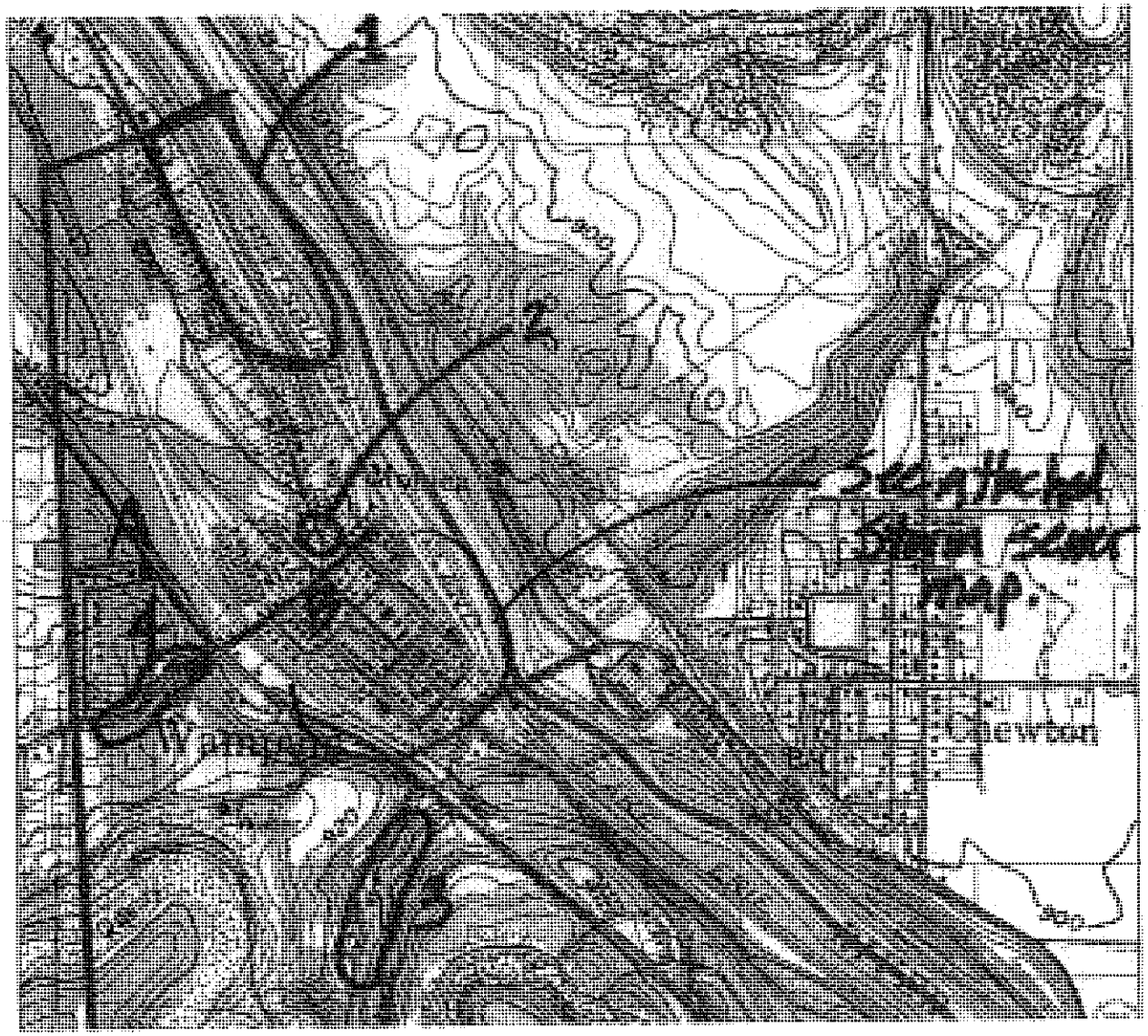
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	Optional Description:			
2	Optional Description:			
3	Optional Description:			
4	Optional Description:			
5	Optional Description:			
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

Municipal Stormwater Problem Survey

Municipality: New Wilmington Boro
Person Completing Form: Fred Garrett
Phone Number: 724 946 2010
Email Address: Fred@NWBoro.net.com

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☑	☐	
Zoning Ordinance	☑	☐	
Subdivision/Land Development Ordinance	☑	☐	
FEMA Flood Insurance Study	☐	☐	
Floodplain Regulations *	☐	☐	
Stormwater Management Regulations *	☑	☐	
Erosion Control Regulations *	☐	☐	
Drainage Regulations *	☐	☐	

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

RECEIVED
JUL 25 2007
BY:

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☑ Yes ☐ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				**Not Important**
Peak Flow Rates	5	4	3	2	1
Water Quality	5	4	3	2	1
Groundwater Recharge	5	4	3	2	1
Stream Bank Protection	5	4	3	2	1
Flooding	5	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				**Strongly Oppose**
5	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

   ☑ Yes ☐ No

   If Yes, please list your meeting representative's contact information below:

   Name: Fred Garrett
   Address: 134 High St New Wilmington PA 16142
   Phone Number: 724 946 8167
   Email Address:

6. Do you know of any existing or proposed flood control projects in your Municipality?

   ☐ Yes ☑ No

   If yes, please describe the project(s) below:

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name:
   Organization:
   Address:
   Phone Number:
   Email Address:

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☑ Yes ☐ No

   If No, please describe the location/problem(s) below:

   _____
   _____
   _____
   _____
   _____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   _____
   _____
   _____
   _____
   _____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

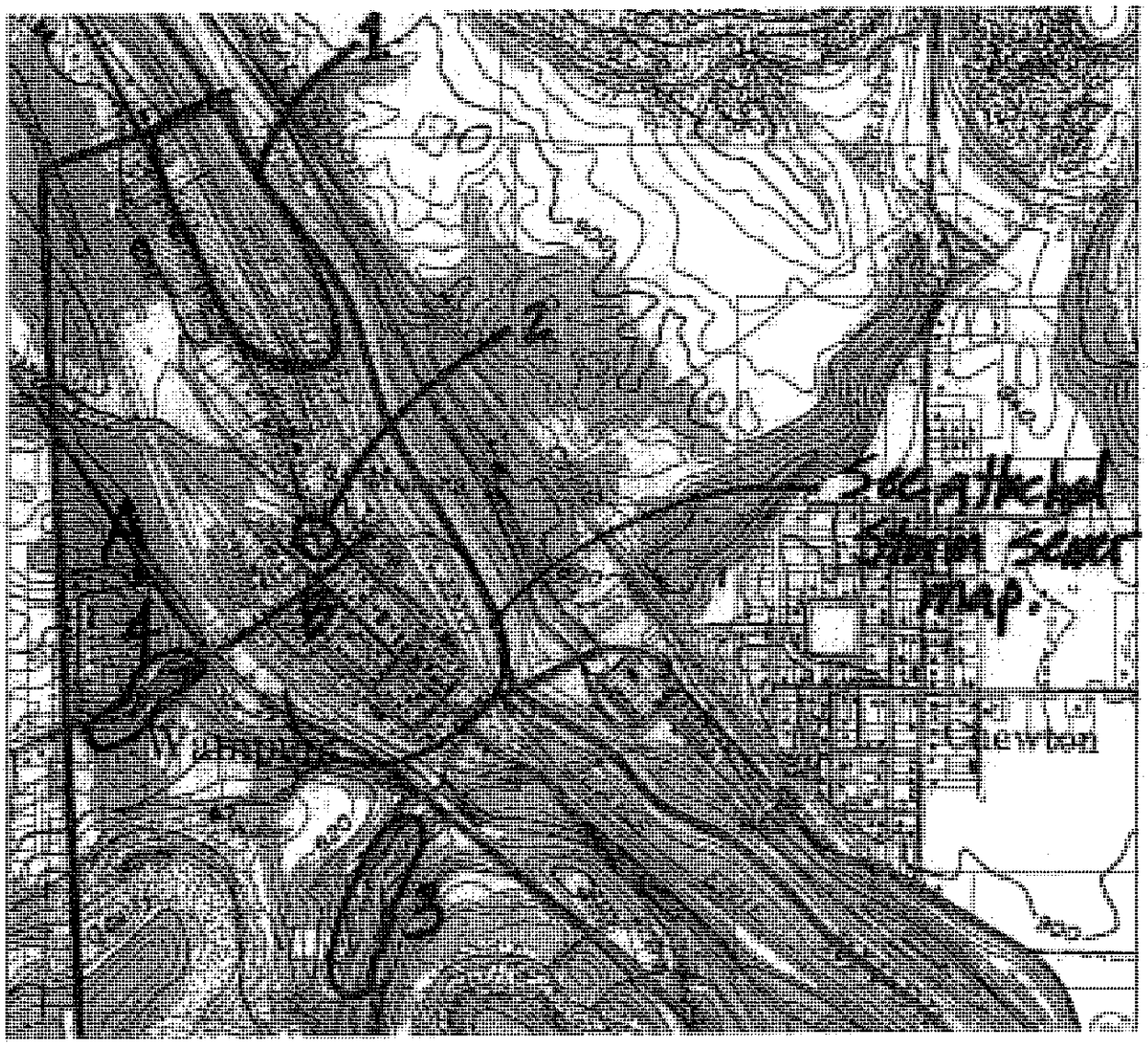
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



NO MAJOR PROBLEM AREAS

The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	Optional Description:			
2	Optional Description:			
3	Optional Description:			
4	Optional Description:			
5	Optional Description:			
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

Municipal Stormwater Problem Survey

Municipality: Plain Grove Twp
Person Completing Form: Jeff Bishop
Phone Number: 724.530.7378
Email Address:

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☒	☐	
Zoning Ordinance	☒	☐	
Subdivision/Land Development Ordinance	☒	☐	
FEMA Flood Insurance Study	☒	☐	
Floodplain Regulations *	☒	☐	
Stormwater Management Regulations *	☐	☒	
Erosion Control Regulations *	☐	☒	
Drainage Regulations *	☐	☒	

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

RECEIVED
JUL 25 2007

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☐ Yes ☒ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				**Not Important**
Peak Flow Rates	5	4	3	2	1
Water Quality	5	4	3	2	1
Groundwater Recharge	5	4	3	2	1
Stream Bank Protection	5	4	3	2	1
Flooding	5	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				**Strongly Oppose**
5	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

   ☐ Yes ☒ No

   If Yes, please list your meeting representative's contact information below:

   Name: _____

   Address: _____

   Phone Number: _____

   Email Address: _____

6. Do you know of any existing or proposed flood control projects in your Municipality?

   ☐ Yes ☒ No

   If yes, please describe the project(s) below:

   _____

   _____

   _____

   _____

   _____

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name: _____

   Organization: _____

   Address: _____

   Phone Number: _____

   Email Address: _____

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☐ Yes ☒ No

   If No, please describe the location/problem(s) below:

   _____
   _____
   _____
   _____
   _____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   _____
   _____
   _____
   _____
   _____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

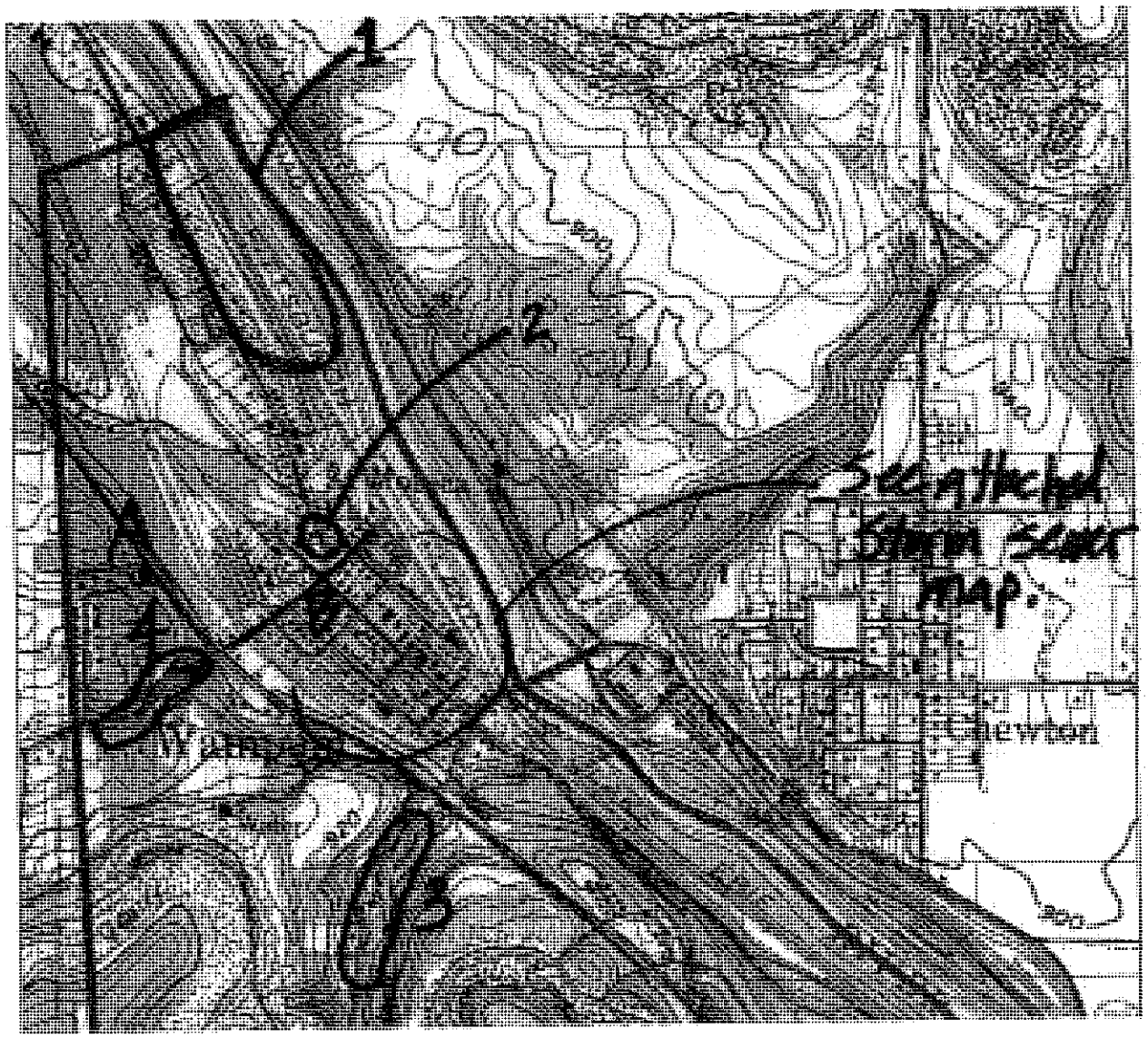
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	Optional Description:			
2	Optional Description:			
3	Optional Description:			
4	Optional Description:			
5	Optional Description:			
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

LAWRENCE COUNTY
ENON VALLEY BOROUGH

341 Cherry Alley • P O Box 295
Enon Valley, PA 16120

724-336-5968
Fax: 724-336-5968

June 8, 2007

Attention: Amy B. McKinney, Director of Planning

Amy:

Attached is the Lawrence Co. Act 167 Phase 1 – Municipal Stormwater Problem Survey.

Tyrone Petrich

RECEIVED
JUN 01 2007
LAWRENCE COUNTY
PLANNING DEPARTMENT

JUL 25 2007

Municipal Stormwater Problem Survey

Municipality: Enon Valley Borough
Person Completing Form: Tyrone W Petrich
Phone Number: 724-336-2661
Email Address:

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	X		
Zoning Ordinance			
Subdivision/Land Development Ordinance			
FEMA Flood Insurance Study	X		
Floodplain Regulations *	X		50
Stormwater Management Regulations *	X		50
Erosion Control Regulations *	X		50
Drainage Regulations *			

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☒ Yes ☐ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				**Not Important**
Peak Flow Rates	5	(4)	3	2	1
Water Quality	5	4	(3)	2	1
Groundwater Recharge	5	4	(3)	2	1
Stream Bank Protection	5	(4)	3	2	1
Flooding	(5)	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				**Strongly Oppose**
(5)	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

   [X] Yes [ ] No

   If Yes, please list your meeting representative's contact information below:

   Name: Tyrone Petrich / Duane Clawson
   Address: P.O. Box 295 Enon Valley Pa. 16120
   Phone Number: 724-336-5968
   Email Address: veronica@ccia.com

6. Do you know of any existing or proposed flood control projects in your Municipality?

   [ ] Yes [X] No

   If yes, please describe the project(s) below:

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name: Kimball and Assoc.
   Organization:
   Address: 415 Moon Clinton Road, Coraopolis, Pa 15108
   Phone Number:
   Email Address:

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☒ Yes ☐ No

   If No, please describe the location/problem(s) below:

   _____
   _____
   _____
   _____
   _____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   Refer to: Enon Valley Watershed Assesment
   _____
   _____
   _____
   _____
   _____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

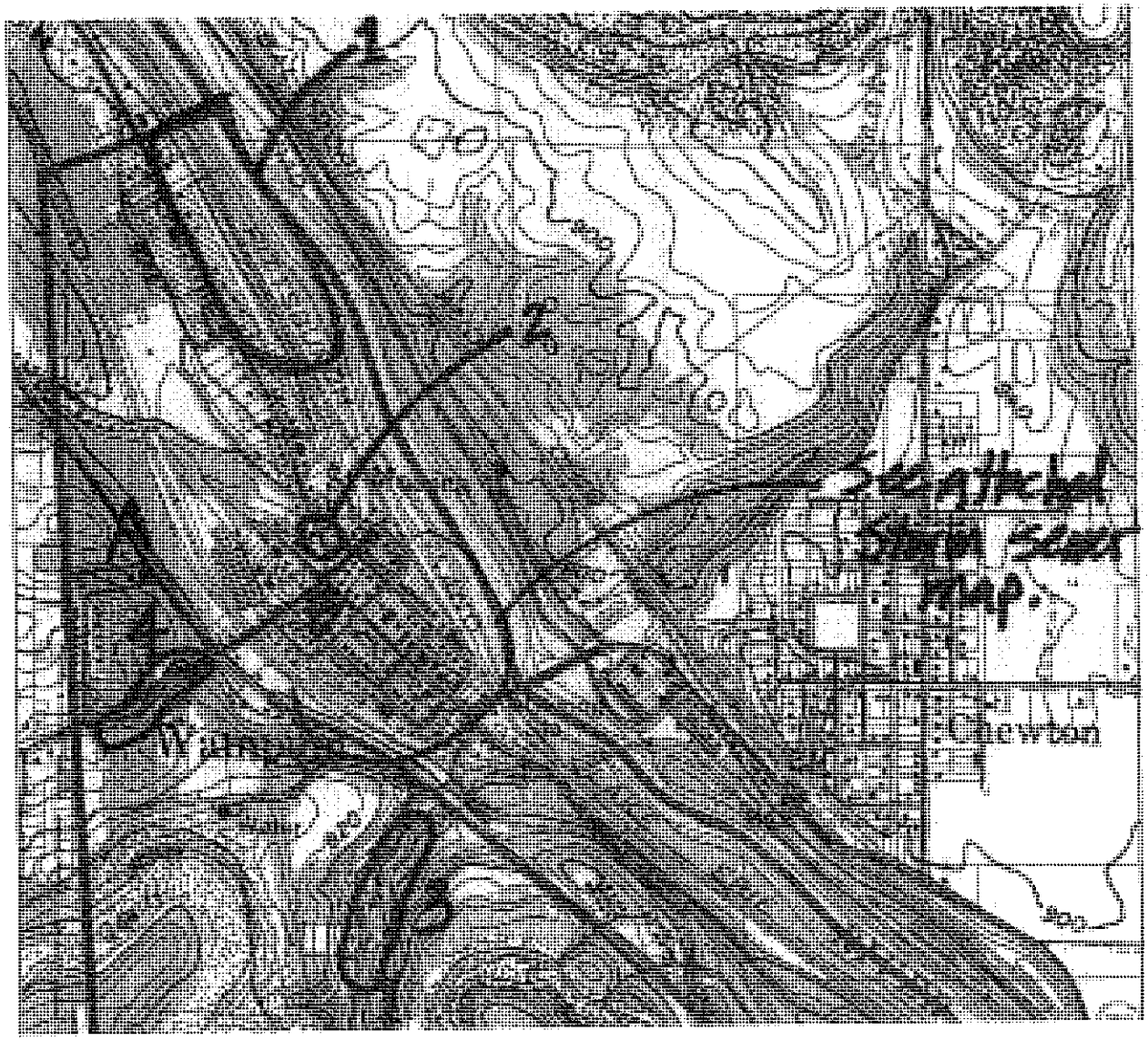
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A + Enclosures Refer to Enon Valley Watershed Assessment

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	Optional Description:			
2	Optional Description:			
3	Optional Description:			
4	Optional Description:			
5	Optional Description:			
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

Municipal Stormwater Problem Survey

Municipality: Borough of Ellwood City
Person Completing Form: Rhonda Zellhart
Phone Number: 724-758-4749 ; 724-333-5579 (cell)
Email Address: cehrenberg@access995.com

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☑	☐	
Zoning Ordinance	☑	☐	
Subdivision/Land Development Ordinance	☑	☐	
FEMA Flood Insurance Study - MAP	☐	☐	
Floodplain Regulations *	☐	☐	
Stormwater Management Regulations *	☐	☐	
Erosion Control Regulations *	☐	☐	
Drainage Regulations *	☐	☐	

In Bno Code.

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

RECEIVED
JUL 25 2007
By: .....

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☒ Yes ☐ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☒ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				**Not Important**
Peak Flow Rates	5	4	3	2	1
Water Quality	5	4	3	2	1
Groundwater Recharge	5	4	3	2	1
Stream Bank Protection	5	4	3	2	1
Flooding	5	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				**Strongly Oppose**
5	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

   ☑ Yes ☐ No

   If Yes, please list your meeting representative's contact information below:

   Name: Rhonda Zellhart, Operations Manager
   Address: 525 Lawrence Ave. Ellwood City Pa. 16117
   Phone Number: 724-758-4749 ; 724-333-5579 (cell)
   Email Address: ccehrenberg@access995.com

6. Do you know of any existing or proposed flood control projects in your Municipality?

   ☐ Yes ☑ No

   If yes, please describe the project(s) below:

   _____
   _____
   _____
   _____
   _____

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name: _____
   Organization: _____
   Address: _____
   Phone Number: _____
   Email Address: _____

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☑ Yes ☐ No

   If No, please describe the location/problem(s) below:

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   Program was hit & miss & over the past few years it has developed structure & is becoming an active/proactive program.

   Labor & resources are limiting factors.

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

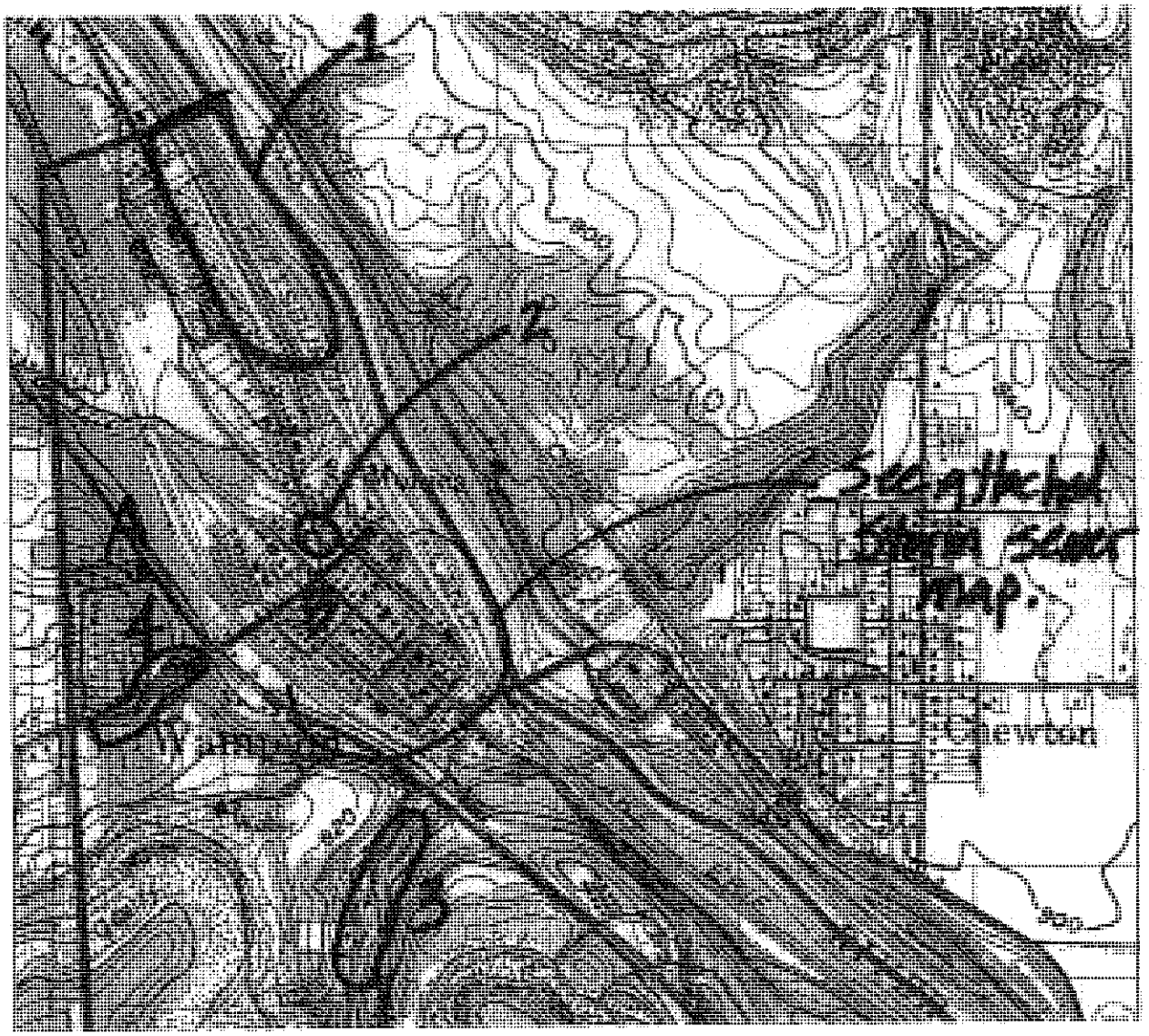
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

* pictures Attached for reference.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	TODD Ave Run	8	1 or 3	yearly	- Solids Backup - Bank/yard erosion
	Optional Description: - open Storm Culvert - Eroding			
2	South Street Run* - Same as #1			
	Optional Description: Bank, yard erosion - debris accumulation.			
	* This sight has possible Acid mine drainage entering the Run in Beaver County.			
3	Ewing Park - Combined Sewer System			
	Optional Description: 11 - inadequate infrastructure.			
	This system is old & was build as a combined system occassinaly we have problems. The number of problems have been greatly reduced by implemention of a more proactive maintenance program.			
4	Barry's Run - Same as 1 & 2 ~~No pict.~~			
	Optional Description:			
5	Bridge St. Run.			NO pict
	Optional Description: Same as 1, 2, & 4			
	* Also has possible Acid mine drainage entering run from Wayne TWP.			
6	WWTP - storm steps. - old Storm outfall is deteriorating.			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

Municipal Stormwater Problem Survey

Municipality: NORTH BEAVER TWP.
Person Completing Form: JAMES GAGLIANO JR.
Phone Number: 724-667-9956
Email Address:

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☒	☐	
Zoning Ordinance	☒	☐	
Subdivision/Land Development Ordinance	☒	☐	
FEMA Flood Insurance Study	☒	☐	
Floodplain Regulations *	☒	☐	SO
Stormwater Management Regulations *	☒	☐	SL
Erosion Control Regulations *	☒	☐	SL
Drainage Regulations *	☒	☐	SL

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☐ Yes ☒ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				**Not Important**
Peak Flow Rates	5	4	3	2	1
Water Quality	5	4	3	2	1
Groundwater Recharge	5	4	3	2	1
Stream Bank Protection	5	4	3	2	1
Flooding	5	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				**Strongly Oppose**
5	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

   ☒ Yes ☐ No

   If Yes, please list your meeting representative's contact information below:

   Name: JAMES GAGLIANO, JR.
   Address: 225 OLD HICKORY ROAD NEW CASTLE PA 16102
   Phone Number: 724-667-7413
   Email Address: jjugagliano@comcast.net

6. Do you know of any existing or proposed flood control projects in your Municipality?

   ☐ Yes ☒ No

   If yes, please describe the project(s) below:

   _____
   _____
   _____
   _____
   _____

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name: _____
   Organization: _____
   Address: _____
   Phone Number: _____
   Email Address: _____

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☒ Yes ☐ No

   If No, please describe the location/problem(s) below:

   AS NEEDED - BASICALLY, REMOVAL OF DEBRIS

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   THERE IS NO MANAGEMENT PLAN - MAINTAIN AS NEEDED

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

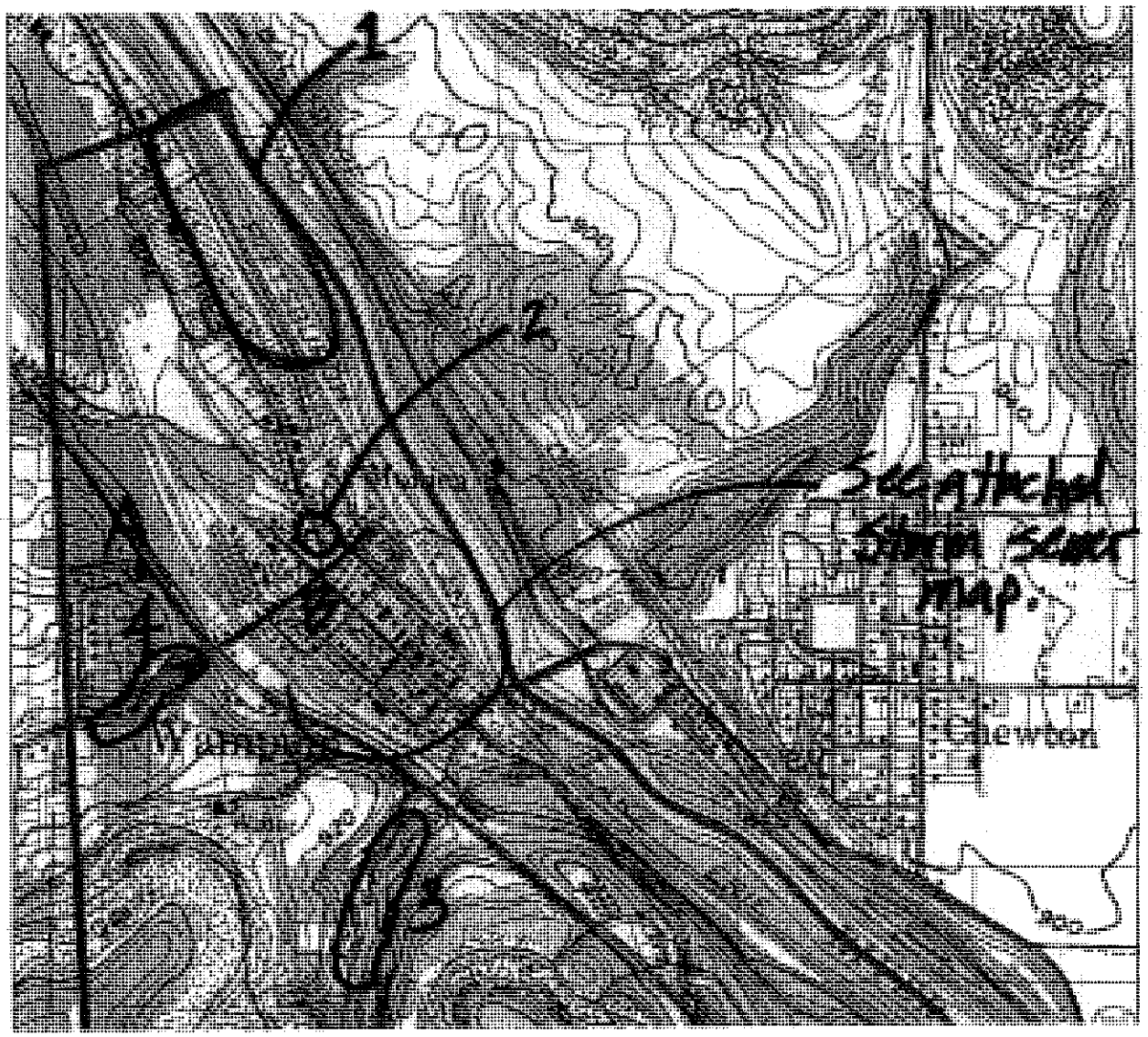
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

Most areas are small streams that overflow during heavy rains. Properties + streets flood depending on amount of rain.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	1	1		3
	Optional Description: Mallory / Halltown Road			
2	1	1		3
	Optional Description: Galilee / Wampum Rd			
3	1	1		3
	Optional Description: Willow Grove			
4	3	3		3
	Optional Description: Jackson Knolls			
5	1 & 3	1 & 3		3
	Optional Description: Hickory View			
6	3	1		3

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description: Westfield Rd. / Pond overflow			
7	1	1		3
	Optional Description: Moravia Rd			
8	1	1		3
	Optional Description: Moravia Rd			
9	1	1		3
	Optional Description: Moravia / Musser Rd			
10	1	1		3
	Optional Description: McClain Rd			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
11		1		3
	Optional Description: SNPJ, surface water washed out culverts			
12	3	1		3
	Optional Description: SNPJ. lake overflow			
13	1	1		3
	Optional Description: Enon Rd. / culvert			
14	1	1		3
	Optional Description: Smalls Ferry Rd			
15	2+3	1+3		3
	Optional Description: Smalls Ferry / Columbiana Rd			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
16	1 & 3	1		3
	Optional Description: East Beechwood Rd			
17	1 & 3	1 & 5		3
	Optional Description: Len Ann Drive			
18	2	1 & 3		3
	Optional Description: Mt. Jackson Rd / Mahoningtown swamp overflow			
19	2 & 3	1		3
	Optional Description: Covert Rd. / run off from Rt. 60 overpass			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	The Trails at Mt. Jackon
B	Hickory Creek / Skyview Drive
C	Hickory Creek Gorge
D	Southbreeze
E	Mohawk Medows
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

Municipal Stormwater Problem Survey

Municipality: WAYNE TWP LAW CO
Person Completing Form: DENNIS HALL
Phone Number: 724-752-1361
Email Address:

RECEIVED
JUL 25 2007
BY:

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☐	☑	
Zoning Ordinance	☐	☑	
Subdivision/Land Development Ordinance	☑	☐	
FEMA Flood Insurance Study	☑	☐	
Floodplain Regulations *	☑	☐	
Stormwater Management Regulations *	☐	☑	
Erosion Control Regulations *	☐	☑	
Drainage Regulations *	☐	☑	

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

RECEIVED
JUN 18 2007
LAWRENCE COUNTY
PLANNING DEPARTMENT

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☐ Yes ☐ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				**Not Important**
Peak Flow Rates	5	4	3	2	1
Water Quality	5	4	3	2	1
Groundwater Recharge	5	4	3	2	1
Stream Bank Protection	5	4	3	2	1
Flooding	5	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				**Strongly Oppose**
5	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

   ☑ Yes ☐ No

   If Yes, please list your meeting representative's contact information below:

   Name: DENNIS HALL
   Address: 1418 WAMPUM ROAD, ELLWOOD CITY PA 16117
   Phone Number: 724-752-1361
   Email Address: _____

6. Do you know of any existing or proposed flood control projects in your Municipality?

   ☐ Yes ☑ No

   If yes, please describe the project(s) below:

   _____
   _____
   _____
   _____
   _____

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name: _____
   Organization: _____
   Address: _____
   Phone Number: _____
   Email Address: _____

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☑ Yes ☐ No

   If No, please describe the location/problem(s) below:

   _____
   _____
   _____
   _____
   _____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   _____
   _____
   _____
   _____
   _____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

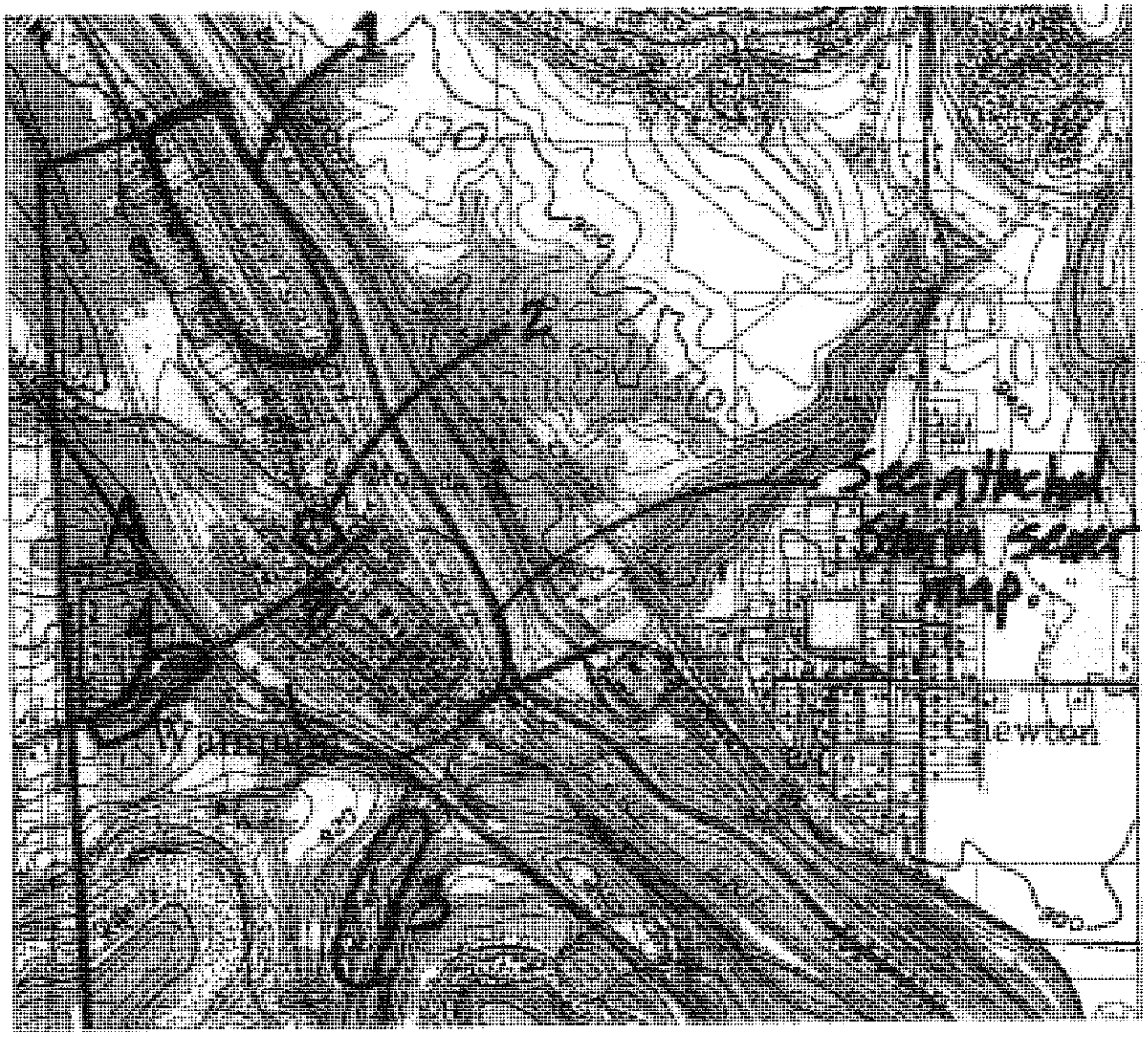
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	Optional Description:			
2	Optional Description:			
3	Optional Description:			
4	Optional Description:			
5	Optional Description:			
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description: 11	1	4	LITTLE
GREEN HOUSE ROAD				
7	Optional Description: 11	1	1	LITTLE
SMILLEY STOP				
8	Optional Description: 11	3	1	LITTLE
PRI HILL ROAD				
9	Optional Description:			
[illegible]				
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

Municipal Stormwater Problem Survey

Municipality: Wilmington Twp Lawr Co
Person Completing Form: Dale Ellder
Phone Number: 724-946 2560
Email Address: —

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☐	☐	
Zoning Ordinance	☒	☐	
Subdivision/Land Development Ordinance	☒	☐	
FEMA Flood Insurance Study	☐	☐	
Floodplain Regulations *	☒	☐	
Stormwater Management Regulations *	☐	☐	
Erosion Control Regulations *	☐	☐	
Drainage Regulations *	☐	☐	

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

RECEIVED
JUL 25 2007
BY: .....

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☐ Yes ☐ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				**Not Important**
Peak Flow Rates	5	4	3	2	1
Water Quality	5	4	3	2	1
Groundwater Recharge	5	4	3	2	1
Stream Bank Protection	5	4	3	2	1
Flooding	5	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				**Strongly Oppose**
5	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

   ☒ Yes ☐ No

   If Yes, please list your meeting representative's contact information below:

   Name: Dale Elder
   Address: 2810 ST RT 206 Volant PA
   Phone Number: 724 246-3226
   Email Address:

6. Do you know of any existing or proposed flood control projects in your Municipality?

   ☐ Yes ☒ No

   If yes, please describe the project(s) below:

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name:
   Organization:
   Address:
   Phone Number:
   Email Address:

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☒ Yes ☐ No

   If No, please describe the location/problem(s) below:

   _____
   _____
   _____
   _____
   _____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   _____
   _____
   _____
   _____
   _____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

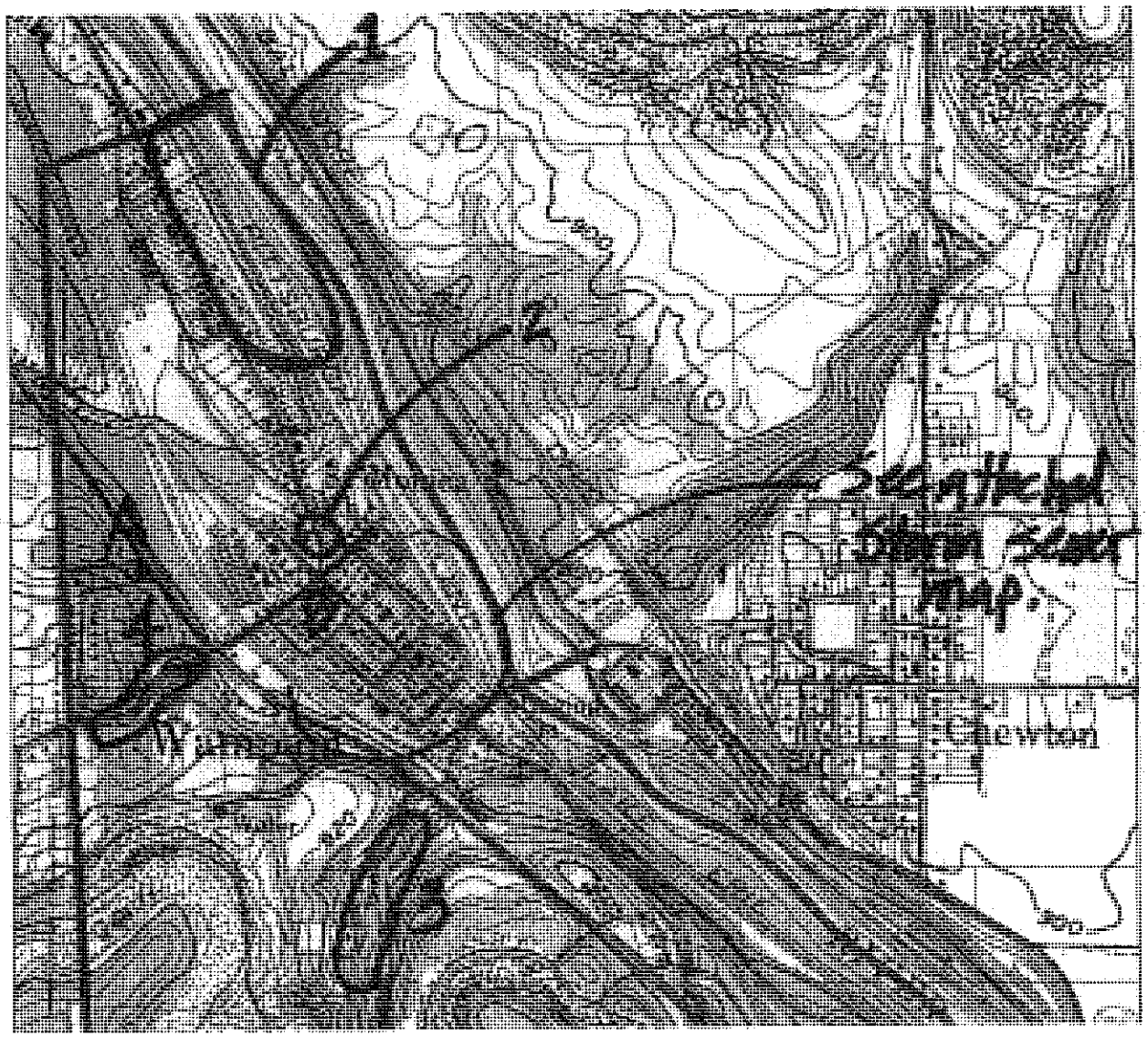
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	– When we get lots of Rain			
	Optional Description: Cottage Grove – Maywille – Wilson Camper Little Neshannock Creek –			
2	Fay – ~~near~~ Wilmington Area –			
	Optional Description: Redwing Stark – Area – Small Stream – From 208 – When 1" Rain Flood Road And Basements			
3				
	Optional Description: Big Neshannock Creek Near Maywille –			
4	~~Big~~ ~~Road~~			
	Optional Description: Beechwood Rd, near Road – 3 Foot Culvert Plugs up And			
5	– Needs Replaced because of Heavy Rains –			
	Optional Description:			
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

Municipal Stormwater Problem Survey

Municipality: New Beaver Boro
Person Completing Form: Lorraine Leslie/David Hairhoger
Phone Number: 724-535-8868
Email Address: newbeaverboro@access995.com

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☒	☐	
Zoning Ordinance	☐	☐	
Subdivision/Land Development Ordinance	☒	☐	
FEMA Flood Insurance Study	☐	☐	
Floodplain Regulations *	☒	☐	SO
Stormwater Management Regulations *	☒	☐	SO
Erosion Control Regulations *	☐	☐	
Drainage Regulations *	☐	☐	

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

RECEIVED
JUL 25 2007
BY:.....

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☐ Yes ☒ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				**Not Important**
Peak Flow Rates	(5)	4	3	2	1
Water Quality	(5)	4	3	2	1
Groundwater Recharge	(5)	4	3	2	1
Stream Bank Protection	(5)	4	3	2	1
Flooding	(5)	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				**Strongly Oppose**
(5)	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

   ☒ Yes ☐ No

   If Yes, please list your meeting representative's contact information below:

   Name: DAVID HAIRhoger
   Address: 778 WAMPUM-NewGalilee Rd NewGalilee 16141
   Phone Number: 724-535-8868
   Email Address: NewBeaverboro@Access995.com

6. Do you know of any existing or proposed flood control projects in your Municipality?

   ☐ Yes ☒ No

   If yes, please describe the project(s) below:

   _____
   _____
   _____
   _____
   _____

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name: _____
   Organization: _____
   Address: _____
   Phone Number: _____
   Email Address: _____

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☒ Yes ☐ No

   If No, please describe the location/problem(s) below:

   _____
   _____
   _____
   _____
   _____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   _____
   _____
   _____
   _____
   _____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

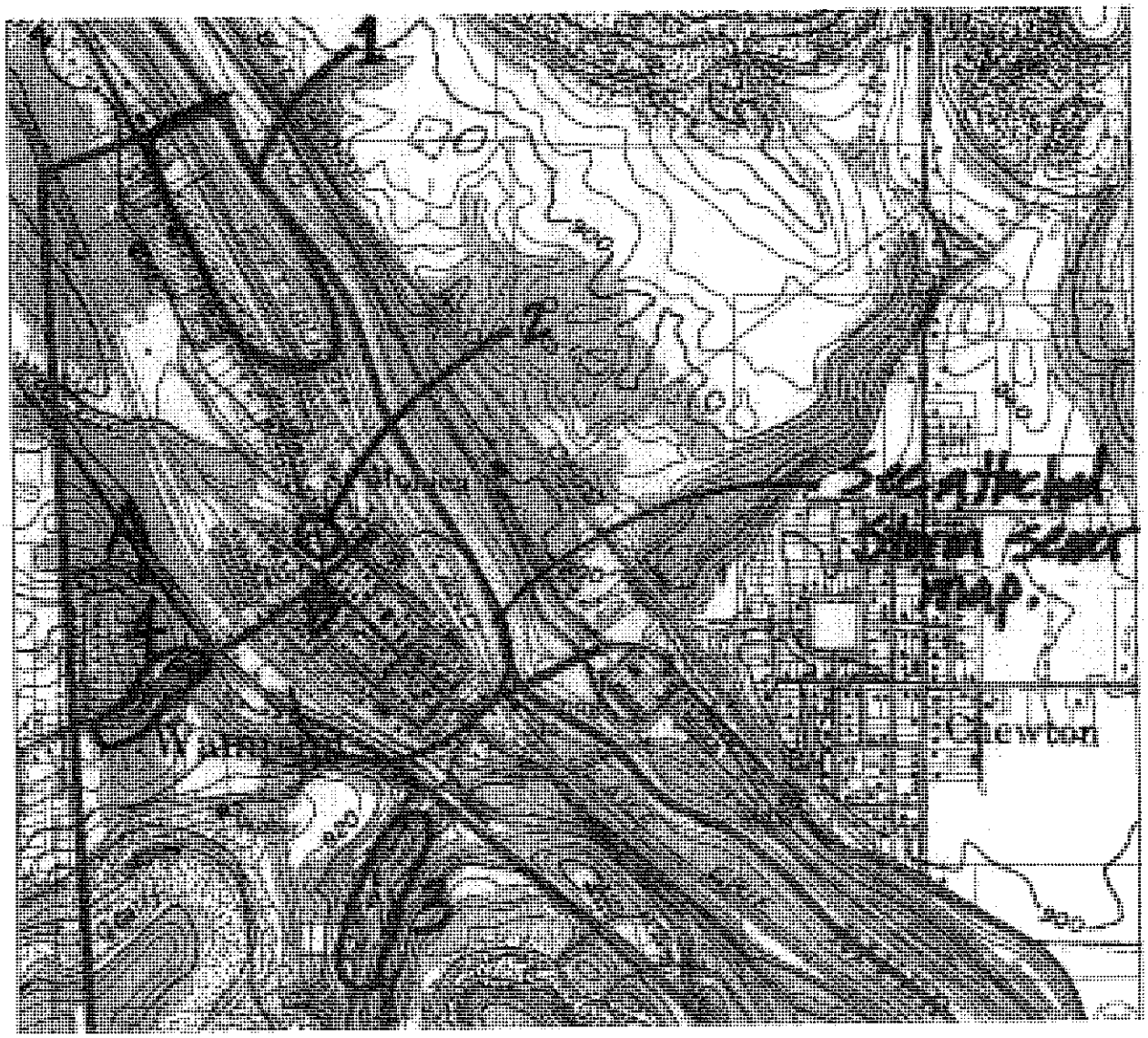
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	Optional Description:			
2	Optional Description:			
3	Optional Description:			
4	Optional Description:			
5	Optional Description:			
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
1.	Optional Description: (3) PROPERTY FLOODING - HEAVY RAIN (PRIVATE ROAD - FREED'S CAMP)	Floodplain (6) (1)	(1) 2X YR.	
2.	Haggerty Road Optional Description: (2) STREET FLOODING - HEAVY RAIN	(1)	(1) 2X YR.	
3.	Glenkirk Rd. Optional Description: (2) STREET FLOODING - HEAVY RAIN	(1)	(1) 2X YR.	
4.	McBride Rd Optional Description: (3) PROPERTY FLOODING - HEAVY RAIN (8) STREAM BED EROSION	(1)	(1) 2X YR.	
5.	Mallory Rd. Optional Description: (2) STREET FLOODING	(1) HEAVY RAIN	(1) 2 X YR.	

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
6 ① ②	Optional Description: Possum Hollow Rd Street Flooding - Debris in Run	① Heavy Rain	① 2x 4R.	
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

Municipal Stormwater Problem Survey

Municipality: City of New Castle
Person Completing Form: Tamara P. Gibson
Phone Number: 724-656-3540
Email Address: bus.admin@verizon.net

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater-related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	[X]	[ ]	
Zoning Ordinance	[X]	[ ]	
Subdivision/Land Development Ordinance	[X]	[ ]	
FEMA Flood Insurance Study	[X]	[ ]	
Floodplain Regulations *	[X]	[ ]	SO
Stormwater Management Regulations *	[X]	[ ]	SO
Erosion Control Regulations *	[X]	[ ]	SO & ZO
Drainage Regulations *	[X]	[ ]	SO & ZO

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

JUL 25 2007
BY:

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   [X] Yes ☐ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   [X] Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				Not Important
Peak Flow Rates	(5)	4	3	2	1
Water Quality	(5)	4	3	2	1
Groundwater Recharge	5	4	3	(2)	1
Stream Bank Protection	5	(4)	3	2	1
Flooding	5	4	(3)	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				Strongly Oppose
5	(4)	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

   [X] Yes [ ] No

   If Yes, please list your meeting representative's contact information below:

   Name: Tamara P. Gibson
   Address: Municipal Building, 230 N. Jefferson Street
   New Castle, PA 16101-2220
   Phone Number: 724-656-3540
   Email Address: bus.admin@verizon.net

6. Do you know of any existing or proposed flood control projects in your Municipality?

   [ ] Yes [X] No

   If yes, please describe the project(s) below:

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name:
   Organization: U.S. Army Corps of Engineers (Pittsburgh District)
   Address: William S. Moorhead Federal Building
   Phone Number: Project Management Branch
   Email Address: 1000 Liberty Avenue, Room 1805
   Pittsburgh, PA 15222-4186

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☒ Yes ☐ No

   If No, please describe the location/problem(s) below:

   _____
   _____
   _____
   _____
   _____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   _____
   _____
   _____
   _____
   _____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

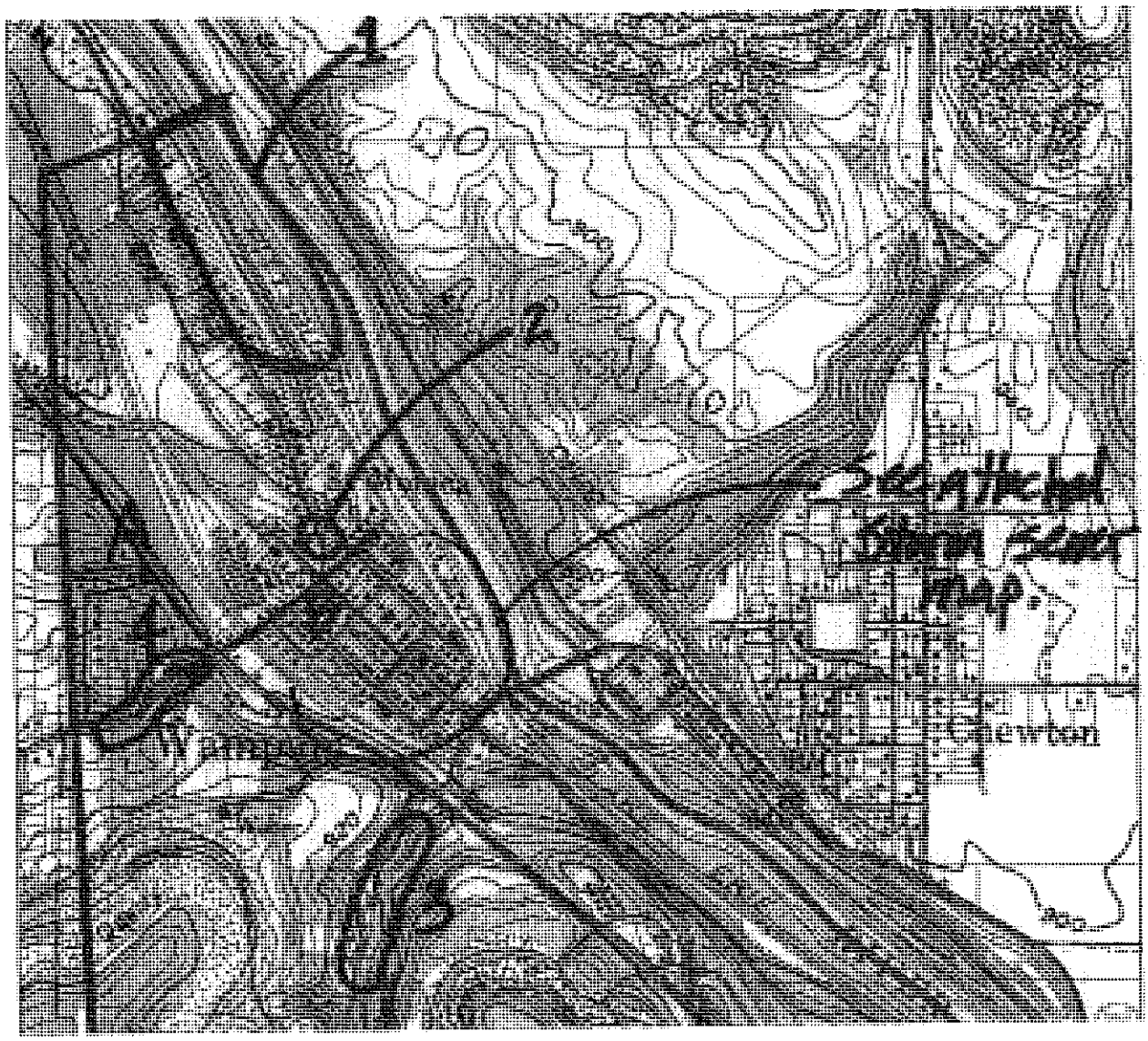
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	8 Optional Description:	1	1	3 NOW could become 2
2	13 Optional Description:	1 & 5	3	3
3	2 & 3 Optional Description:	1	4	3
4	2 & 3 Optional Description:	1	3	3
5	8 Optional Description:	1 & 2	1	3
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	Storm Sewer System - see Figure 1
B	Storm Sewer System - see Figure 2
C	Storm Sewer System - see Figure 3
D	Storm Sewer System - see Figure 4
E	Storm Sewer System - see Figure 5
F	Storm Sewer System - see Figure 6
G	Storm Sewer System - see Figure 7
H	Storm Sewer System - see Figure 8
I	Storm Sewer System - see Figure 9
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

Municipal Stormwater Problem Survey

Municipality: Borough of Ellwood City
Person Completing Form: Rhonda Zellhart
Phone Number: 724-758-4749; 724-333-5579 (cell)
Email Address: cehrenberg@access995.com

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☑	☐	
Zoning Ordinance	☑	☐	
Subdivision/Land Development Ordinance	☑	☐	
FEMA Flood Insurance Study-MAP	☐	☐	
Floodplain Regulations *	☐	☐	
Stormwater Management Regulations *	☐	☐	
Erosion Control Regulations *	☐	☐	
Drainage Regulations *	☐	☐	

In Bro Code.

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

RECEIVED
JUL 25 2007
BY.....

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☒ Yes ☐ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☒ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				**Not Important**
Peak Flow Rates	5	(4)	3	2	1
Water Quality	(5)	4	3	2	1
Groundwater Recharge	5	4	(3)	2	1
Stream Bank Protection	5	(4)	3	2	1
Flooding	5	4	(3)	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				**Strongly Oppose**
(5)	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

☒ Yes ☐ No

If Yes, please list your meeting representative's contact information below:

Name: Rhonda Zellhart, Operations Manager
Address: 525 Lawrence Ave. Ellwood City Pa. 16117
Phone Number: 724-758-4749; 724-333-5579 (cell)
Email Address: ccehrenberg@access995.com

6. Do you know of any existing or proposed flood control projects in your Municipality?

☐ Yes ☒ No

If yes, please describe the project(s) below:

_____
_____
_____
_____
_____

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

Name: _____
Organization: _____
Address: _____
Phone Number: _____
Email Address: _____

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☑ Yes ☐ No

   If No, please describe the location/problem(s) below:

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   Program was hit & miss & over the past few years it has developed structure & is becoming an active/proactive program.

   Labor & resources are limiting factors.

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

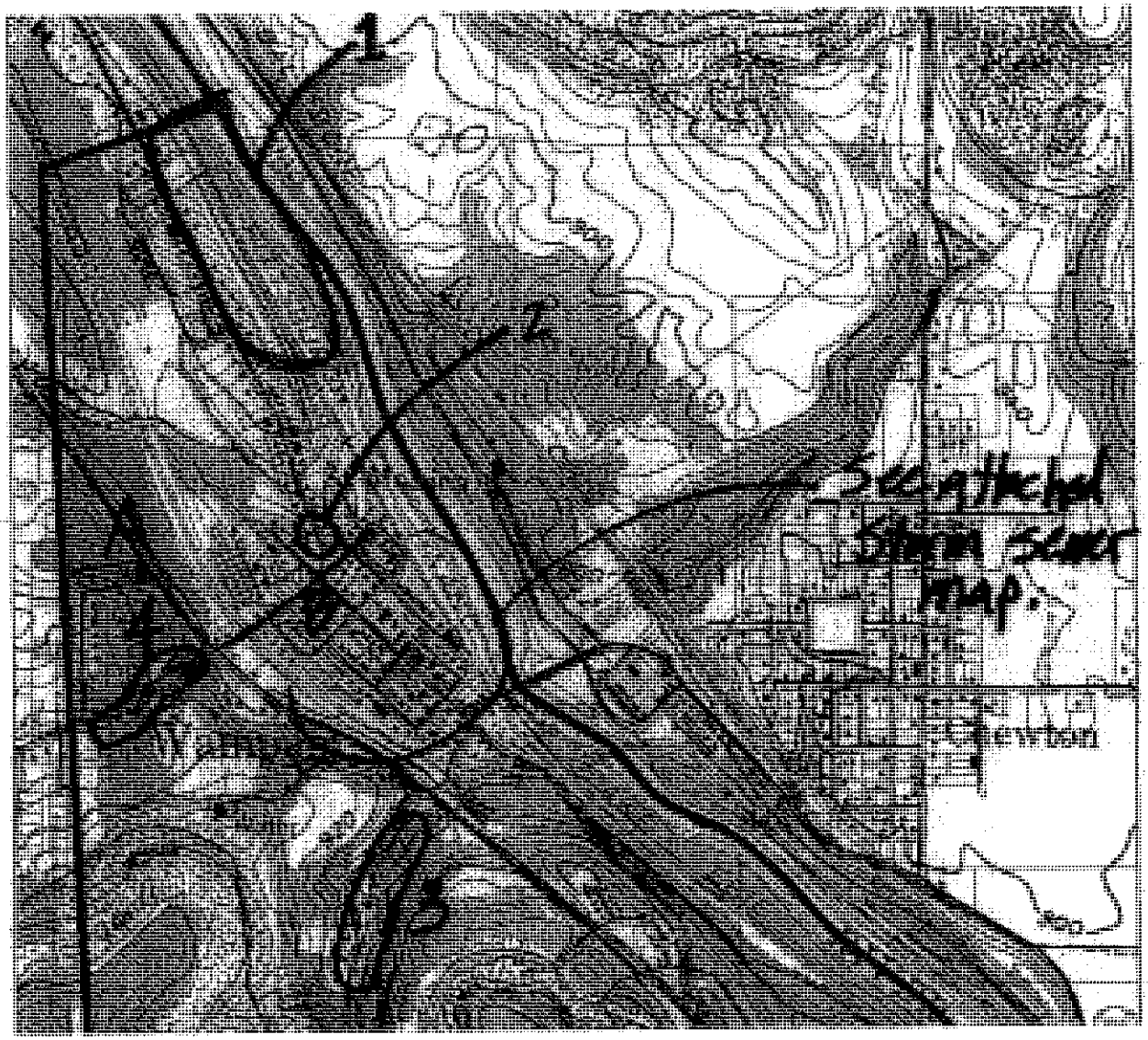
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

* pictures Attached for reference.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	TODD Ave Run	8 1 or 3	yearly	- Solids Backup - Bank/yard erosion
	Optional Description: - open Storm Culvert - Eroding			
2	South Street Run* - Same as #1			
	Optional Description: Bank, yard erosion - debris accumulation.			
	* This sight has possible Acid mine drainage entering the Run in Beaver County.			
3	Ewing Park - Combined Sewer System			
	Optional Description: 11 - inadequate infrastructure.			
	This system is old & was built as a combined system occassionaly we have problems. The number of problems have been greatly reduced by implementation of a more proactive maintenance program.			
4	Barry's Run - Same as 1 & 2 ~~No pict.~~			
	Optional Description:			
5	Bridge St. Run.		NO pict	
	Optional Description: Same as 1, 2, & 4			
	* Also has possible Acid mine drainage entering run from Wayne TWP.			
6	WWTP - storm steps. - old Storm outfall is deteriorating.			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

Municipal Stormwater Problem Survey

Municipality: NORTH BEAVER TWP.
Person Completing Form: JAMES GAGLIANO JR.
Phone Number: 724-667-9956
Email Address:

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater-related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☒	☐	
Zoning Ordinance	☒	☐	
Subdivision/Land Development Ordinance	☒	☐	
FEMA Flood Insurance Study	☒	☐	
Floodplain Regulations *	☒	☐	SO
Stormwater Management Regulations *	☒	☐	SL
Erosion Control Regulations *	☒	☐	SL
Drainage Regulations *	☒	☐	SL

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☐ Yes ☒ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				Not Important
Peak Flow Rates	5	4	3	2	1
Water Quality	5	4	3	2	1
Groundwater Recharge	5	4	3	2	1
Stream Bank Protection	5	4	3	2	1
Flooding	5	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				Strongly Oppose
5	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

   ☒ Yes ☐ No

   If Yes, please list your meeting representative's contact information below:

   Name: JAMES GAGLIANO, JR.
   Address: 225 OLD HICKORY ROAD NEW CASTLE PA 16102
   Phone Number: 724-667-7413
   Email Address: jjrgagliano@comcast.net

6. Do you know of any existing or proposed flood control projects in your Municipality?

   ☐ Yes ☒ No

   If yes, please describe the project(s) below:

   _____
   _____
   _____
   _____
   _____

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name: _____
   Organization: _____
   Address: _____
   Phone Number: _____
   Email Address: _____

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☒ Yes ☐ No

   If No, please describe the location/problem(s) below:

   AS NEEDED - BASICALLY, REMOVAL OF DEBRIS

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   THERE IS NO MANAGEMENT PLAN - MAINTAIN AS NEEDED

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

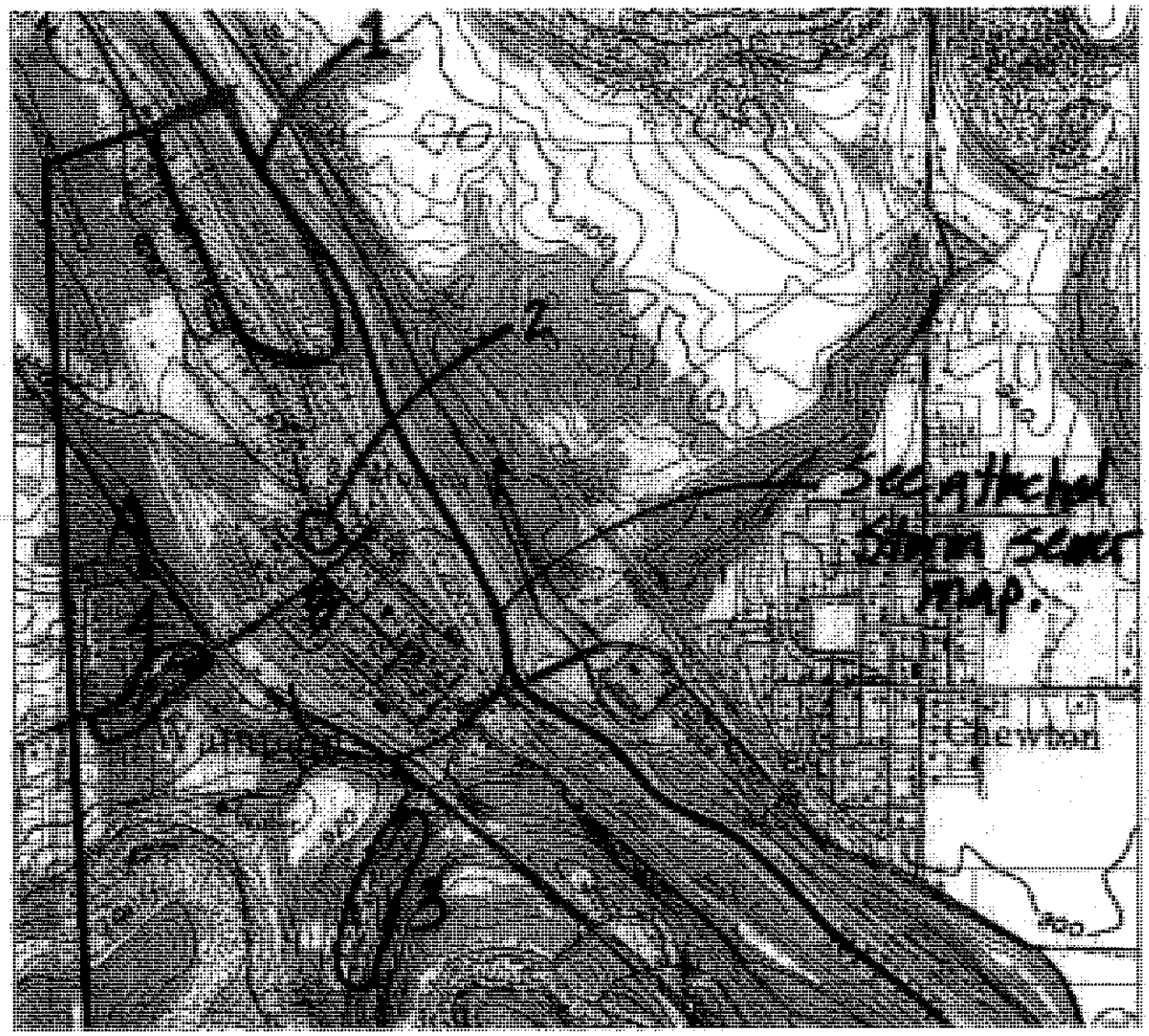
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

Most areas are small streams that overflow during heavy rains. Properties + streets flood depending on amount of rain.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	1	1		3
	Optional Description: Mallory / Halltown Road			
2	1	1		3
	Optional Description: Galilee / Wampum Rd			
3	1	1		3
	Optional Description: Willow Grove			
4	3	3		3
	Optional Description: Jackson Knolls			
5	1 & 3	1 & 3		3
	Optional Description: Hickory View			
6	3	1		3

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description: Westfield Rd. / Pond overflow			
7	1	1		3
	Optional Description: Moravia Rd			
8	1	1		3
	Optional Description: Moravia Rd			
9	1	1		3
	Optional Description: Moravia / Musser Rd			
10	1	1		3
	Optional Description: McClain Rd			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
11		1		3
	Optional Description: SNPJ, surface water washed out culverts			
12	3	1		3
	Optional Description: SNPJ. lake overflow			
13	1	1		3
	Optional Description: Enon Rd. / culvert			
14	1	1		3
	Optional Description: Smalls Ferry Rd			
15	2+3	1+3		3
	Optional Description: Smalls Ferry / Columbiana Rd			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
16	1 & 3	1		3
	Optional Description: East Beechwood Rd			
17	1 & 3	1 & 5		3
	Optional Description: Len Ann Drive			
18	2	1 & 3		3
	Optional Description: Mt. Jackson Rd / Mahoningtown swamp overflow			
19	2 & 3	1		3
	Optional Description: Covert Rd. / run off from Rt. 60 overpass			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	The Trails at Mt. Jackon
B	Hickory Creek / Skyview Drive
C	Hickory Creek Gorge
D	Southbreeze
E	Mohawk Medows
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

Municipal Stormwater Problem Survey

Municipality: Wilmington Twp Law Co
Person Completing Form: Dale Elder
Phone Number: 724-946-2562
Email Address: —

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater-related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	☐	☐	
Zoning Ordinance	☒	☐	
Subdivision/Land Development Ordinance	☒	☐	
FEMA Flood Insurance Study	☐	☐	
Floodplain Regulations *	☒	☐	
Stormwater Management Regulations *	☐	☐	
Erosion Control Regulations *	☐	☐	
Drainage Regulations *	☐	☐	

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

RECEIVED
JUL 25 2007
BY:

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☐ Yes ☐ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				Not Important
Peak Flow Rates	5	4	3	2	1
Water Quality	5	4	3	2	1
Groundwater Recharge	5	4	3	2	1
Stream Bank Protection	5	4	3	2	1
Flooding	5	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				Strongly Oppose
5	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

   ☒ Yes ☐ No

   If Yes, please list your meeting representative's contact information below:

   Name: Dale Elder
   Address: 2810 ST RT 956 Volant PA
   Phone Number: 724-946-3226
   Email Address:

6. Do you know of any existing or proposed flood control projects in your Municipality?

   ☐ Yes ☒ No

   If yes, please describe the project(s) below:

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name:
   Organization:
   Address:
   Phone Number:
   Email Address:

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☒ Yes ☐ No

   If No, please describe the location/problem(s) below:

   _____
   _____
   _____
   _____
   _____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   _____
   _____
   _____
   _____
   _____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

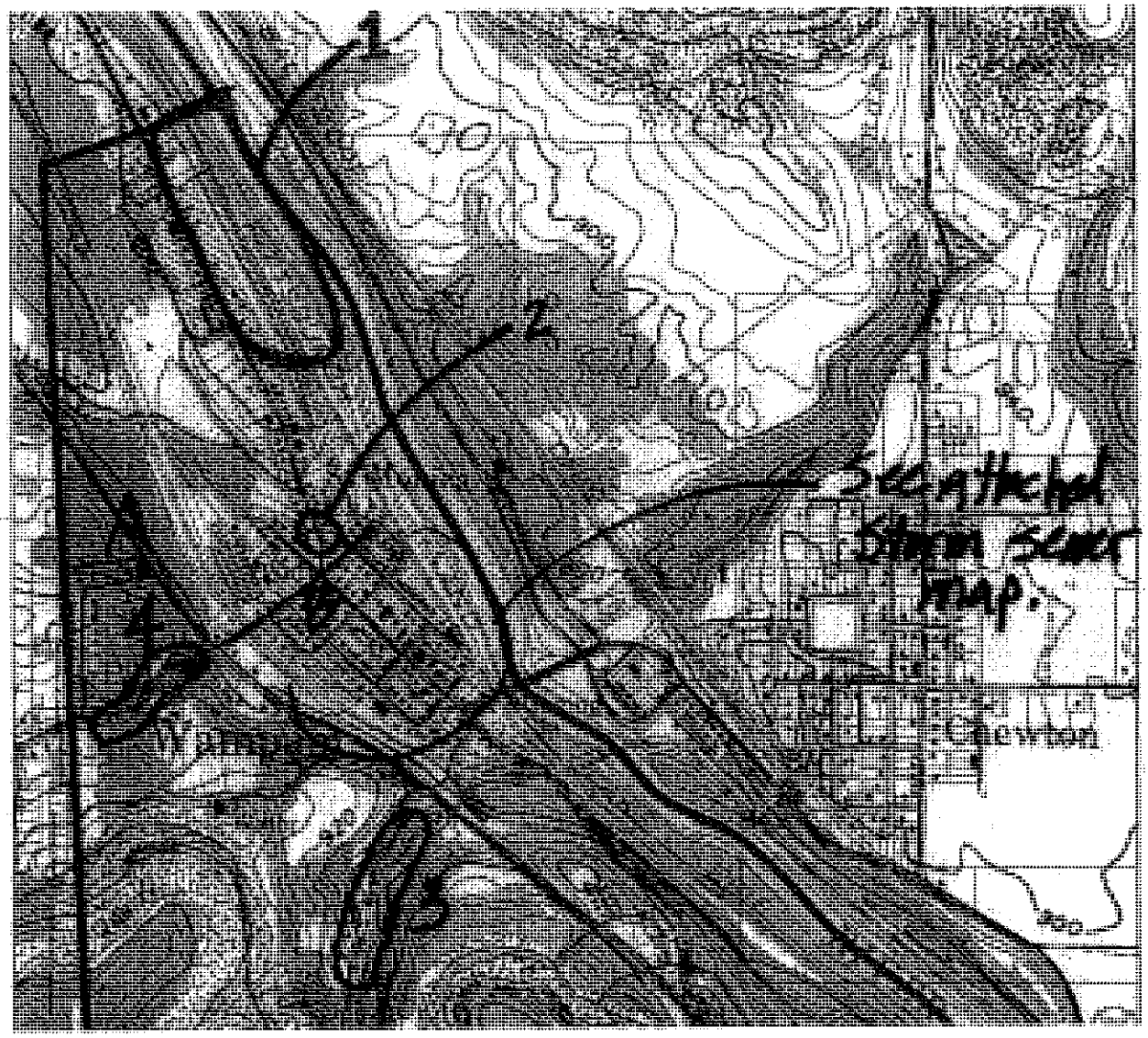
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	When we get lots of			
	Optional Description: Rain			
	Cottage Grove - Maywille - Wilson Camper Little Neshannock Creek.			
2	Fay - ~~Ave~~ Wilmington Area -			
	Optional Description: Red ing Stable - Area			
	Small stream - From 208 - When 1" Rain Flood Road			
3	And Basements			
	Optional Description: Big Neshannock Creek Near Maywille			
4	~~[illegible]~~ ~~[illegible]~~			
	Optional Description: Beechwood Rd, near Bond - 3 Foot Culvert flys up and			
5	- Needs Replaced Because of Heavy Rains -			
	Optional Description:			
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

Municipal Stormwater Problem Survey

Municipality: Enon Valley Borough
Person Completing Form: Tyrone W Petrich
Phone Number: 724-336-2661
Email Address:

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	X		
Zoning Ordinance			
Subdivision/Land Development Ordinance			
FEMA Flood Insurance Study	X		
Floodplain Regulations *	X		50
Stormwater Management Regulations *	X		50
Erosion Control Regulations *	X		50
Drainage Regulations *			

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   ☒ Yes ☐ No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   ☐ Yes ☐ No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				Not Important
Peak Flow Rates	5	(4)	3	2	1
Water Quality	5	4	(3)	2	1
Groundwater Recharge	5	4	(3)	2	1
Stream Bank Protection	5	(4)	3	2	1
Flooding	(5)	4	3	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				Strongly Oppose
(5)	4	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

   [X] Yes [ ] No

   If Yes, please list your meeting representative's contact information below:

   Name: Tyrone Petrich / Duane Clawson
   Address: P.O. Box 295 Enon Valley Pa. 16120
   Phone Number: 724-336-5968
   Email Address: veronica@ccia.com

6. Do you know of any existing or proposed flood control projects in your Municipality?

   [ ] Yes [X] No

   If yes, please describe the project(s) below:

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name: Kimball and Assoc.
   Organization:
   Address: 415 Moon Clinton Road, Coraopolis, Pa 15108
   Phone Number:
   Email Address:

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☒ Yes ☐ No

   If No, please describe the location/problem(s) below:

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   Refer to: Enon Valley Watershed Assesment

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

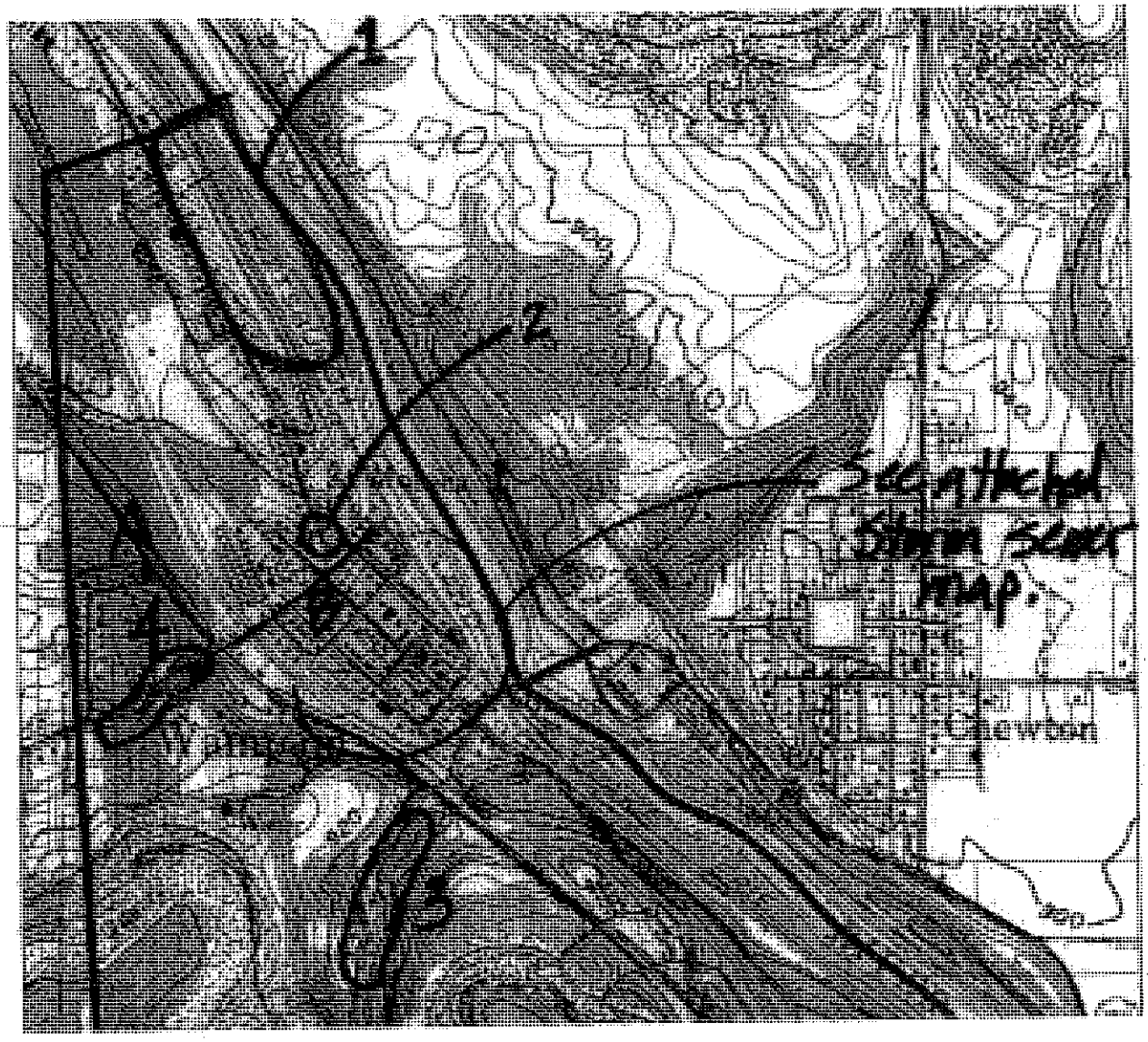
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A + Enclosures Refer to Enon Valley Watershed Assessment

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	Optional Description:			
2	Optional Description:			
3	Optional Description:			
4	Optional Description:			
5	Optional Description:			
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

ATTACHMENT B

Map ID	Description

Municipal Stormwater Problem Survey

Municipality:	City of New Castle
Person Completing Form:	Tamara P. Gibson
Phone Number:	724-656-3540
Email Address:	bus.admin@verizon.net

This survey is the initial stage of Lawrence County's stormwater planning effort for the entire County. Your input and information will help focus the future planning efforts on those areas experiencing stormwater–related problems.

The Survey has two sections. The first section requests general information about municipal ordinances and current municipal Stormwater – related issues and their priority to your community. The second section requests an inventory and identification of stormwater facilities, problem areas, and other related information.

SECTION 1

1. Please identify which of the following your Municipality has:

	YES	NO	LOCATION
Comprehensive Plan	X		
Zoning Ordinance	X		
Subdivision/Land Development Ordinance	X		
FEMA Flood Insurance Study	X		
Floodplain Regulations *	X		SO
Stormwater Management Regulations *	X		SO
Erosion Control Regulations *	X		SO & ZO
Drainage Regulations *	X		SO & ZO

* Please list where the regulation is found in the "Location" column (e.g., Subdivision / Land Development Ordinance, Zoning Ordinance, etc.) using the following abbreviations:
CP = Comprehensive Plan
ZO = Zoning Ordinance
SL = Subdivision/Land Development Ordinance
BC = Building Code
SO = Separate Ordinance

JUL 25 2007

BY:

2. Is your Municipality considered a small MS4 Municipality under the current NPDES Phase II stormwater regulations?

   [X] Yes [ ] No

   If yes, is your small MS4 Municipality currently in compliance with the NPDES Phase II Permit?

   [X] Yes [ ] No

3. The Lawrence County Act 167 Plan will address five (5) key stormwater design criteria, as listed below. Please identify the importance of each in your community.

	Very Important				Not Important
Peak Flow Rates	(5)	4	3	2	1
Water Quality	(5)	4	3	2	1
Groundwater Recharge	5	4	3	(2)	1
Stream Bank Protection	5	(4)	3	2	1
Flooding	5	4	(3)	2	1

Peak Flow Rates: Increased flow rates of stormwater runoff contribute to stream erosion, localized ponding, and flooding, which may cause damage to infrastructure.

Water Quality: Dissolved and un-dissolved pollutants washed off the land surface have negative impacts to recreation, aesthetics, and in-stream habitat.

Groundwater Recharge: Increased runoff volumes decrease the amount of rain that recharges groundwater. Decreased groundwater supplies may have negative effects on well water supplies and may decrease or eliminate stream baseflow during periods of dry weather.

Stream Bank Protection: Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, and clog and or scour culverts and bridges.

Flooding: Large scale overbank flows, such as the 50-year and 100-year floods associated with extreme storm events, cause damage to roads, bridges, culverts, etc.

4. Stormwater Management Plans are required under the Pennsylvania Stormwater Management Act, Act 167. Authorization to proceed with this plan as required by Act 167 has been given by the Lawrence County Commissioners. The long-term goal of this Plan will be to maintain the existing hydrologic conditions including: stream storm flows, water quality, groundwater levels, and stream base flow. With this in mind, what level of support will your Municipality or agency provide for this project?

Strongly Support				Strongly Oppose
5	(4)	3	2	1

5. Will your Municipality or agency be interested in attending future Watershed Plan Advisory Committee meetings?

   [X] Yes [ ] No

   If Yes, please list your meeting representative's contact information below:

   Name: Tamara P. Gibson
   Address: Municipal Building, 230 N. Jefferson Street
   New Castle, PA 16101-2220
   Phone Number: 724-656-3540
   Email Address: bus.admin@verizon.net

6. Do you know of any existing or proposed flood control projects in your Municipality?

   [ ] Yes [X] No

   If yes, please describe the project(s) below:

7. Would you suggest any other agencies or organizations that should be included on the Watershed Plan Advisory Committee? If so, please provide contact information below:

   Name:
   Organization: U.S. Army Corps of Engineers (Pittsburgh District)
   Address: William S. Moorhead Federal Building
   Phone Number: Project Management Branch
   Email Address: 1000 Liberty Avenue, Room 1805
   Pittsburgh, PA 15222-4186

8. Are existing (public or private) stormwater management facilities (storm sewer outfalls, detention/retention basins, etc.) being maintained (e.g., removal of debris from outlet structures, adequate control of vegetation, capacity maintenance, etc.)?

   ☒ Yes ☐ No

   If No, please describe the location/problem(s) below:

   _____
   _____
   _____
   _____
   _____

9. Please provide any input you feel is relevant regarding current watershed management procedures in your municipality.

   _____
   _____
   _____
   _____
   _____

SECTION 2

Step 1. On the attached map, please identify the location of the stormwater problem areas, obstructions, and those areas where you predict stormwater problems developing within the next 10 years. These predicted areas are often those areas where you see growing development pressure. When identifying the problem areas and obstructions, please give each a unique number, and try to outline the boundaries of the areas affected by the stormwater problem.

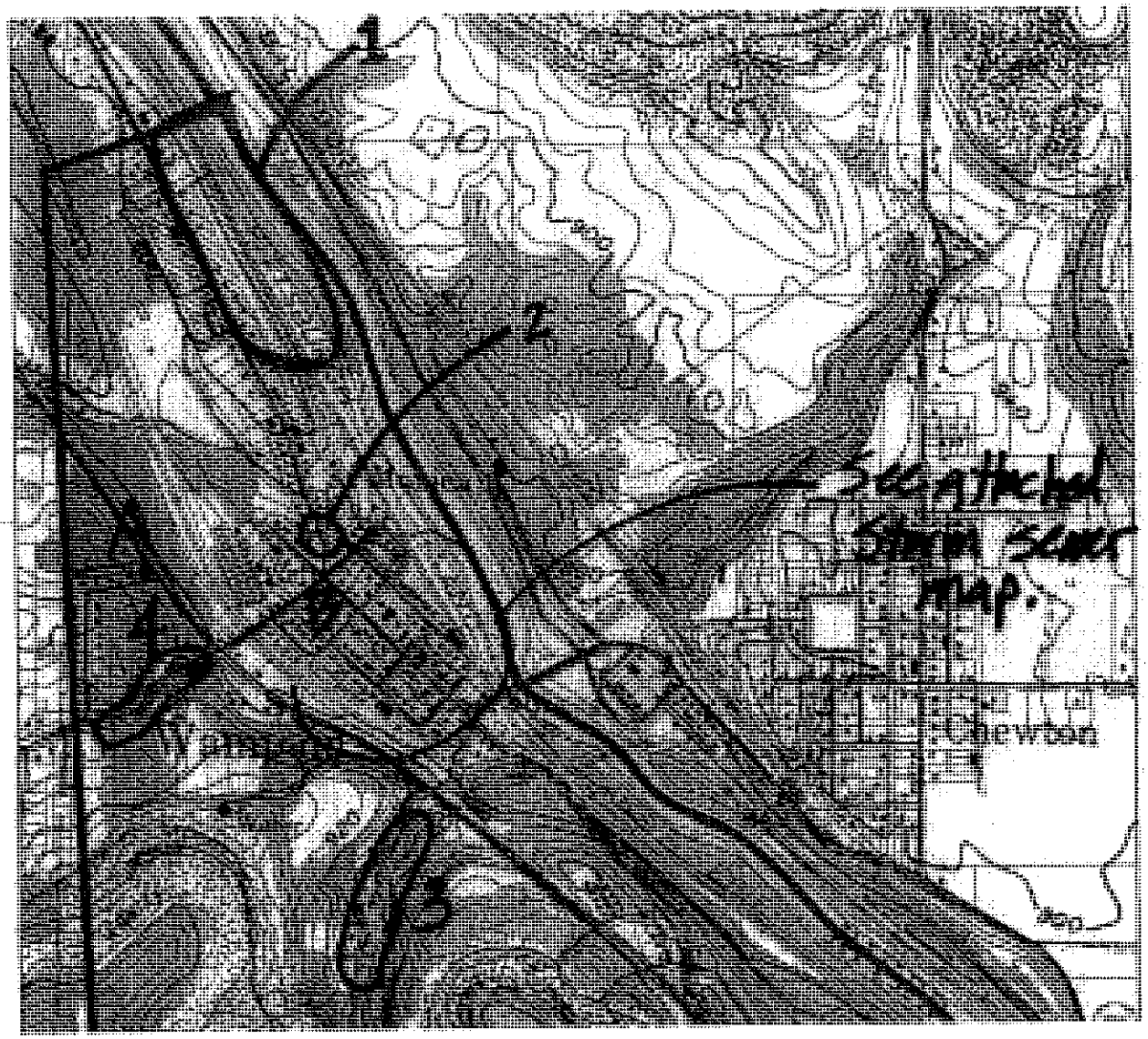
If you received an 11" x 17" map, a pen such as a Sharpie permanent marker works best because these smaller maps were printed on a laser printer.

Definitions:

Problem Areas - Areas of ponding or flooding, erosion, stream channel or bank erosion, property damage, safety concerns, etc.

Obstructions - Bridges, pipes, culverts, dams or other physical barriers to stream flow that restrict the channel flow and typically cause ponding or flooding upstream of the structure.

Refer to the examples below:



The above images are only examples, and may or may not be representative of the stormwater problems in the areas shown.

Step 2. For each problem area identified in Step 1, please use the form provided in Attachment A to describe the type of problem, the cause, how often the problem happens, and the type of damage.

To help you in this effort, we have prepared the following list of codes for you to use so that you do not have to write out detailed descriptions.

Problem Type	Description
1	Stream corridor flooding
2	Street flooding
3	Property flooding
4	Surface Water Pollution
5	Inadequate Infrastructure (culverts/bridges/etc.).
6	Accelerated soil erosion
7	Sediment in streams
8	Stream bed/bank erosion
9	Storm sewer outfall erosion
10	Surface Water Pollution
11	Inadequate Infrastructure (culverts/bridges/etc.)
12	Habitat/water resource loss or damage
13	Other

Problem Cause	Description
1	Increase in the amount of stormwater (volume)
2	Velocity of stormwater
3	Poor drainage
4	Discharge location (direction of flow)
5	Water obstruction
6	Floodplain development
7	Other

How Often?	Description
1	Occurs more than once per year
2	Occurs every 1 to 3 years
3	Occurs every 4 to 8 years
4	Only during major flood events

Damage Type	Description
1	Loss of life
2	Loss of vital services
3	Property damage

If a problem area solution is already planned, please identify the proposed solution in the "Optional Description" areas of Attachment A.

If you wish to more fully describe the stormwater problem(s), please feel free to write in your descriptions in the space provided below each Problem ID.

Step 3. Please also identify on the attached map all existing or proposed stormwater management or drainage facilities. These are storm sewer systems, permanent stormwater detention ponds, underground detention facilities or other systems or facilities intended to collect, convey, or detain stormwater.

Please place a letter on the map corresponding to each site. Use the form provided in Attachment B to provide a brief description of each facility.

Should you have any question about this Survey or about the information being requested, please do not hesitate to call either of the following:

Amy McKinney, Lawrence County Planning Director 724-656-2193

or

Tim Dean, L. Robert Kimball & Associates, 412-262-5400

We value your input and your responses will provide focus and direction for the County's stormwater planning process.

Please return the completed survey by June 22, 2007 to:

Amy McKinney
Lawrence County Planning Director
Lawrence County Planning Department
430 Court Street
New Castle, PA 16101

Thank you for participating.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
1	8 Optional Description:	1	1	3 NOW could become 2
2	13 Optional Description:	1 & 5	3	3
3	2 & 3 Optional Description:	1	4	3
4	2 & 3 Optional Description:	1	3	3
5	8 Optional Description:	1 & 2	1	3
6				

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT A

Map ID	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
7	Optional Description:			
8	Optional Description:			
9	Optional Description:			
10	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

(Copy this sheet for additional problem areas)

Problem ID (from map)	Problem Type	Problem Cause	How Often?	Damage Type
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			
	Optional Description:			

Should a problem area involve a culvert, storm sewer, or bridge, please provide the size or dimensions of the problem structures.

ATTACHMENT B

EXISTING OR PROPOSED STORMWATER MANAGEMENT OR DRAINAGE FACILITIES

Map ID	Description
A	Storm Sewer System - see Figure 1
B	Storm Sewer System - see Figure 2
C	Storm Sewer System - see Figure 3
D	Storm Sewer System - see Figure 4
E	Storm Sewer System - see Figure 5
F	Storm Sewer System - see Figure 6
G	Storm Sewer System - see Figure 7
H	Storm Sewer System - see Figure 8
I	Storm Sewer System - see Figure 9
J	
K	
L	
M	
N	

Map ID	Description
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

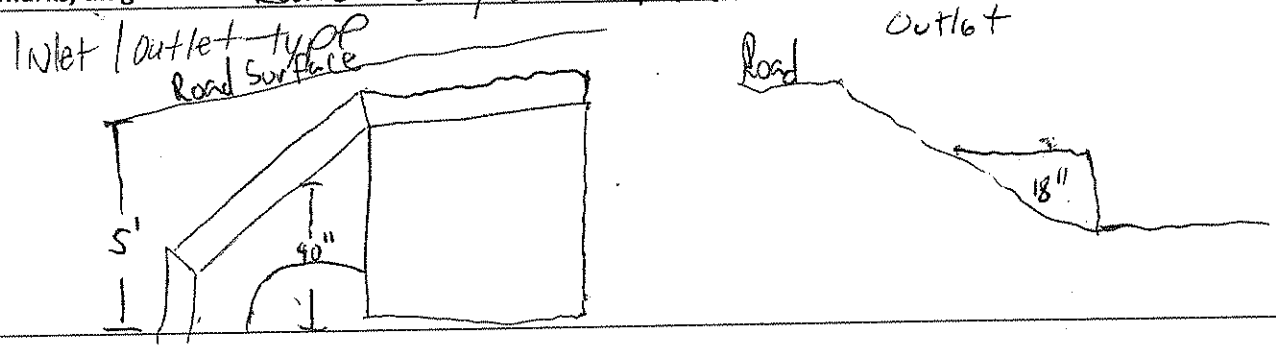
APPENDIX E FIELD VERIFICATION DATA

Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy / Jay / Megan	
Structure ID/Number: 1	Date: 10/27/09
Stream Name:	County: Lawrence
Watershed: ~~Hickory~~ / Shenango	
Photo ID: #1, #2	
Latitude: N 40° 58.23 ~~Min~~	W 80° 23.400 Longitude

Remarks/diagrams: Route 108 / Covert Road



Culvert Type: (please circle the type as shown below)

Diameter 18 in.
Number of Barrels: 1

Material: (select one)
- [x] RCP (Reinforced Concrete Pipe) Inlet
- [x] CMP (Corrugated Metal Pipe) outlet
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

BOX

Entrance Coefficient:	
Exit Coefficient:	
Length:	40'
Mannings n:	
Depth to Crown:	5'
Depth (inv. To stream bed)	13"
Bank Full Width (where poss.)	15"

Inlet/Outlet Type:
- [x] Headwall
- [x] Wingwalls:

Type: Concrete

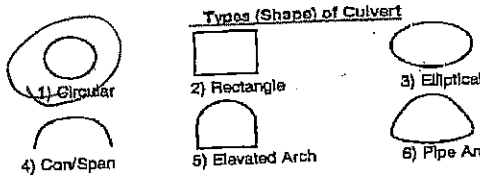
0° 45° 90° (circle)
- [x] Projecting
- [ ] Flush with Slope
- [x] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

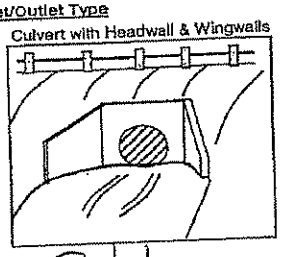
Types (Shape) of Culvert



7) Other

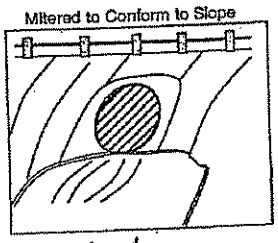
Inlet/Outlet Type

Culvert with Headwall & Wingwalls



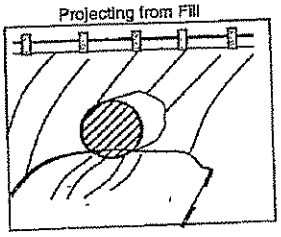
Inlet

Mitered to Conform to Slope



~~Outlet~~

Projecting from Fill



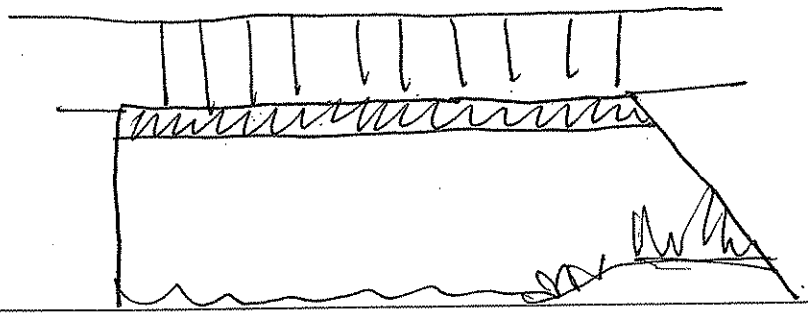
Outlet

Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 34	Date: 11/3/09
Stream Name: McCLURE	County: LAWRENCE
Watershed: McCLURE	
Photo ID: 119, 120	
Latitude: 41° 2.0431	Longitude 80° 19.863'

Remarks/diagrams: PEDESTRIAN BRIDGE



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 6'
Depth (inv. To stream bed) 5.5'
Bank Full Width (where poss.) 24'

Inlet/Outlet Type:
- [ ] Headwall
- [x] Wingwalls:

Type: _____

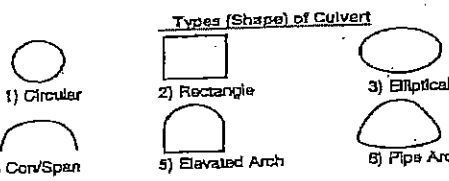
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 5.5'
Width of opening (abutment) 20'
Width of opening (obstruction) 32'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

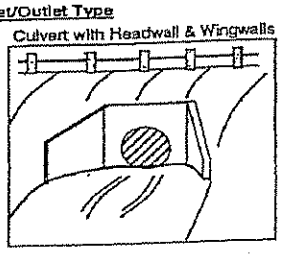
Types (Shape) of Culvert



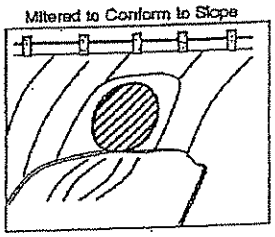
7) Other

Inlet/Outlet Type

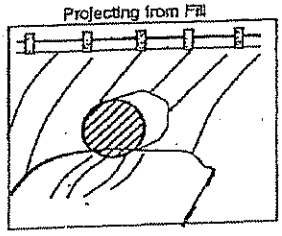
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



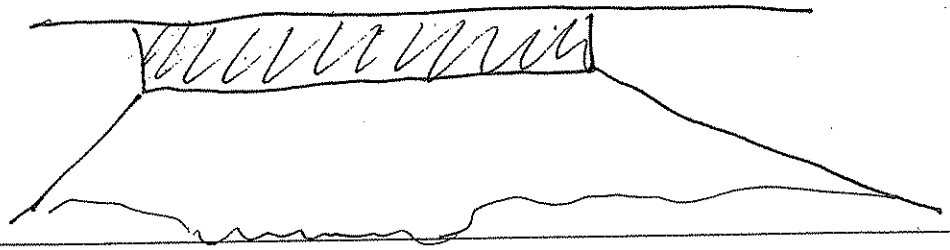
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Meg
Structure ID/Number: 35
Date: 11/3/09
Stream Name: McCURE
County: Lawrence
Watershed:
Photo ID: 121, 122, 123
Latitude: 41° 7.077'
Longitude 80° 19.775'

Remarks/diagrams: CAMPUS BRIDGE



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 6.5'
Depth (inv. To stream bed) 5'
Bank Full Width (where poss.) 17'

Inlet/Outlet Type:
- [ ] Headwall
- [X] Wingwalls:

Type: _____

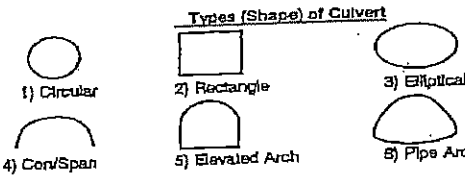
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 5'
Width of opening (abutment) 16.6"
Width of opening (obstruction) 32'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

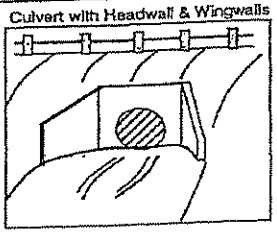
Types (Shape) of Culvert



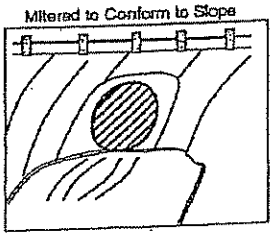
7) Other

Inlet/Outlet Type

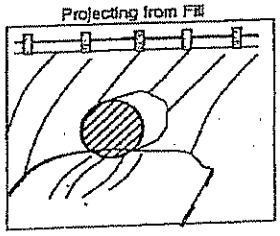
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

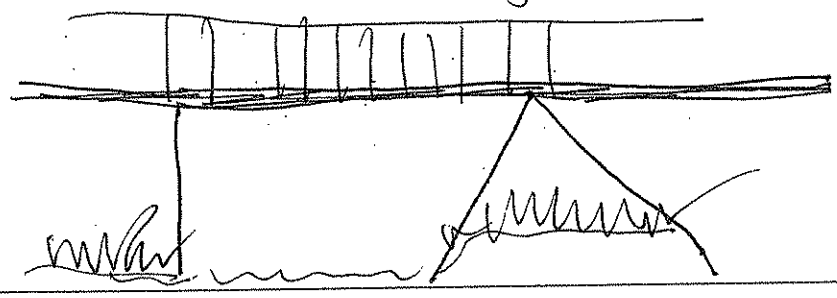


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Megan
Structure ID/Number: 36
Date: 11/3/09
Stream Name: McClure
County: Lawrence
Watershed:
Photo ID: 124, 125, 126
Latitude: 41° 7.148'
Longitude 80° 19.636'

Remarks/diagrams: ~~Culvert~~ Bridge



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 8.2'
Depth (inv. To stream bed) 7.3'
Bank Full Width (where poss.) 25'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

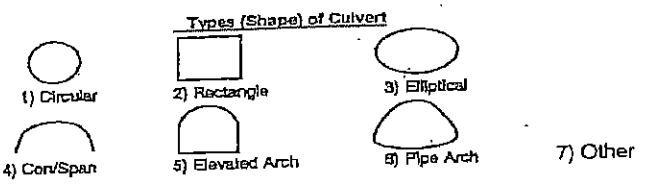
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 7.3'
Width of opening (abutment) 29'
Width of opening (obstruction) 20'6"

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

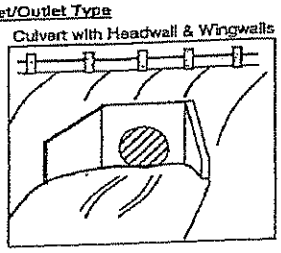
Types (Shape) of Culvert



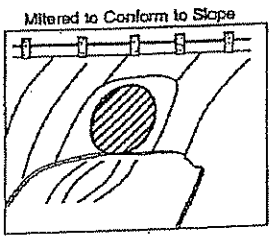
7) Other

Inlet/Outlet Type

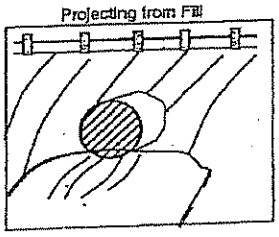
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



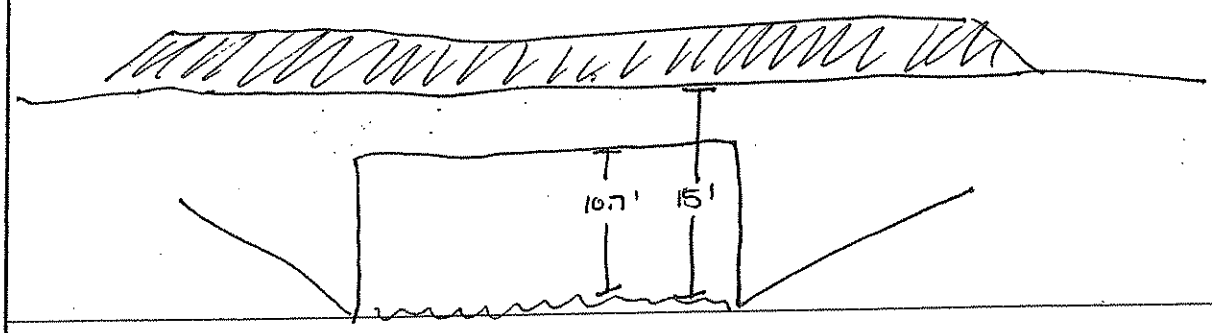
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Megan	
Structure ID/Number: 37 PT 158	Date: 11/3/09
Stream Name:	County: Lawrence
Watershed: McClure	
Photo ID: 127, 128, 129	
Latitude: 41°7.117'	Longitude 80°20.120'

Remarks/diagrams: PT 158



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 15'
Depth (inv. To stream bed) 10.7'
Bank Full Width (where poss.) 25'

Inlet/Outlet Type:
- [ ] Headwall
- [x] Wingwalls:

Type: _____

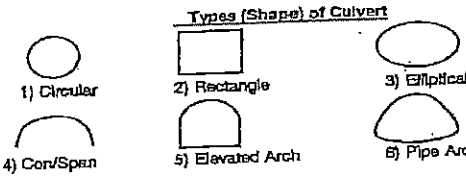
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 10.7'
Width of opening (abutment) 35'
Width of opening (obstruction) 58'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

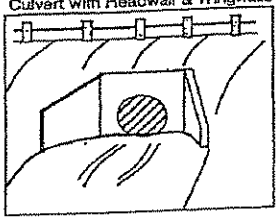
Types (Shape) of Culvert



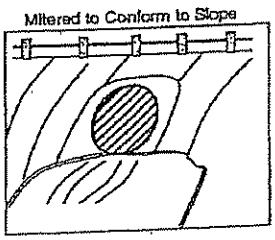
7) Other

Inlet/Outlet Type

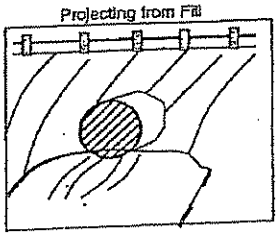
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



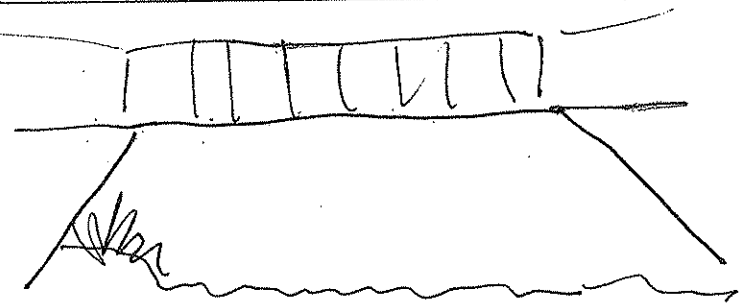
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Megan	
Structure ID/Number: 38	Date: 11/3/09
Stream Name:	County: Lawrence
Watershed: McCalmie	
Photo ID: 130, 131, 132	
Latitude: 41° 7.271'	Longitude 80° 20.521'

Remarks/diagrams: RT 208



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 10'
Depth (inv. To stream bed) 8.5'
Bank Full Width (where poss.) 15'

Inlet/Outlet Type:
- [ ] Headwall
- [x] Wingwalls:

Type: _____

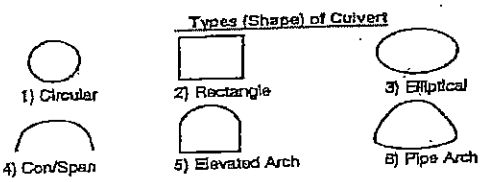
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 8.5'
Width of opening (abutment) 15'
Width of opening (obstruction) 22'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

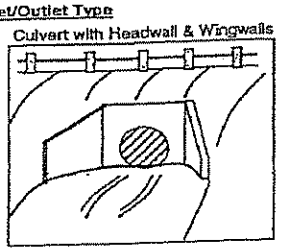
Types (Shape) of Culvert



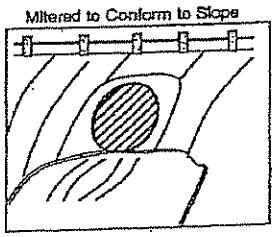
7) Other

Inlet/Outlet Type

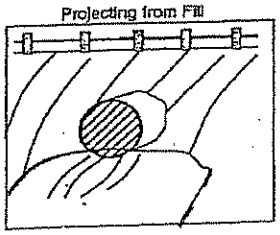
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

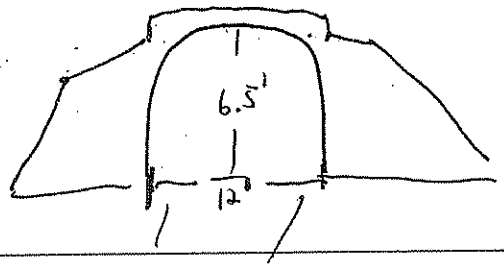


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s):	Amy Jay Meg		
Structure ID/Number:	39	Date:	11/3/09
Stream Name:	Trib to McClure	County:	Lawrence
Watershed:	McClure Run		
Photo ID:	133, 134, 135		
Latitude:	41°7.253'	Longitude	80°20.825'

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter: H 6.5' x W 12'
Number of Barrels: 1

Material: (select one)
- [✓] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: Approx 100'
Mannings n:
Depth to Crown: Approx 25'
Depth (inv. To stream bed) 6.5'
Bank Full Width (where poss.) 8'

Inlet/Outlet Type:
- [✓] Headwall
- [✓] Wingwalls:

Type:

0° 45° 90° (circle)

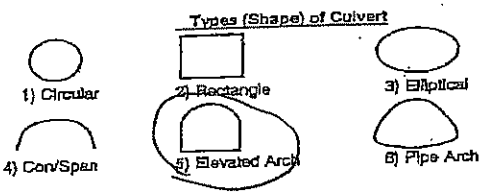
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

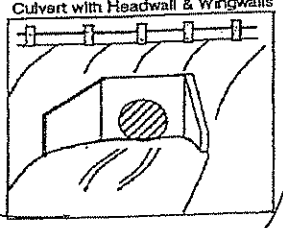
Types (Shape) of Culvert



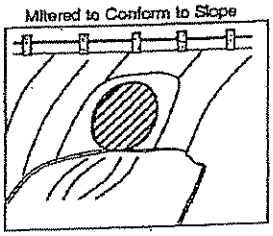
Outlet

Inlet/Outlet Type

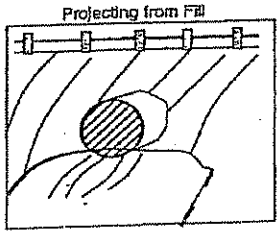
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



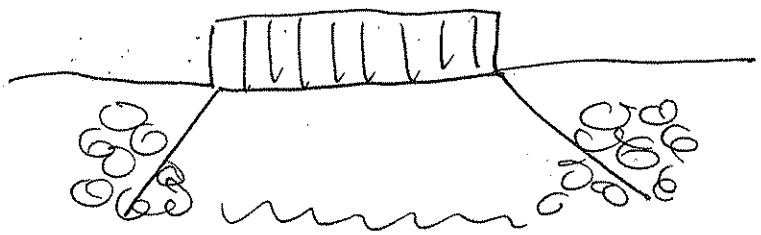
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s):	Amy Jay Meg		
Structure ID/Number:	40	Date:	11/3/09
Stream Name:	Trib to LW	County:	Lawrence
Watershed:	Little Neshannock		
Photo ID:	136, 137		
Latitude:	41° 7.541	Longitude	80° 19.980

Remarks/diagrams: RT 158



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 5'
Depth (inv. To stream bed) 4'
Bank Full Width (where poss.) 6'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

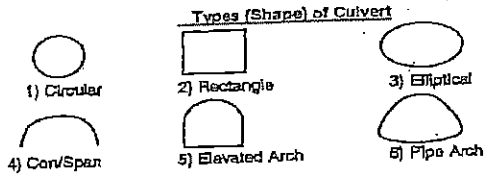
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 4'
Width of opening (abutment) 10'3"
Width of opening (obstruction) 14'

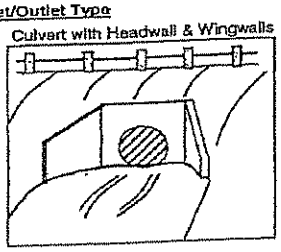
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

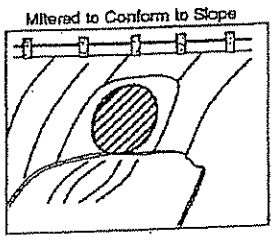


Inlet/Outlet Type

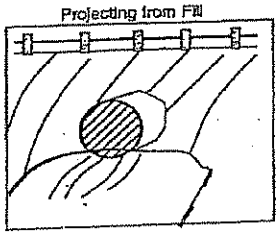
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



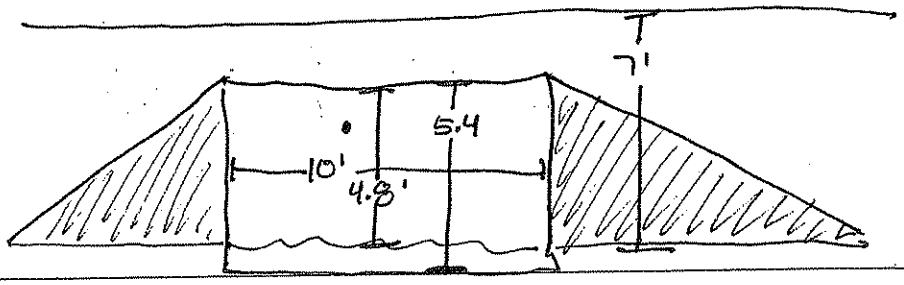
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Meg Jay	
Structure ID/Number: 41	Date: 11/3/09
Stream Name: Trib to LN	County:
Watershed: L. Neshannock	
Photo ID: 1, 2, 3 (Meg's camera)	
Latitude: 41° 7.630	Longitude 80° 20.089

Remarks/diagrams: Culvert



Culvert Type: (please circle the type as shown below)

Diameter 10'
Number of Barrels: 1

Material: (select one)
- [x] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 60'
Mannings n:
Depth to Crown: 7'
Depth (inv. To stream bed) 4.8'/5.4' sedimentatio
Bank Full Width (where poss.) 8'/

Inlet/Outlet Type:
- [x] Headwall
- [x] Wingwalls:

Type:

0° 45° 90° (circle)

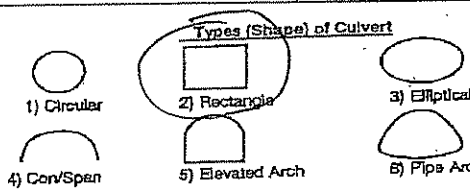
- [ ] Projecting
- [x] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

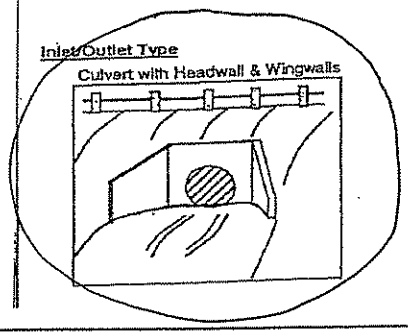
Types (Shape) of Culvert



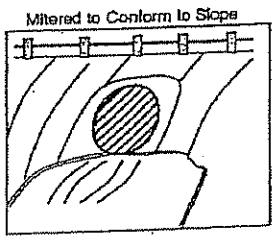
7) Other

Inlet/Outlet Type

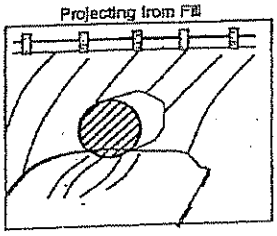
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



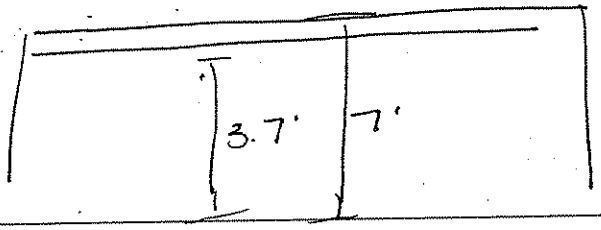
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 42	Date: 11/3/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 4, 5, 6	
Latitude: 41° 7.356	Longitude 80° 18.913

Remarks/diagrams: Bridge



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)

- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: _____
Depth (inv. To stream bed) _____
Bank Full Width (where poss.) 10'

Inlet/Outlet Type:

- [ ] Headwall
- [ ] Wingwalls:

Type: _____

0° 45° 90° (circle)

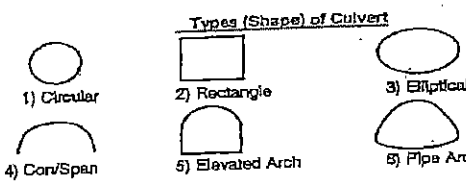
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 3' 7"
Width of opening (abutment) 9.5'
Width of opening (obstruction) 15'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

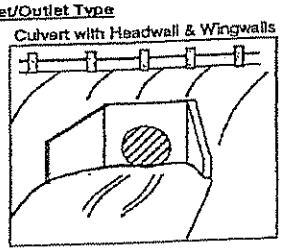
Types (Shape) of Culvert



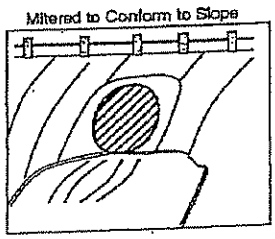
7) Other

Inlet/Outlet Type

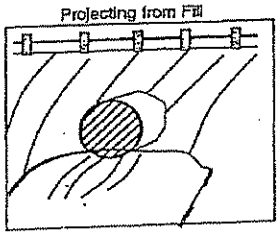
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

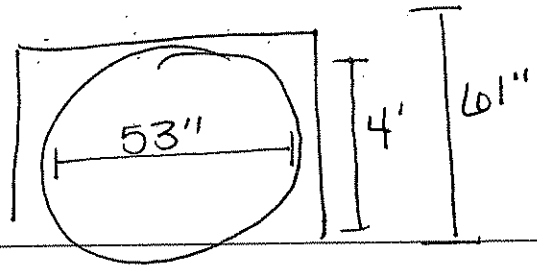


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Meg Jay	
Structure ID/Number: 43	Date: 11/3/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 7. 8. 9	
Latitude: 41° 6.994	Longitude 80° 18.934

Remarks/diagrams: ~~Bridge~~ Culvert



Culvert Type: (please circle the type as shown below)

Diameter 53"
Number of Barrels: 1

Material: (select one)
- [x] RCP (Reinforced Concrete Pipe)
- [x] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 31'
Mannings n:
Depth to Crown: 61"
Depth (inv. To stream bed) 4'
Bank Full Width (where poss.) 8'

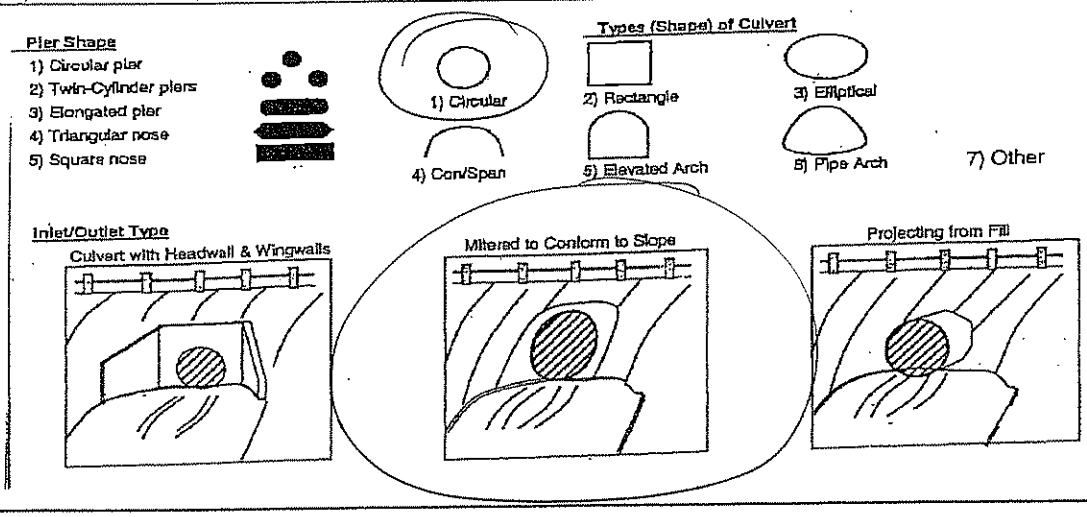
Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type:

0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)



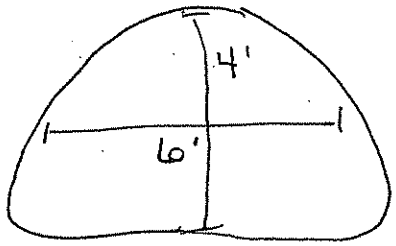
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 44	Date: 11/3/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 10, 11, 12	
Latitude: 40°6.303	Longitude 80°8.696

Remarks/diagrams: Culvert



Culvert Type: (please circle the type as shown below)

Diameter 6' W 4' H

Number of Barrels:

Material: (select one)

- [ ] RCP (Reinforced Concrete Pipe)
- [x] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 35'
Mannings n:
Depth to Crown: 6'
Depth (inv. To stream bed) 4'
Bank Full Width (where poss.) 6'

Inlet/Outlet Type:

- [ ] Headwall
- [ ] Wingwalls:

Type:

0° 45° 90° (circle)

- [x] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers

Number of Piers
Width
Width of Opening (c to c)

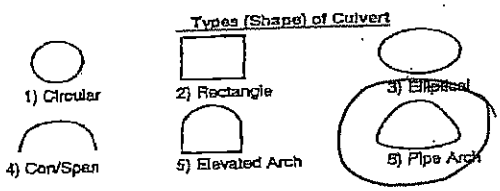
Bridge Measurements

Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

Pier Shape

1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

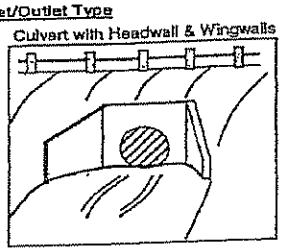
Types (Shape) of Culvert



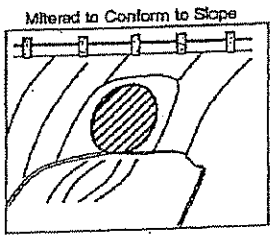
7) Other

Inlet/Outlet Type

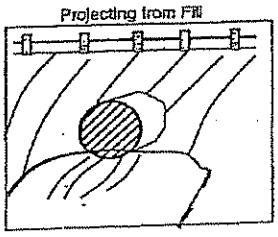
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



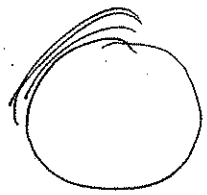
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Meg Jay	
Structure ID/Number: 45	Date: 11/3/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 13 14 15 16	
Latitude: 41° 6.073	Longitude 80° 18.501

Remarks/diagrams: Culvert



Culvert Type: (please circle the type as shown below)

Diameter 36"
Number of Barrels: 1

Material: (select one)

- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [x] Other: ~~PVC~~ Plastic - Smooth wall

Entrance Coefficient:
Exit Coefficient:
Length: 104'
Mannings n:
Depth to Crown: ~~7'~~ 4'
Depth (inv. To stream bed) 2'8"
Bank Full Width (where poss.) 3'

Inlet/Outlet Type:

- [ ] Headwall
- [ ] Wingwalls:
- Type:

0° 45° 90° (circle)

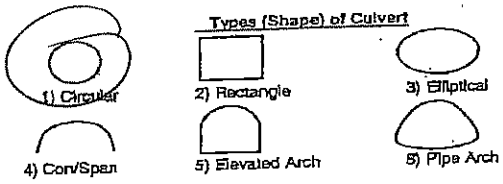
- [x] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

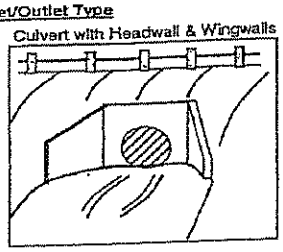
Types (Shape) of Culvert



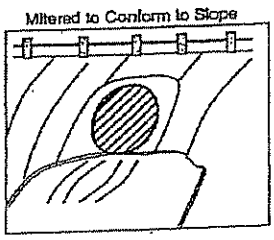
7) Other

Inlet/Outlet Type

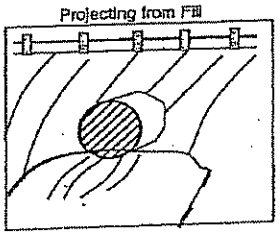
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



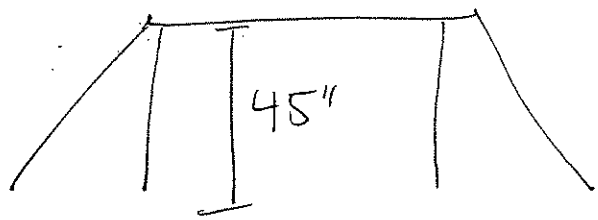
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy, Jay Megan	
Structure ID/Number: 46	Date: 11/3/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 17, 18, 19	
Latitude: 41° 7.105	Longitude 80° 17.012

Remarks/diagrams: Culvert - Barbwire



Culvert Type: (please circle the type as shown below)

Diameter 45"
Number of Barrels:

Material: (select one)
- [x] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 68'
Mannings n:
Depth to Crown: ~~13'5"~~ 13'
Depth (inv. To stream bed)
Bank Full Width (where poss.) 8'

Inlet/Outlet Type:
- [ ] Headwall
- [x] Wingwalls:

Type: concrete

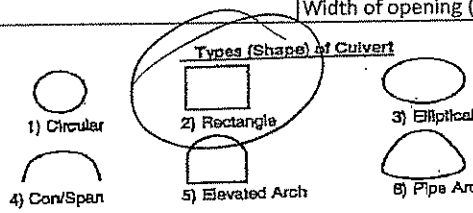
	0°	45°	90°	(circle)
Projecting				
Flush with Slope				
MES (mitered end section)				
FES (flared end section)				

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

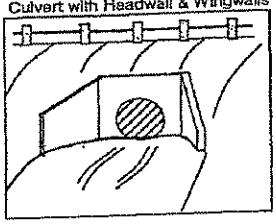
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

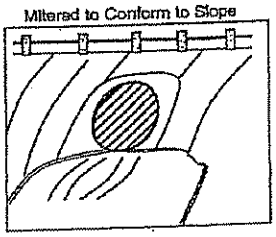


Inlet/Outlet Type

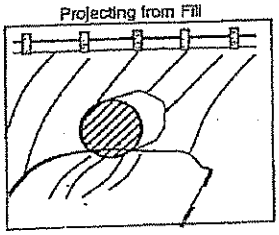
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



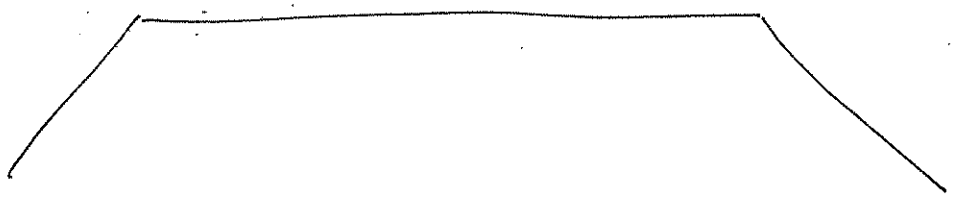
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Mey
Structure ID/Number: 47
Date: 11/3/09
County: Lawrence
Stream Name:
Watershed:
Photo ID: 20 21 22
Latitude: 41° 7.070
Longitude 80° 16.870

Remarks/diagrams: ~~Culvert~~ Bridge



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 12'
Depth (inv. To stream bed) _____
Bank Full Width (where poss.) 20'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

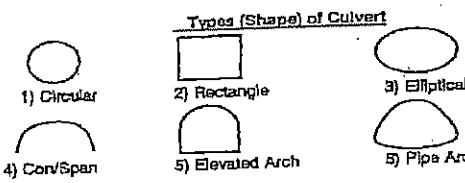
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 5'
Width of opening (abutment) 16'
Width of opening (obstruction) 24"

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

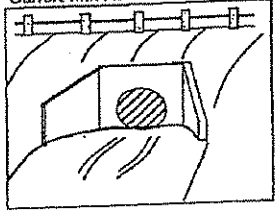
Types (Shape) of Culvert



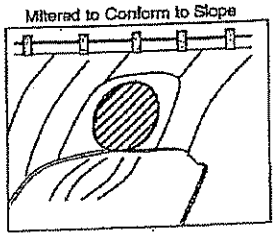
7) Other

Inlet/Outlet Type

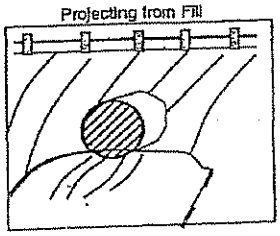
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



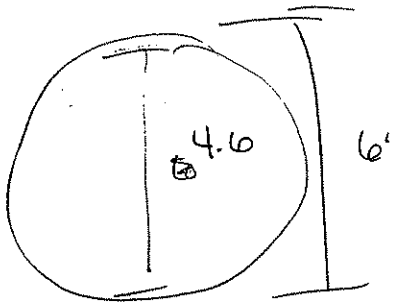
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 48	Date: 11/3/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 23, 24, 25	
Latitude: 41° 6.967	Longitude 80° 15.472

Remarks/diagrams: Culvert



Culvert Type: (please circle the type as shown below)

Diameter 4.6
Number of Barrels:

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [x] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 36'
Mannings n:
Depth to Crown: 6'
Depth (inv. To stream bed) 4.6'
Bank Full Width (where poss.) 7'

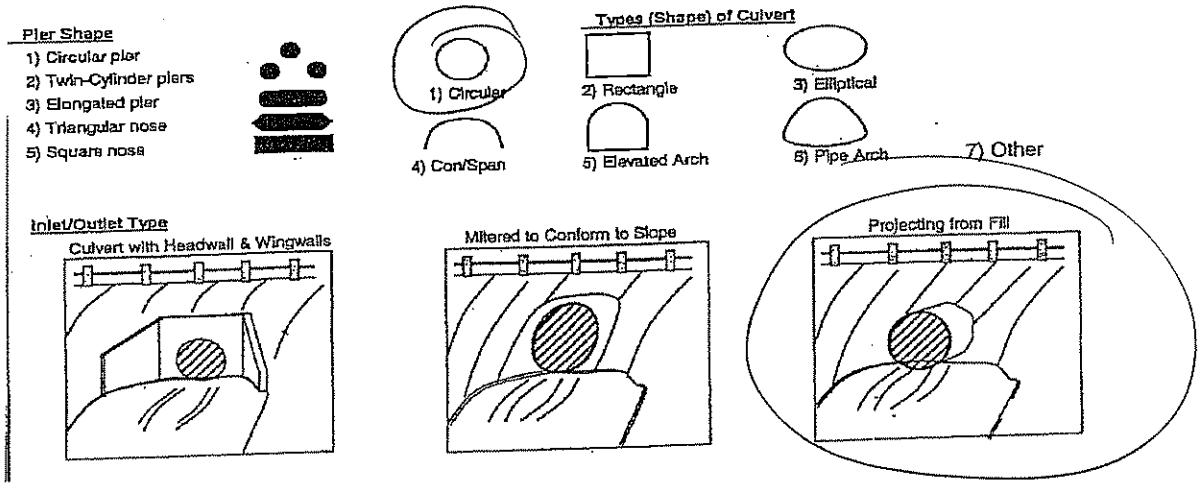
Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type:

0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)



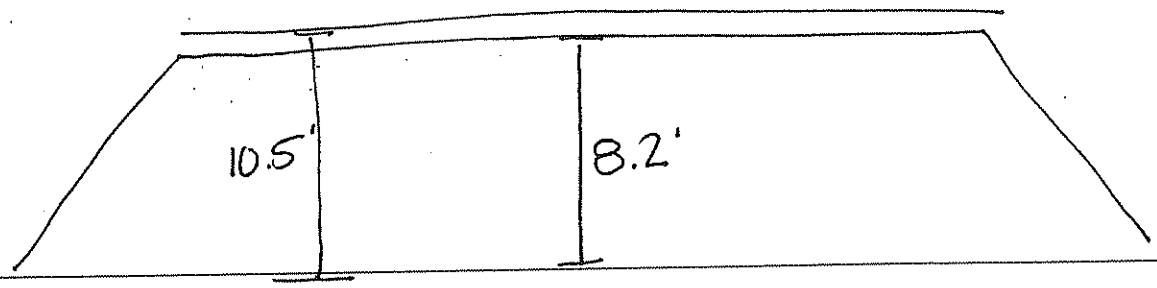
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Meg
Structure ID/Number: 49
Date: 11/3/09
Stream Name:
County: Lawrence
Watershed:
Photo ID: 26, 27, 28, 29
Latitude: 41° 6.758
Longitude 80° 15.461

Remarks/diagrams: Bridge



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 10.5'
Depth (inv. To stream bed) _____
Bank Full Width (where poss.) 24'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

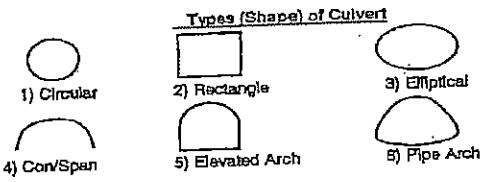
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 8.2'
Width of opening (abutment) 36'
Width of opening (obstruction) 44'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

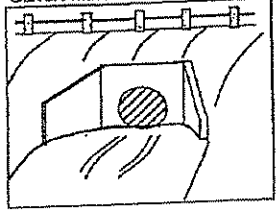
Types (Shape) of Culvert



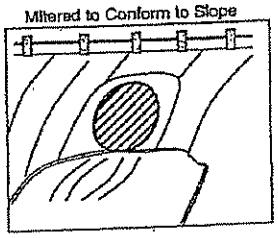
7) Other

Inlet/Outlet Type

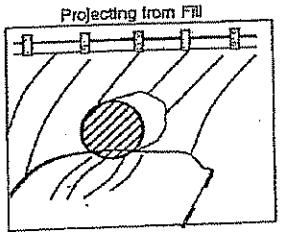
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



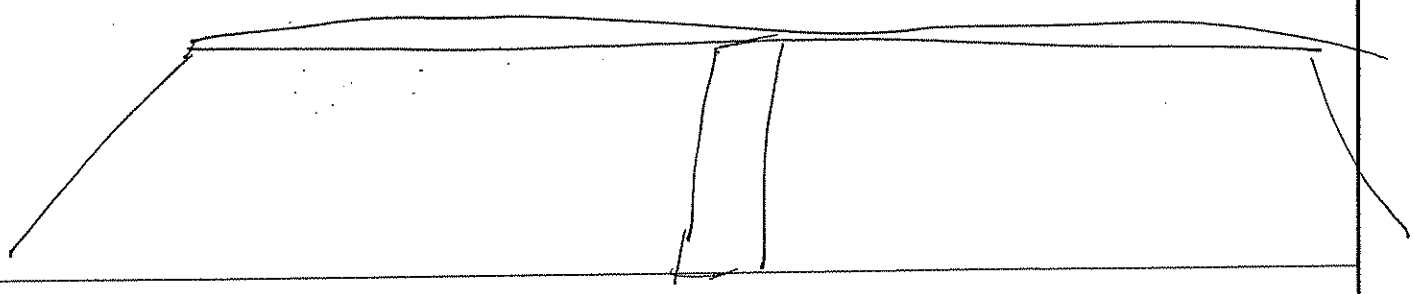
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 50	Date: 11/3/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: ~~29~~ 30,31,32	
Latitude: ~~41~~ 41°2.728	Longitude 80°15.402

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient:	
Exit Coefficient:	
Length:	
Mannings n:	
Depth to Crown:	20.2'
Depth (inv. To stream bed)	
Bank Full Width (where poss.)	94'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

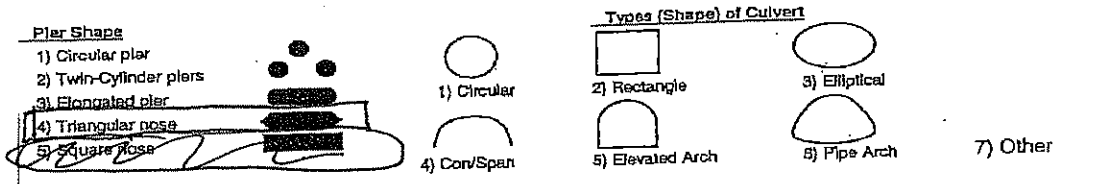
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

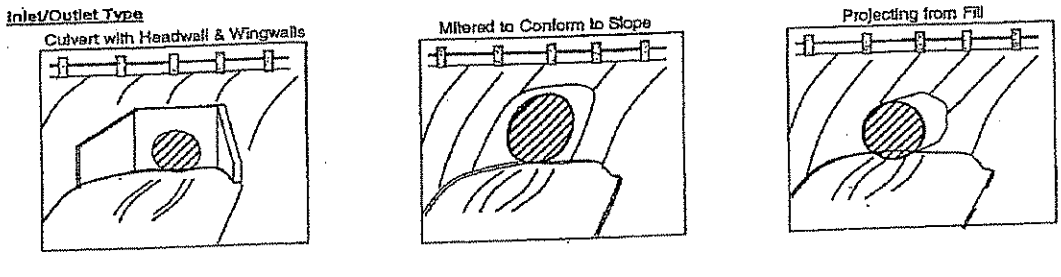
Piers

Number of Piers	1
Width	1
Width of Opening (c to c)	76'

Bridge Measurements

Center of stream to bottom of structure:	18.6'
Width of opening (abutment)	154'
Width of opening (obstruction)	173'





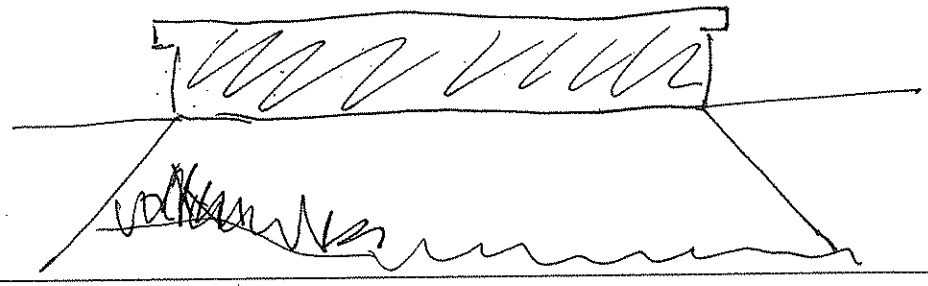
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Megan	
Structure ID/Number: 51	Date: 11/3/09
Stream Name: TRIB TO NESH	County: Lawrence
Watershed:	
Photo ID: 33, 34	
Latitude: 41° 6.571	Longitude 80°15.256

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 8'
Depth (inv. To stream bed) 8'
Bank Full Width (where poss.) 14'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

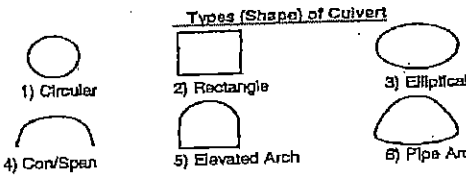
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 6'
Width of opening (abutment) 35'
Width of opening (obstruction) 53'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

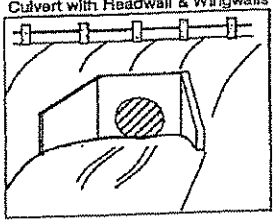
Types (Shape) of Culvert



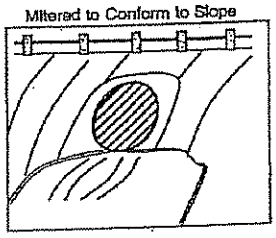
7) Other

Inlet/Outlet Type

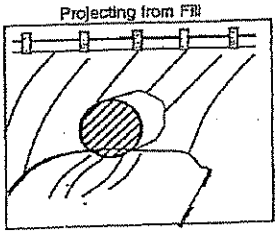
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



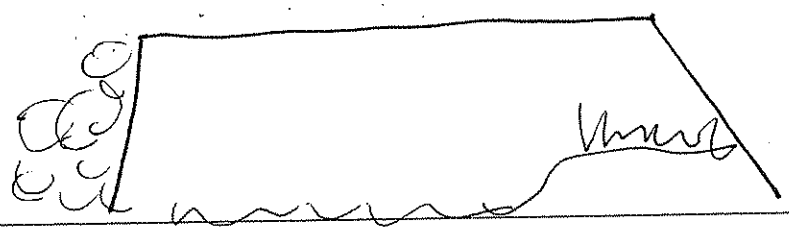
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: S2	Date: 11/3/09
Stream Name: TRIB. NESH	County: Lawrence
Watershed:	
Photo ID: 35 36	
Latitude: 41° 6.582	Longitude 80° 15.319

Remarks/diagrams: PT 168



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient:	
Exit Coefficient:	
Length:	
Mannings n:	
Depth to Crown:	15'
Depth (inv. To stream bed)	12.2'
Bank Full Width (where poss.)	30'

Inlet/Outlet Type:
- [ ] Headwall
- [x] Wingwalls:

Type: _____

0° 45° 90° (circle)

- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers

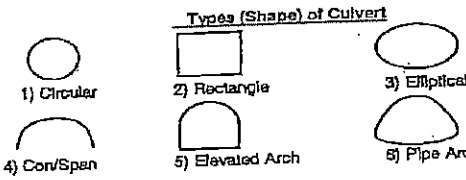
Number of Piers	
Width	
Width of Opening (c to c)	

Bridge Measurements

Center of stream to bottom of structure:	12.2'
Width of opening (abutment)	34'
Width of opening (obstruction)	47'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

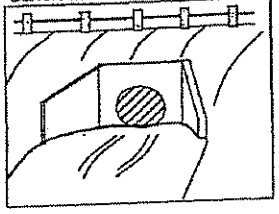
Types (Shape) of Culvert



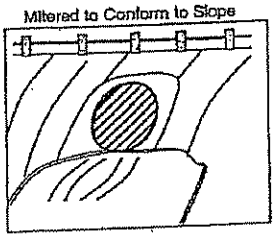
7) Other

Inlet/Outlet Type

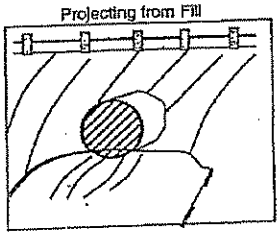
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay ~~Bill~~ Meg	
Structure ID/Number: 53	Date: 11/3/09
Stream Name: TRIB to Nash	County: Lawrence
Watershed:	
Photo ID: 37, 38	
Latitude: 41° 6.531	Longitude 80° 14.556

Remarks/diagrams: Culvert

Culvert Type: (please circle the type as shown below)

Diameter 14'
Number of Barrels:

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [x] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 79'
Mannings n:
Depth to Crown: 10'
Depth (inv. To stream bed) 6.8'
Bank Full Width (where poss.) 15'

Inlet/Outlet Type:
- [x] Headwall
- [x] Wingwalls:

Type:

0° 45° 90° (circle)

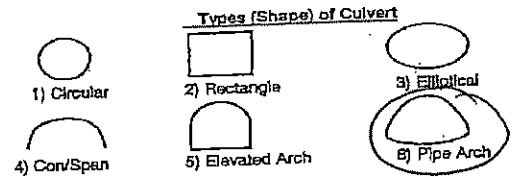
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

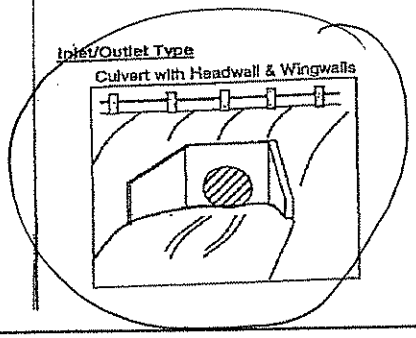
Types (Shape) of Culvert



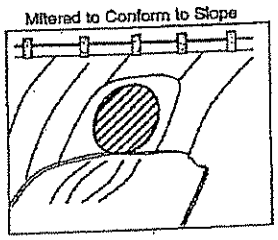
7) Other

Inlet/Outlet Type

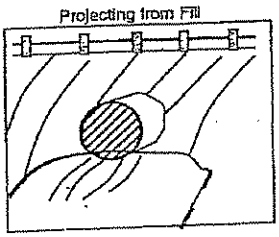
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



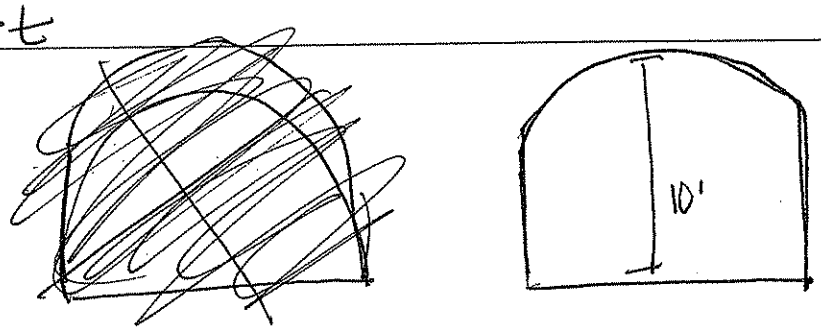
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Meg Jay	
Structure ID/Number: 54	**Date:** 11/3/09
Stream Name:	**County:** Lawrence
Watershed:	
Photo ID: 39 40 41 42 43	
Latitude: 41° 5.883	**Longitude** 80° 15.563

Remarks/diagrams: Culvert



Culvert Type: (please circle the type as shown below)

Diameter 10'
Number of Barrels:

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 51'
Mannings n:
Depth to Crown: ~~15~~ 14'
Depth (inv. To stream bed) 8'
Bank Full Width (where poss.) 5'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls: Endwalls

Type:

0° 45° 90° (circle)

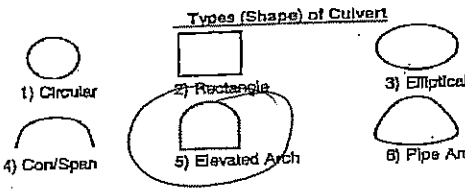
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

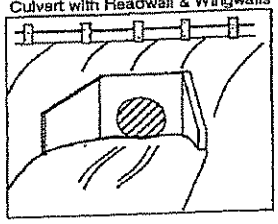
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

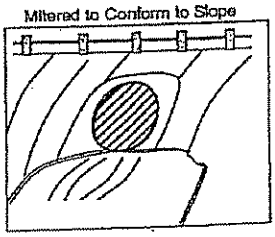


Inlet/Outlet Type

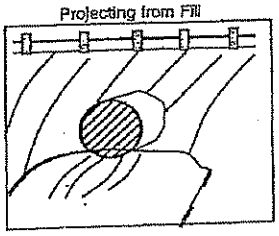
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



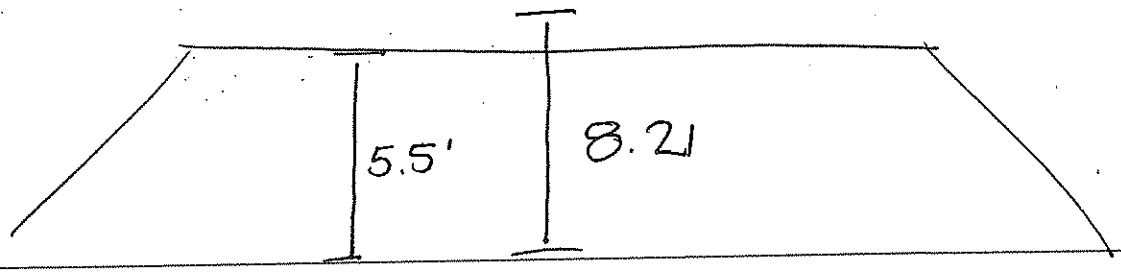
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy, Jay, Meg	
Structure ID/Number: 55	Date: 11/3/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 44 45 46	
Latitude: 41°5.708	Longitude 80°14.122

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 8.2'
Depth (inv. To stream bed) _____
Bank Full Width (where poss.) 15'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

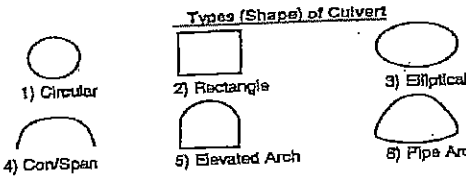
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 5.5'
Width of opening (abutment) 20'
Width of opening (obstruction) 28'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

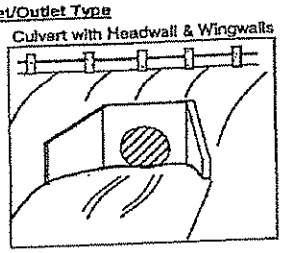
Types (Shape) of Culvert



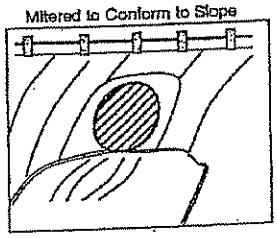
7) Other

Inlet/Outlet Type

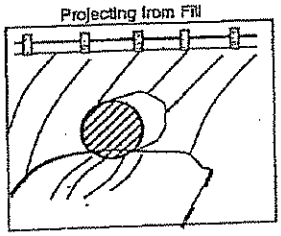
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

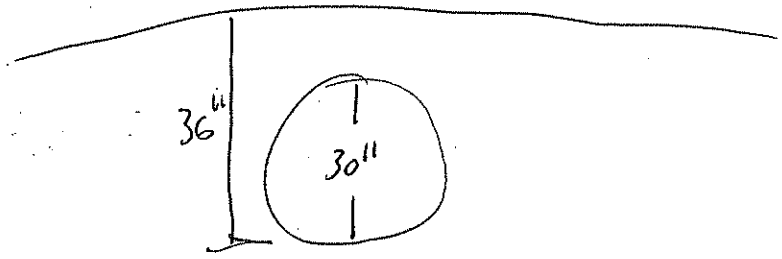


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 56	Date: 11/3/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 47, 48 49, 50	
Latitude: 41° 4.275'	Longitude 80° 13.114'

Remarks/diagrams: Culvert



Culvert Type: (please circle the type as shown below)

Diameter 30"
Number of Barrels:

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [x] Other: Plastic - smooth on inside

Entrance Coefficient:
Exit Coefficient:
Length: 40'
Mannings n:
Depth to Crown: 36"
Depth (inv. To stream bed)
Bank Full Width (where poss.) N/A wetland

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

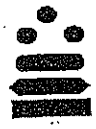
Type:

	0°	45°	90°	(circle)
[x] Projecting				
[ ] Flush with Slope				
[ ] MES (mitered end section)				
[ ] FES (flared end section)				

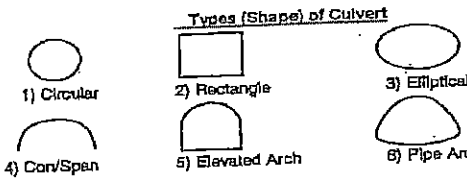
Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose



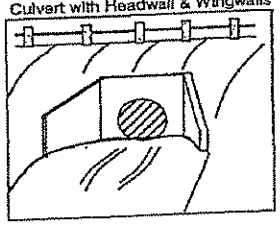
Types (Shape) of Culvert



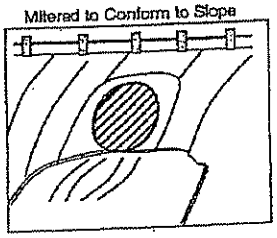
7) Other

Inlet/Outlet Type

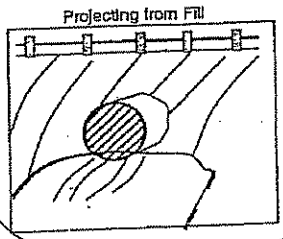
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

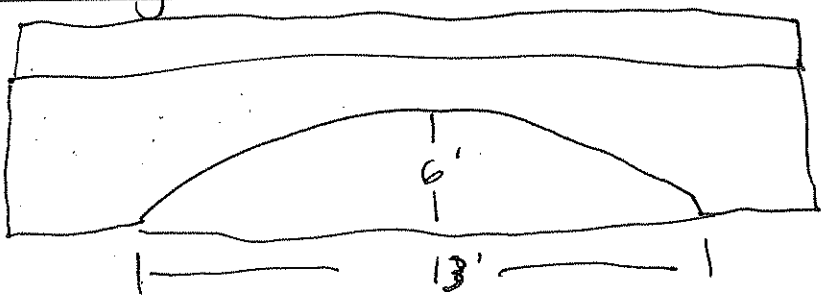


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Neg	
Structure ID/Number: 570	Date: 1/13/09
Stream Name: /	County: LAWRENCE
Watershed: Hatton Branch	
Photo ID: 51, 52	
Latitude: 41° 3.644	Longitude 80° 13.253

Remarks/diagrams: Bridge



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 7'
Depth (inv. To stream bed) _____
Bank Full Width (where poss.) 13'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

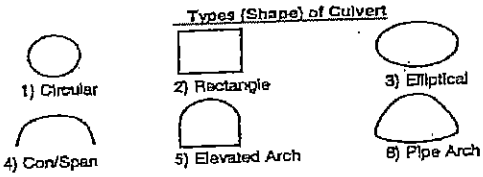
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 6'
Width of opening (abutment) 8.8'
Width of opening (obstruction) 41'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

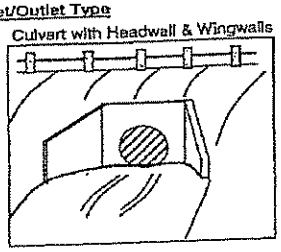
Types (Shape) of Culvert



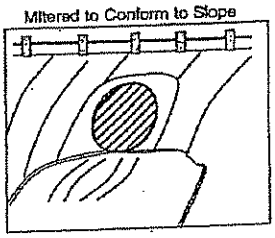
7) Other

Inlet/Outlet Type

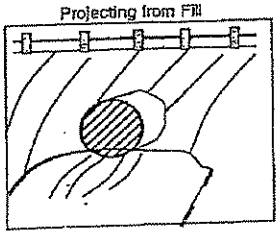
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

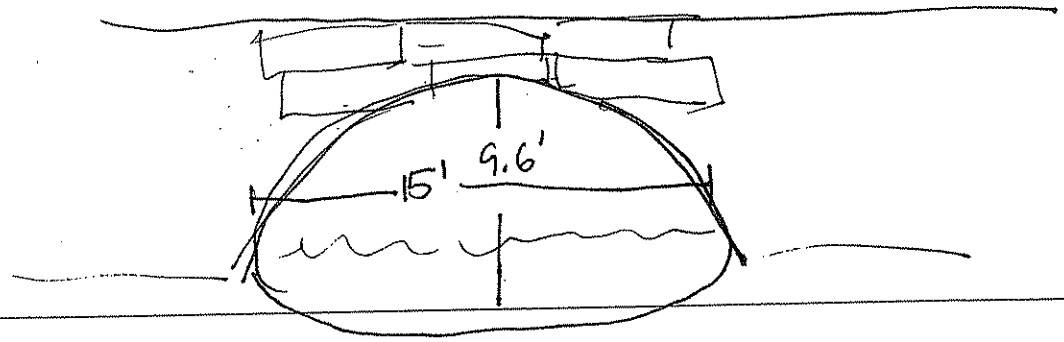


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Megan	
Structure ID/Number: 68	Date: 11/3/09
Stream Name:	County: ~~Hs~~ Lawrence
Watershed:	
Photo ID: 53, 54	
Latitude: 41° 3.531	Longitude 80° 13.362

Remarks/diagrams: Culvert



Culvert Type: (please circle the type as shown below)

Diameter 15'
Number of Barrels: 1

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [x] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 33'
Mannings n:
Depth to Crown: 12'
Depth (inv. To stream bed) 9.6'
Bank Full Width (where poss.) 20'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type:

0° 45° 90° (circle)

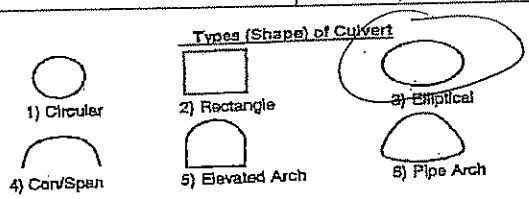
- [ ] Projecting
- [ ] Flush with Slope
- [x] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

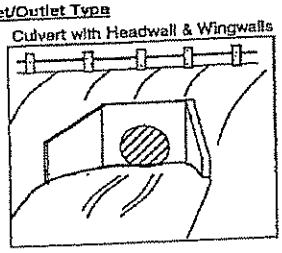
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

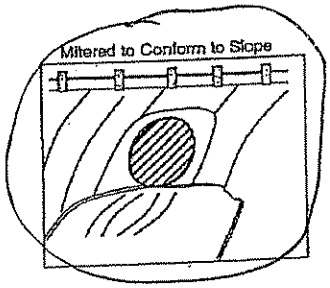


Inlet/Outlet Type

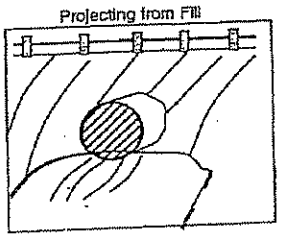
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

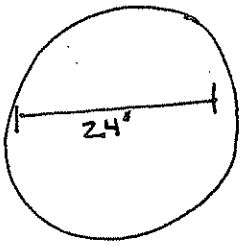


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy JW Meg	
Structure ID/Number: 59	Date: 11/3/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 55 56 57	
Latitude: 41° 2.956	Longitude 80° 13.587

Remarks/diagrams: Culvert



Culvert Type: (please circle the type as shown below)

Diameter 24"
Number of Barrels:

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [x] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 43'
Mannings n:
Depth to Crown: 6.5'
Depth (inv. To stream bed) 20"
Bank Full Width (where poss.)

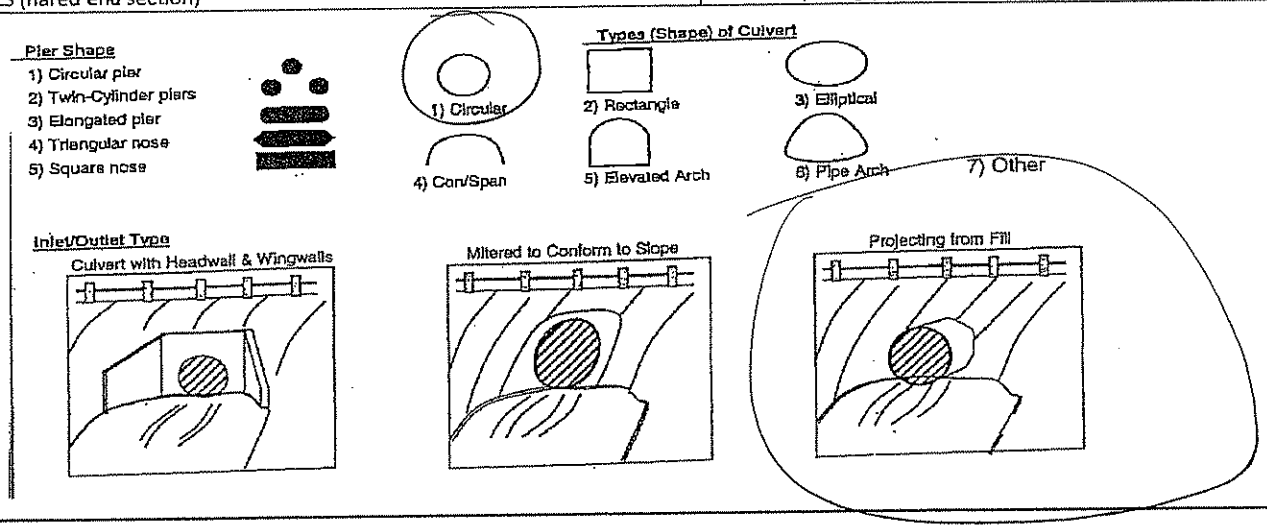
Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type:

0° 45° 90° (circle)
- [x] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

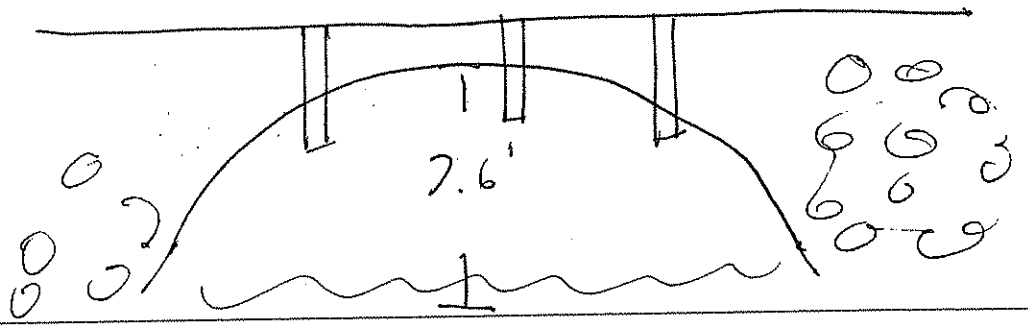


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 60	Date: 11/3/09
Stream Name: Hottenlaugh	County: Lawrence
Watershed:	
Photo ID: 5659	
Latitude: 41° 2.871	Longitude 80°13.412

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 8.7'
Depth (inv. To stream bed) 7.6'
Bank Full Width (where poss.) _____

Inlet/Outlet Type:
- [x] Headwall
- [ ] Wingwalls:

Type: _____

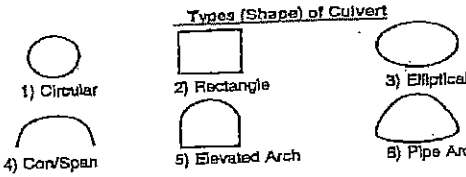
	0°	45°	90°	(circle)
Projecting				
Flush with Slope				
MES (mitered end section)				
FES (flared end section)				

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 7.6'
Width of opening (abutment) 29'
Width of opening (obstruction) 53'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

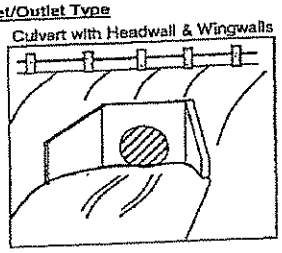
Types (Shape) of Culvert



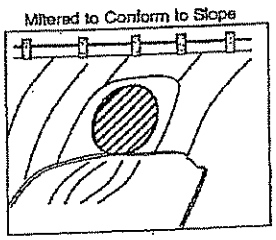
7) Other

Inlet/Outlet Type

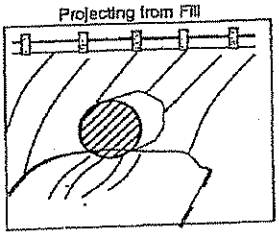
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

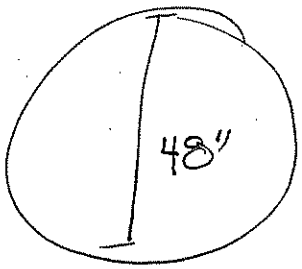


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Nagan	
Structure ID/Number: 101	Date: 11/3/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 100 102 103	
Latitude: 41° 3.882	Longitude 80° 14.799

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter ~~48"~~ 48"
Number of Barrels: 1

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [x] Other: Plastic

Entrance Coefficient:
Exit Coefficient:
Length: 58'
Mannings n:
Depth to Crown: 7'
Depth (inv. To stream bed)
Bank Full Width (where poss.) 8"

Inlet/Outlet Type:
- [x] Headwall Stone
- [ ] Wingwalls:

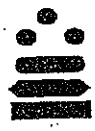
Type:

0° 45° 90° (circle)
- [x] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

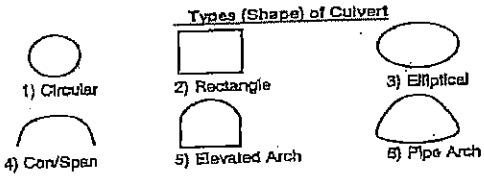
Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose



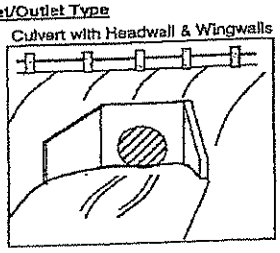
Types (Shape) of Culvert



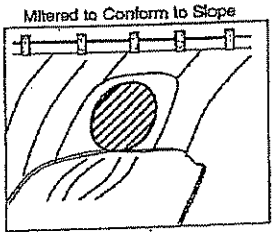
7) Other

Inlet/Outlet Type

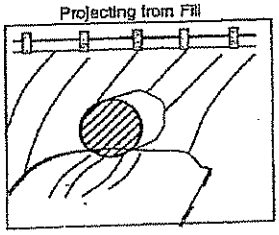
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

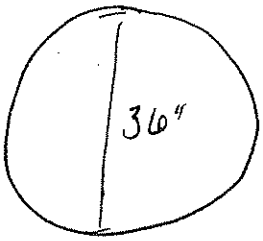


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 62	Date: 11/3/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 64, 65	
Latitude: 40° 3.860	Longitude 80° 14.881

Remarks/diagrams: Culvert



Culvert Type: (please circle the type as shown below)

Diameter 36"
Number of Barrels:

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [x] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 29'
Mannings n:
Depth to Crown: 4'
Depth (inv. To stream bed)
Bank Full Width (where poss.) 5'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type:

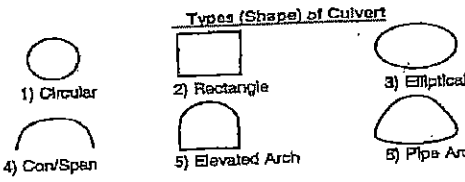
0° 45° 90° (circle)
- [x] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

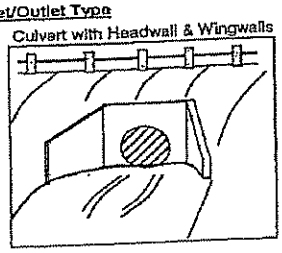
Types (Shape) of Culvert



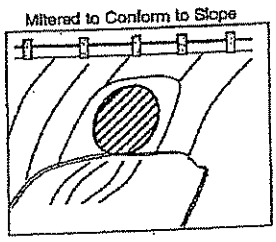
7) Other

Inlet/Outlet Type

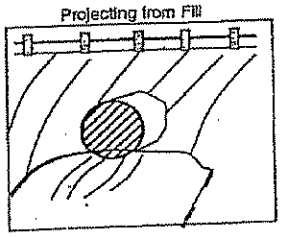
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Megan	
Structure ID/Number: 637	Date: 11/3/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 609, 607, 608	
Latitude: 41° 3.642	Longitude 80° 16.006

Remarks/diagrams: ~~Bridge 108~~ Culvert

Culvert Type: (please circle the type as shown below)

Diameter 12' W 10' H
Number of Barrels:

Material: (select one)
- [x] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 43'
Mannings n:
Depth to Crown: 13'
Depth (inv. To stream bed) 10'
Bank Full Width (where poss.) 12'

Inlet/Outlet Type: Endwalls
- [ ] Headwall
- [x] Wingwalls:

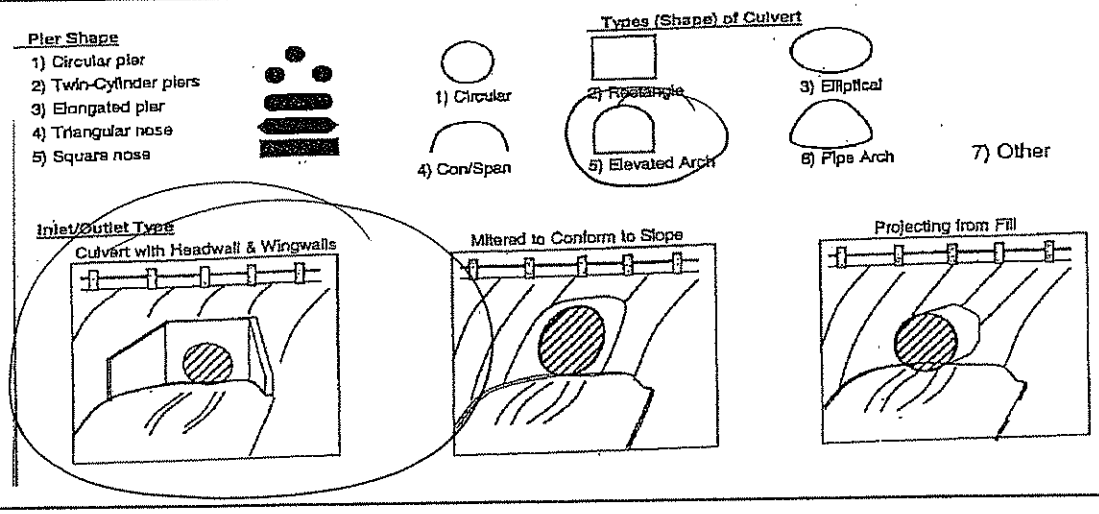
Type:

0° 45° 90° (circle)

- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)



Kimball

L. Robert Kimball & Associates

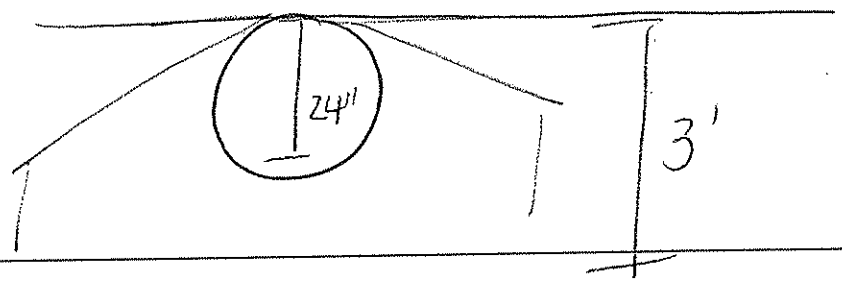
Lawrence County- ACT 167 Plan Phase II Data Collection

Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy, Jay, Meg	
Structure ID/Number: ~~LP~~ 70	Date: 11/12/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: L6, L7 (My camera)	
Latitude: 40° 54.396	Longitude 80° 22.505

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter 24"

Number of Barrels:

Material: (select one)

- [ ] RCP (Reinforced Concrete Pipe)
- [x] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:

Exit Coefficient:

Length: 40'

Mannings n:

Depth to Crown: 3'

Depth (inv. To stream bed) 24"

Bank Full Width (where poss.) 4'

Inlet/Outlet Type:

- [x] Headwall
- [ ] Wingwalls:

Type:

0° 45° 90° (circle)

- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers

Number of Piers

Width

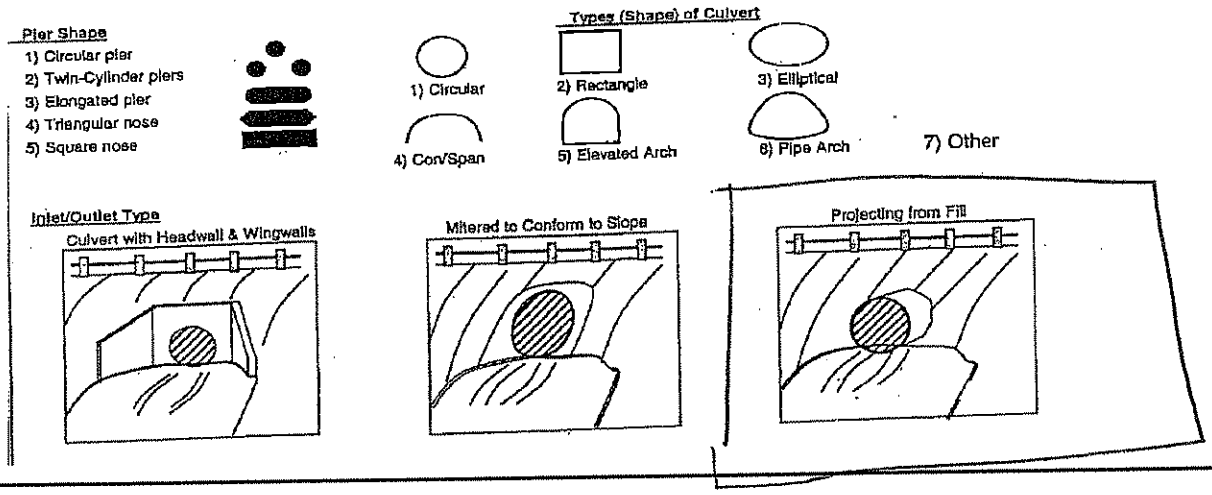
Width of Opening (c to c)

Bridge Measurements

Center of stream to bottom of structure:

Width of opening (abutment)

Width of opening (obstruction)



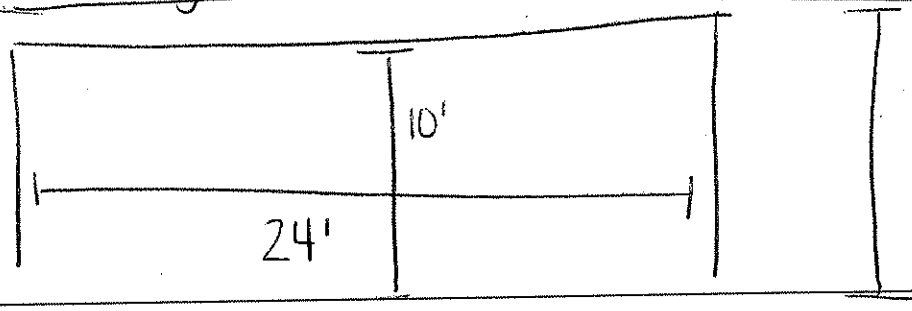
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Meej	
Structure ID/Number: ~~65~~ 69	Date: 11/12/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 63 64 65 (Aly Camera)	
Latitude: 40° 54.515	Longitude 80° 22.221

Remarks/diagrams: Bridge



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: 24'
Mannings n: _____
Depth to Crown: 21'
Depth (inv. To stream bed) 10'
Bank Full Width (where poss.) 12'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

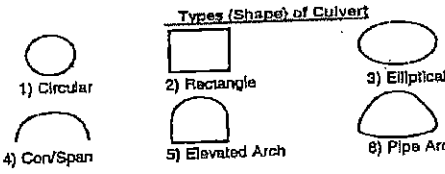
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

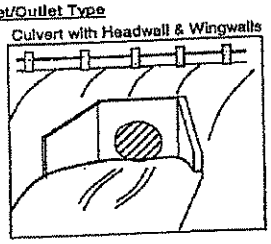
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

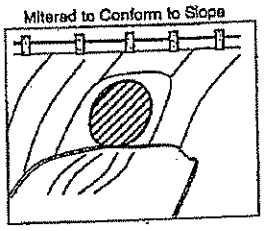


Inlet/Outlet Type

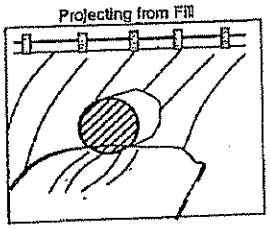
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

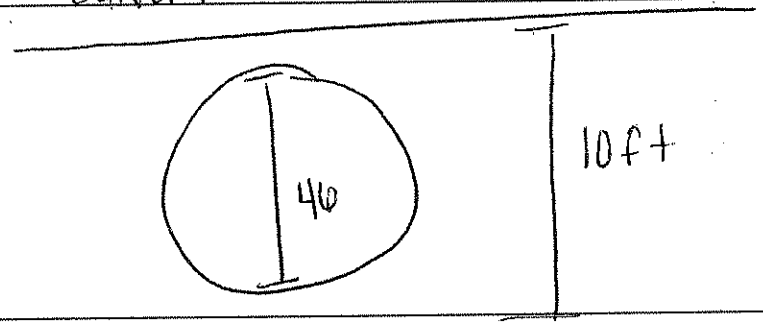


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 68	Date: 11/12/09
Stream Name:	County:
Watershed:	
Photo ID: 61 (my camera), 62	
Latitude: 40° 54.615	Longitude 80°22.221

Remarks/diagrams: Culvert



Culvert Type: (please circle the type as shown below)

Diameter 46
Number of Barrels:

Material: (select one)
- [x] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 72'
Mannings n:
Depth to Crown: 10'
Depth (inv. To stream bed) 4.0'
Bank Full Width (where poss.) 8'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type:

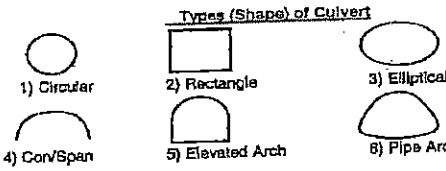
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

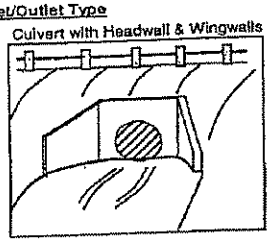
Types (Shape) of Culvert



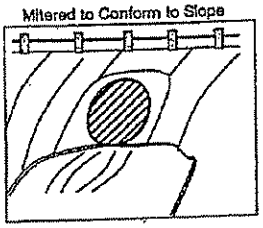
7) Other

Inlet/Outlet Type

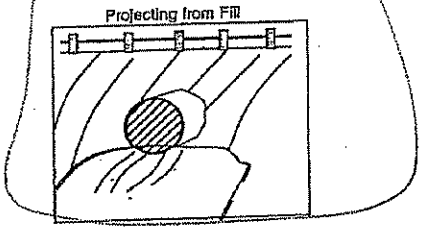
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

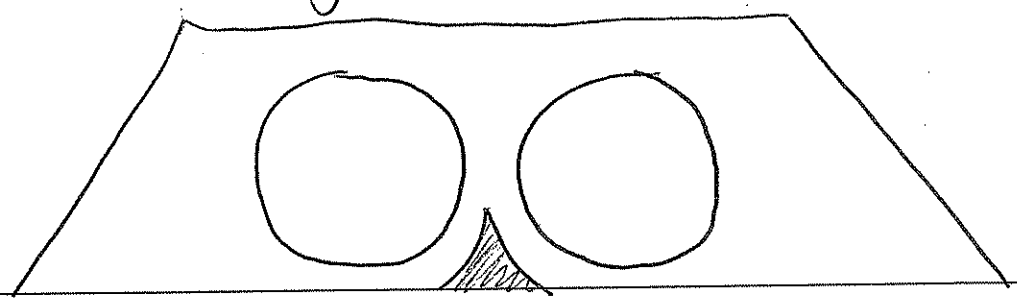


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 12	**Date:** 11/12/09
Stream Name:	**County:** Lawrence
Watershed:	
Photo ID: 109 70 71 (my camera)	
Latitude: 40°54.371	**Longitude** 80°22.835

Remarks/diagrams: Bridge



Culvert Type: (please circle the type as shown below)

Diameter 6'
Number of Barrels: 2

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [x] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 20'
Mannings n:
Depth to Crown: 8'
Depth (inv. To stream bed) 6'
Bank Full Width (where poss.) 15'

Inlet/Outlet Type:
- [x] Headwall
- [x] Wingwalls:

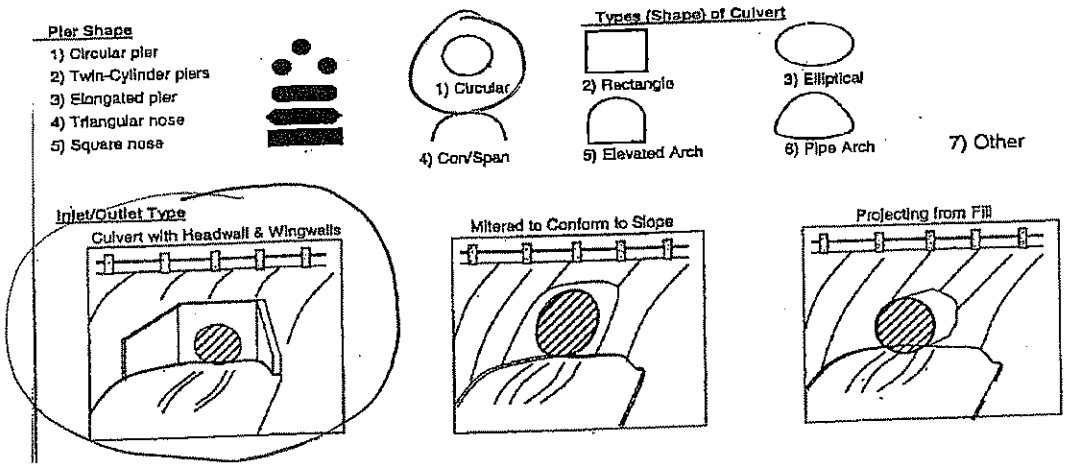
Type:

0° 45° 90° (circle)

- [ ] Projecting
- [x] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

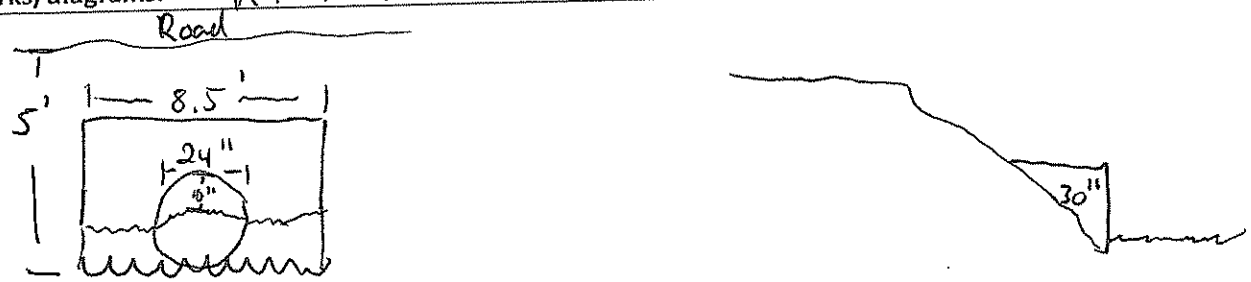


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Megan	
Structure ID/Number: 2	Date: 10/27
Stream Name:	County: Lawrence
Watershed: ~~Hickory~~ Shenango	
Photo ID: 3, 4, 5	
Latitude: N 40° 58.23 min	Longitude W 80° 23.406 min

Remarks/diagrams: Rt 108



Culvert Type: (please circle the type as shown below)

Diameter: 24" W
Number of Barrels: 1

Material: (select one)
- ✓ RCP (Reinforced Concrete Pipe)
- CMP (Corrugated Metal Pipe)
- Steel
- DIP (Ductile Iron Pipe)
- VCP (Vitrified Clay Pipe)
- Other:

Entrance Coefficient:
Exit Coefficient:
Length:
Mannings n:
Depth to Crown: 6 ft 2 in
Depth (inv. To stream bed) 10"
Bank Full Width (where poss.) 10 ft

Inlet/Outlet Type:
- ✓ Headwall
- Wingwalls:
- Type: Concrete

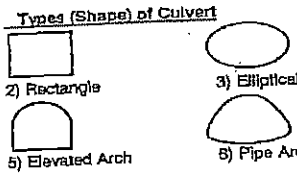
	0° (circle)	45°	90°	
✓ Projecting	30'	concrete	open	
Flush with Slope				
MES (mitered end section)				
FES (flared end section)				

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

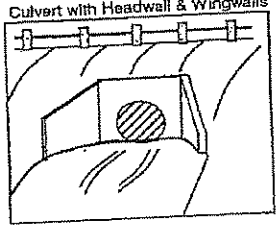
Types (Shape) of Culvert



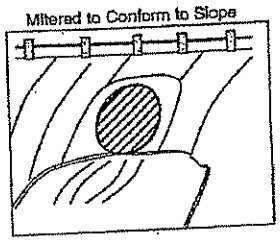
7) Other

Inlet/Outlet Type

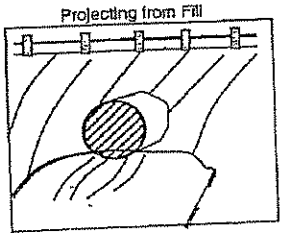
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



0

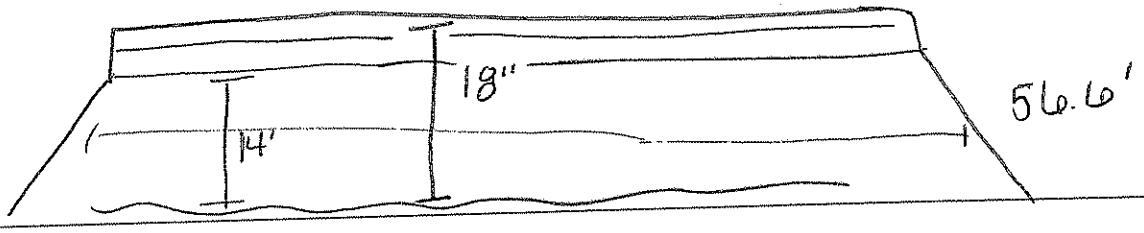
Kimball
L. Robert Kimball & Associates

Bridge

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Megan
Date: 10/27/09
Structure ID/Number: 3
County: Lawrence
Stream Name:
Watershed: Hickory Run
Photo ID: 6, 7, 8
Latitude: 40° N 57 min. 1052
Longitude 80° W 20 M. 1013

Remarks/diagrams: 18" Bottom of stream to top of deck
Bank Full Stream Width 38'



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: _____
Depth (inv. To stream bed) _____
Bank Full Width (where poss.) _____

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

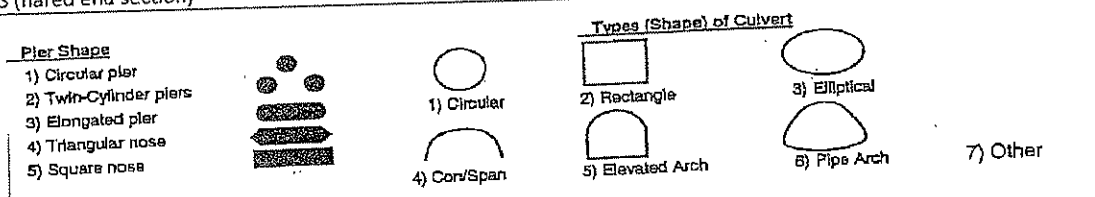
Type: _____

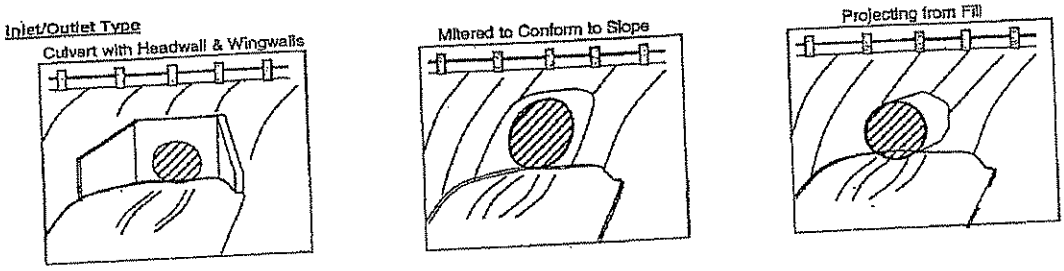
0° 45° 90° (circle)

- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers 0
Width N/A
Width of Opening (c to c) N/A

Bridge Measurements
Center of stream to bottom of structure: 14'
Width of opening (abutment) 44.6'
Width of opening (obstruction) 56.6'



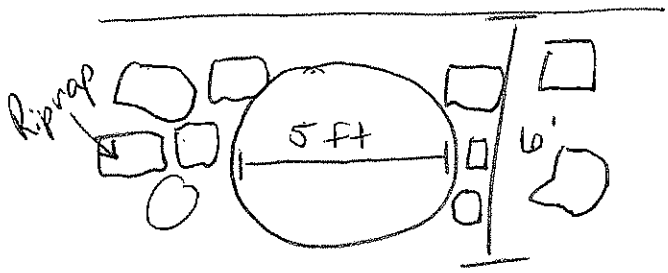


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Megan
Structure ID/Number: 4
Date: 10/27/09
County: Lawrence
Stream Name:
Watershed:
Photo ID: 9 10
Latitude: 40°N 58.146
Longitude 80°W 26.852

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter 5 ft
Number of Barrels: 1

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [x] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 37'
Mannings n:
Depth to Crown: 6'
Depth (inv. To stream bed) 43 in
Bank Full Width (where poss.) 8'

Inlet/Outlet Type:
- 0 Headwall
- 0 Wingwalls:
- Type:

0° 45° 90° (circle)

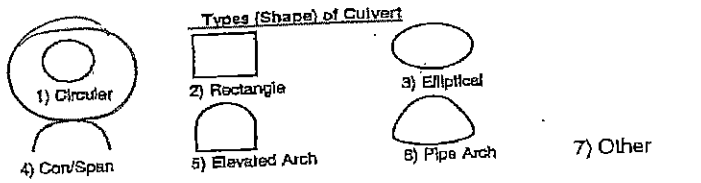
- [x] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

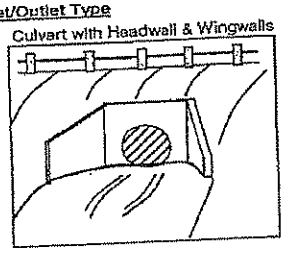
Types (Shape) of Culvert



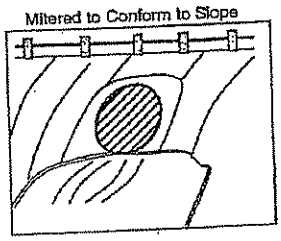
7) Other

Inlet/Outlet Type

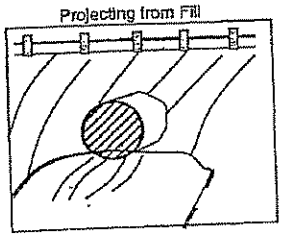
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

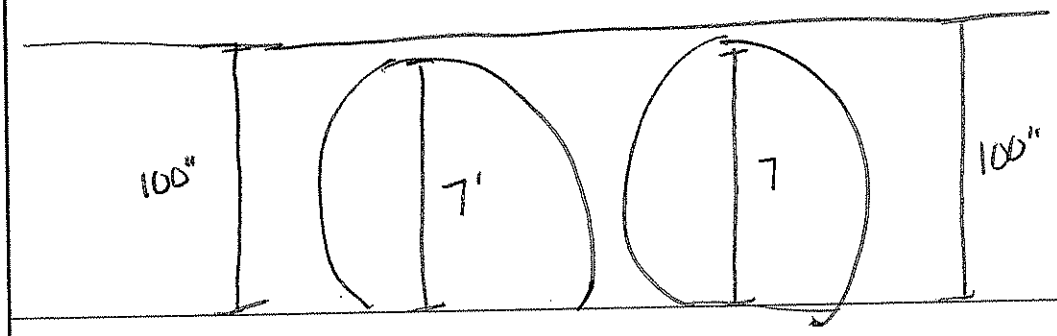


L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Megan	
Structure ID/Number: 5	Date: 10/27/09
Stream Name:	County: Lawrence
Watershed: Hickory Run	
Photo ID: 11, 12, 13	
Latitude: 40°N 58.1810	Longitude 80°N 27.022

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter 7'
Number of Barrels: 2

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: ✓

Entrance Coefficient:
Exit Coefficient:
Length: 30'
Mannings n:
Depth to Crown:
Depth (inv. To stream bed) -3"
Bank Full Width (where poss.) 30'

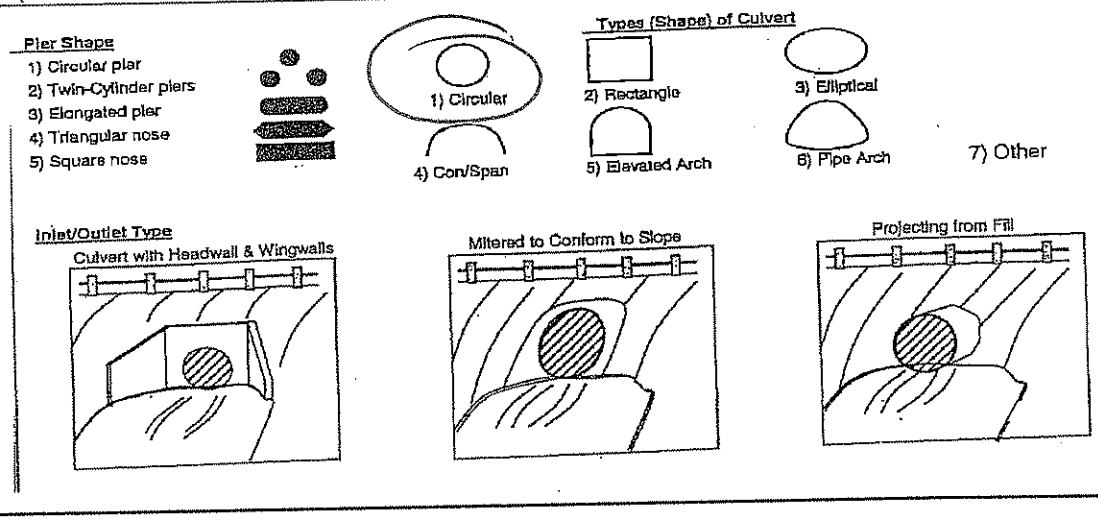
Inlet/Outlet Type:
- [✓] Headwall
- [ ] Wingwalls:

Type:

	0°	45°	90°	(circle)
✓	Projecting			
	Flush with Slope			
	MES (mitered end section)			
	FES (flared end section)			

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)



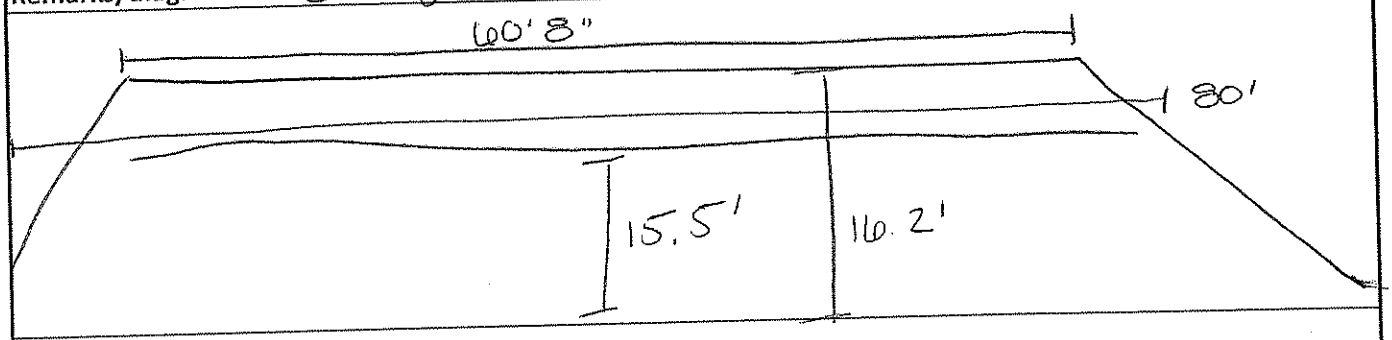
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Megan	Date: 10/27/09
Structure ID/Number: 6	County: Lawrence
Stream Name:	
Watershed: Hickory Run	
Photo ID: 14,15	
Latitude: 40°N 58.551	Longitude 80° W 27.724

Remarks/diagrams: Bridge



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: _____
Depth (inv. To stream bed) _____
Bank Full Width (where poss.) 53'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

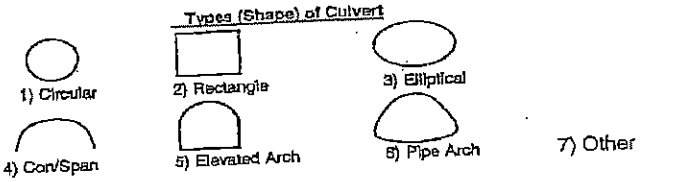
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers 0
Width N/A
Width of Opening (c to c) N/A

Bridge Measurements
Center of stream to bottom of structure: 15.5'
Width of opening (abutment) 60'8"
Width of opening (obstruction) 80'

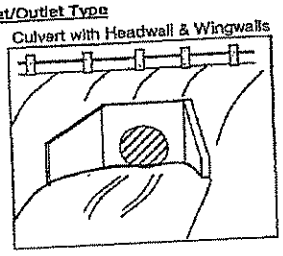
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

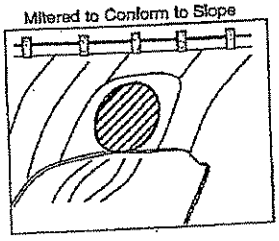


Inlet/Outlet Type

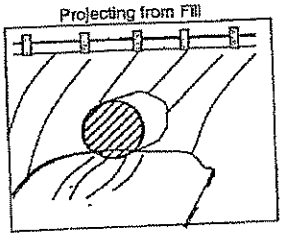
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

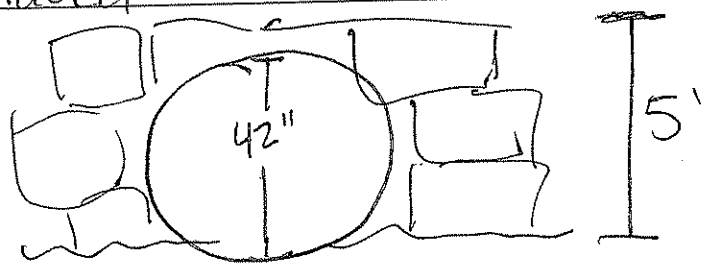


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Ami Jay Meg	Date: 10/27/09
Structure ID/Number: 7	County: Lawrence
Stream Name:	
Watershed:	
Photo ID: 16 17 18	
Latitude: 40° N 58.444	Longitude 80° W 27.551

Remarks/diagrams: Obstructed



Culvert Type: (please circle the type as shown below)

Diameter 42"
Number of Barrels: 1

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [x] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length:
Mannings n:
Depth to Crown: 5'
Depth (inv. To stream bed) 42"
Bank Full Width (where poss.) 2'

Inlet/Outlet Type:
- [x] Headwall
- [ ] Wingwalls:

Type: Concrete Block

0° (circle) 45° 90°

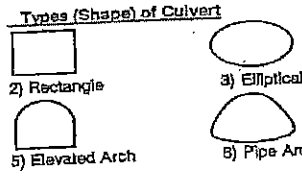
- [x] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

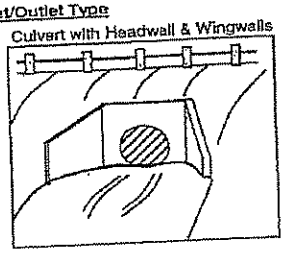
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

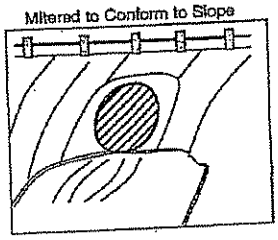


Inlet/Outlet Type

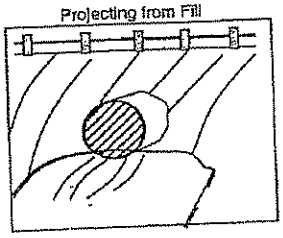
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



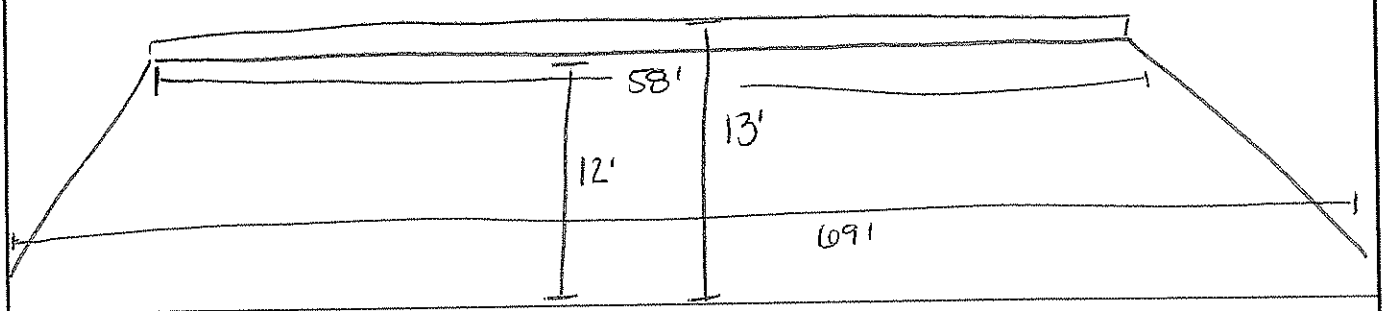
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 8	Date: 10/27/09
Stream Name:	County: Lawrence
Watershed: Hicky Run	
Photo ID: 19, 20, 21	
Latitude: 40°58.771	Longitude 80°28.141 W

Remarks/diagrams: Bridge



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)

- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: _____
Depth (inv. To stream bed) _____
Bank Full Width (where poss.) 38.5'

Inlet/Outlet Type:

- [ ] Headwall
- [ ] Wingwalls:

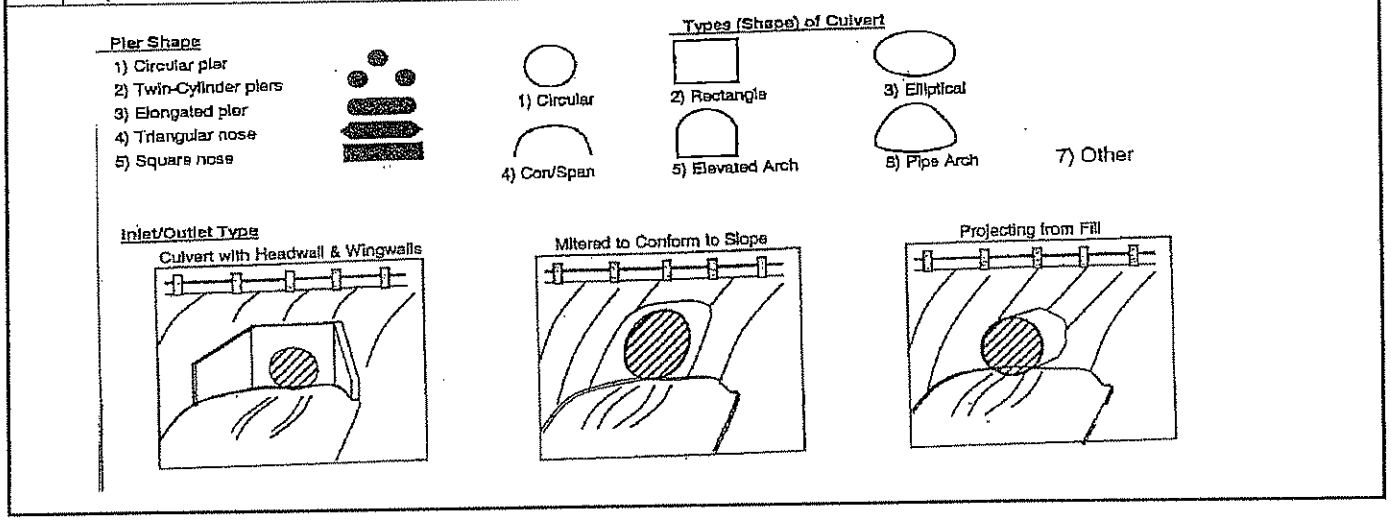
Type: _____

0° 45° 90° (circle)

- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers 0
Width N/A
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 12'
Width of opening (abutment) 58'
Width of opening (obstruction) 60'

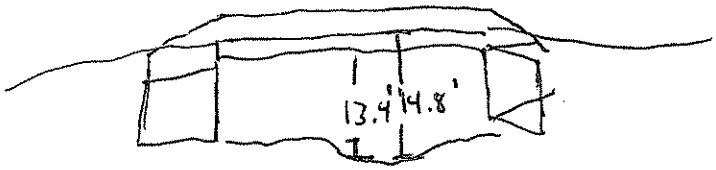


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy JAY Neg
Structure ID/Number: 9
Date: 10/27/09
County: Lawrence
Stream Name:
Watershed: Hickory Run
Photo ID: 22, 23, 24, 25
Latitude: 40° N 58.5316
Longitude 80° W 28.1022

Remarks/diagrams: Bridge



Culvert Type: (please circle the type as shown below)

Diameter
Number of Barrels:

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length:
Mannings n:
Depth to Crown: 14.8 ft
Depth (inv. To stream bed)
Bank Full Width (where poss.) 38 ft

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type:

0° 45° 90° (circle)

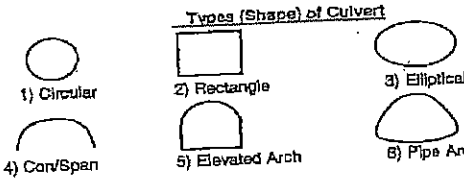
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers 0
Width N/A
Width of Opening (c to c) N/A

Bridge Measurements
Center of stream to bottom of structure: 13.4 ft
Width of opening (abutment) 45.5 ft
Width of opening (obstruction) 58 ft

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

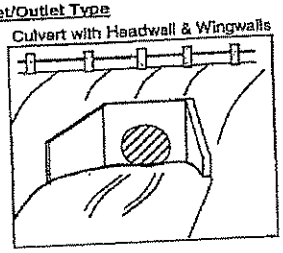
Types (Shape) of Culvert



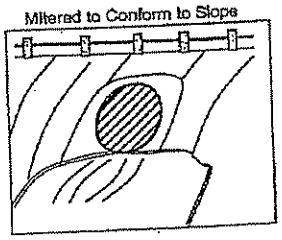
7) Other

Inlet/Outlet Type

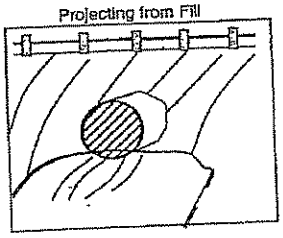
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

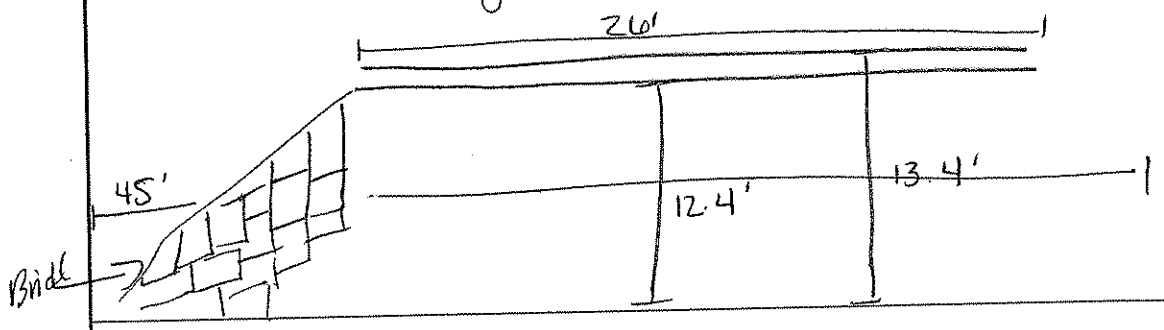


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Megan
Structure ID/Number: 10
Date: 10/27/09
County: Lawrence
Stream Name:
Watershed:
Photo ID: 26, 27, 28, 29
Latitude: 40 N 58.474
Longitude 80 W 28.768

Remarks/diagrams: Bridge but obstructed by fence



Culvert Type: (please circle the type as shown below)

Diameter
Number of Barrels:

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length:
Mannings n:
Depth to Crown:
Depth (inv. To stream bed)
Bank Full Width (where poss.) 32'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type:

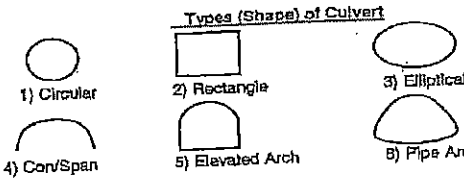
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure: 12.4'
Width of opening (abutment) 26'
Width of opening (obstruction) ~~26'~~ 45'

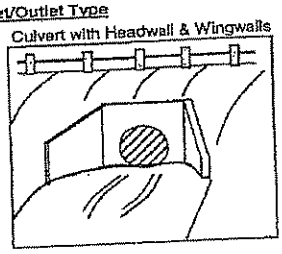
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

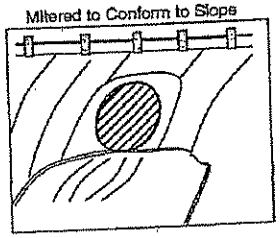


Inlet/Outlet Type

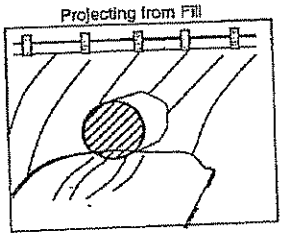
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



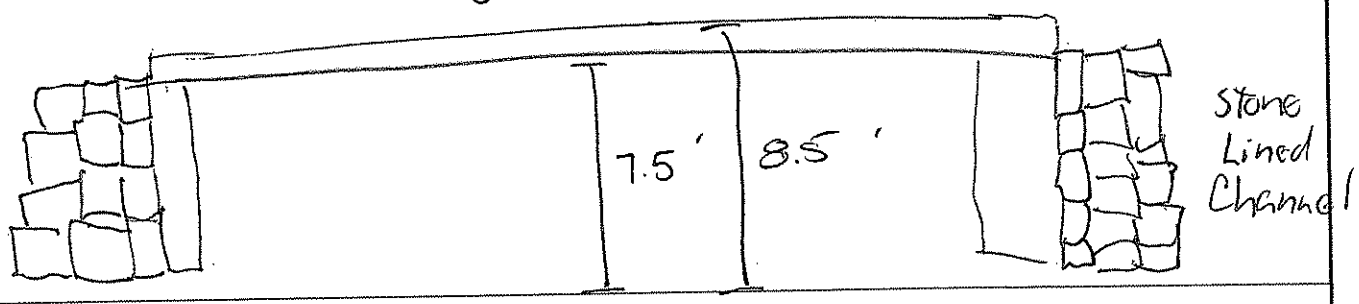
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 11	Date: 10/27/09
Stream Name:	County: Lawrence
Watershed: Hickory Run	
Photo ID: 30, 31	
Latitude: 40° N 58.419	Longitude 80°W 29.642

Remarks/diagrams: Bridge



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: _____
Depth (inv. To stream bed) _____
Bank Full Width (where poss.) 34'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:
  Type: _____

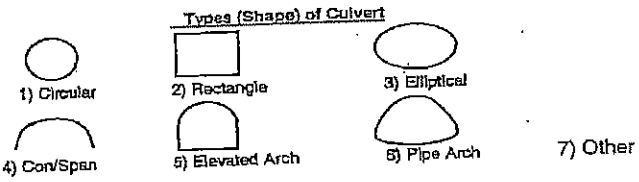
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers 0
Number of Piers N/A
Width N/A
Width of Opening (c to c) N/A

Bridge Measurements
Center of stream to bottom of structure: 7.5'
Width of opening (abutment) 33'
Width of opening (obstruction) 34'

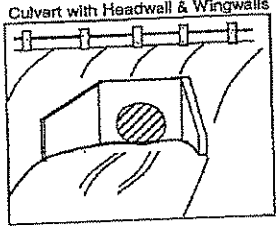
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

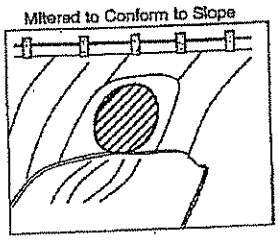


Inlet/Outlet Type

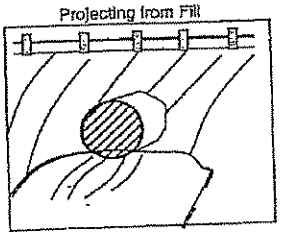
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

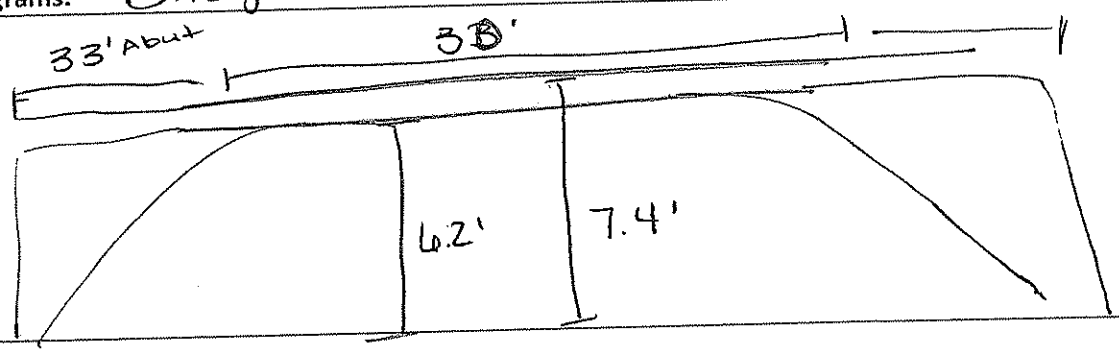


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 12	Date: 10/27/09
Stream Name:	County: LAWRENCE
Watershed: Hickory Run Creek	
Photo ID: 32, 33, 34	
Latitude: N 40° 58.493'	Longitude W 080°29.622'

Remarks/diagrams: Bridge



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: _____
Depth (inv. To stream bed) _____
Bank Full Width (where poss.) 30

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

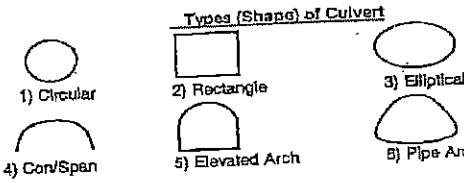
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 6.2
Width of opening (abutment) 33
Width of opening (obstruction) 33

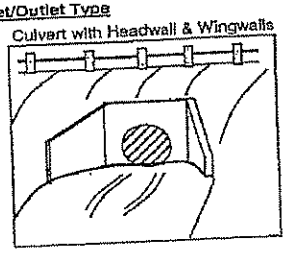
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

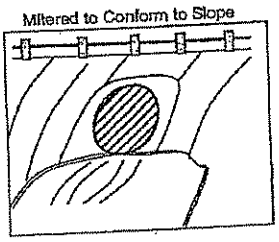


Inlet/Outlet Type

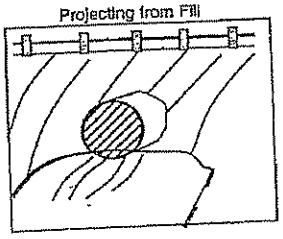
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

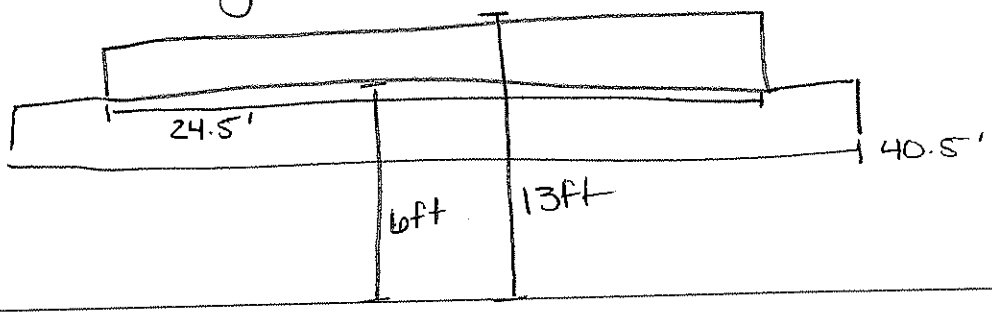


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Mey	
Structure ID/Number: 13	Date: 10/27/09
Stream Name:	County: Lawrence
Watershed: Hickory Creek	
Photo ID: 35 36 37	
Latitude: 40°N 58.499	Longitude 80°W 29.690

Remarks/diagrams: Bridge



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 13'
Depth (inv. To stream bed) _____
Bank Full Width (where poss.) ~~40.5~~ 22

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

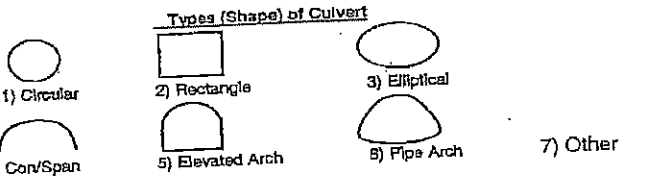
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 6'
Width of opening (abutment) 24.5'
Width of opening (obstruction) ~~40.5~~ 40.5

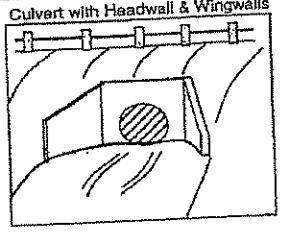
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

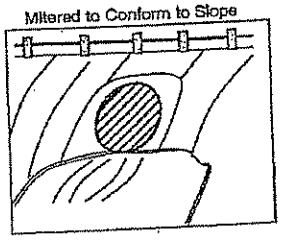


Inlet/Outlet Type

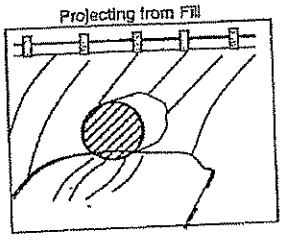
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



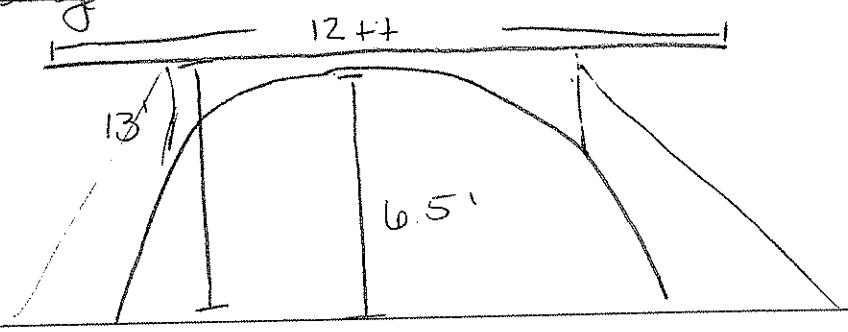
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Meg
Structure ID/Number: 14
Date: 10/27/09
Stream Name:
County: Lawrence
Watershed: Hickory Creek
Photo ID: 38 39 40 41 42
Latitude: 40°58.032
Longitude 80°W 29.0086

Remarks/diagrams: Bridge



Culvert Type: (please circle the type as shown below)

Diameter
Number of Barrels:

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length:
Mannings n:
Depth to Crown: 13'
Depth (inv. To stream bed)
Bank Full Width (where poss.) 20'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type:

0° 45° 90° (circle)

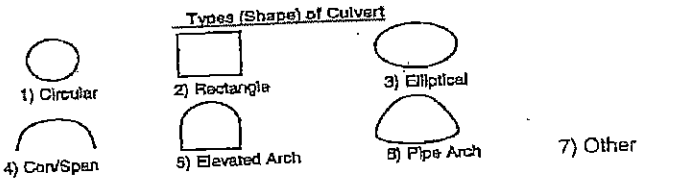
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure: 6.5'
Width of opening (abutment) 12'
Width of opening (obstruction) 20'

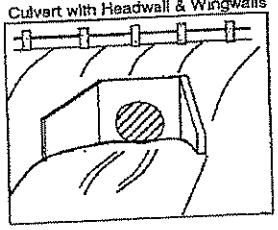
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

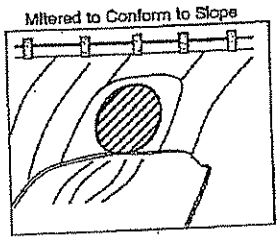


Inlet/Outlet Type

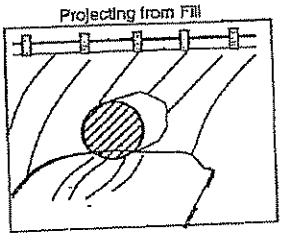
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

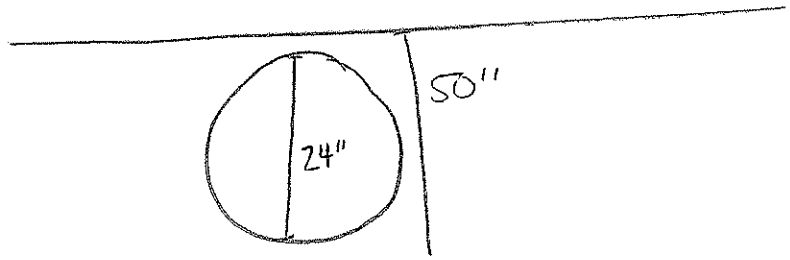


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 15	Date: 10/27/09
Stream Name:	County: Lawrence
Watershed: Hickory Run	
Photo ID: 43 44 45	
Latitude: 40°N 57.027	Longitude 80°W 27.827

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter 24
Number of Barrels:

Material: (select one)
- ✓ RCP (Reinforced Concrete Pipe)
- CMP (Corrugated Metal Pipe)
- Steel
- DIP (Ductile Iron Pipe)
- VCP (Vitrified Clay Pipe)
- Other:

Entrance Coefficient:
Exit Coefficient:
Length: ~~38'~~ 42'
Mannings n:
Depth to Crown: 50"
Depth (inv. To stream bed)
Bank Full Width (where poss.)

Inlet/Outlet Type:
- Headwall
- Wingwalls:
- Type:

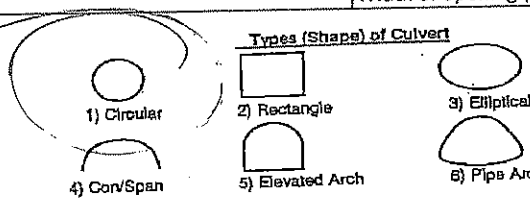
0° 45° 90° (circle)
- ✓ Projecting
- Flush with Slope
- MES (mitered end section)
- FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

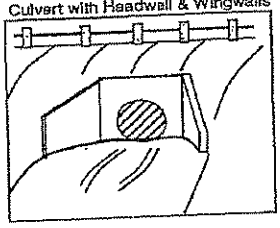
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

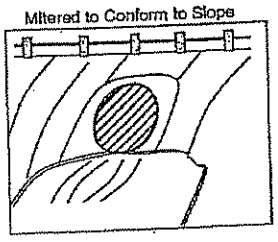


Inlet/Outlet Type

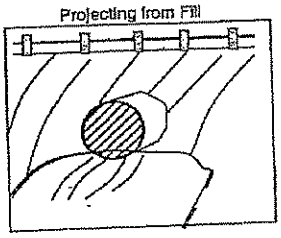
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



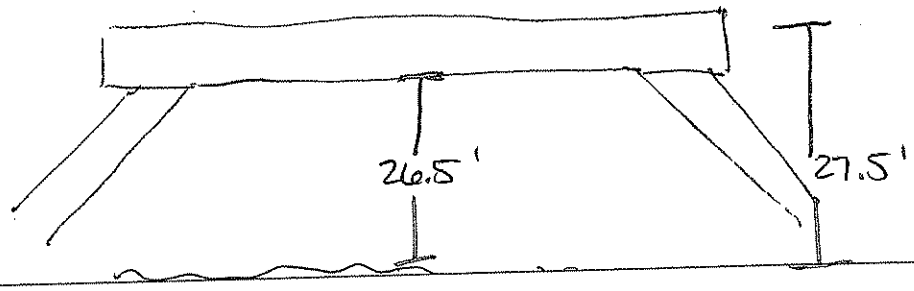
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Meg	Date: 10/27/09
Structure ID/Number: 116	County: LAWRENCE
Stream Name: HICKORY RUN	
Watershed: HICKORY RUN	
Photo ID: 46 47 48 49	Longitude 80°W 21D.017
Latitude: 40°N 57.359	

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 27.5
Depth (inv. To stream bed) 26.5
Bank Full Width (where poss.) 39

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

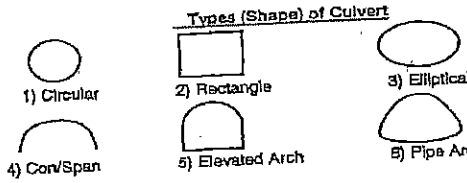
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers 0
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 26.5
Width of opening (abutment) 121
Width of opening (obstruction) 162

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

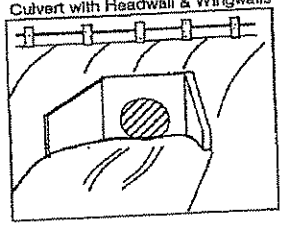
Types (Shape) of Culvert



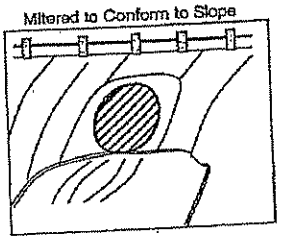
7) Other

Inlet/Outlet Type

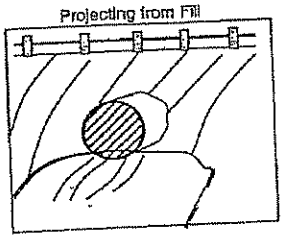
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

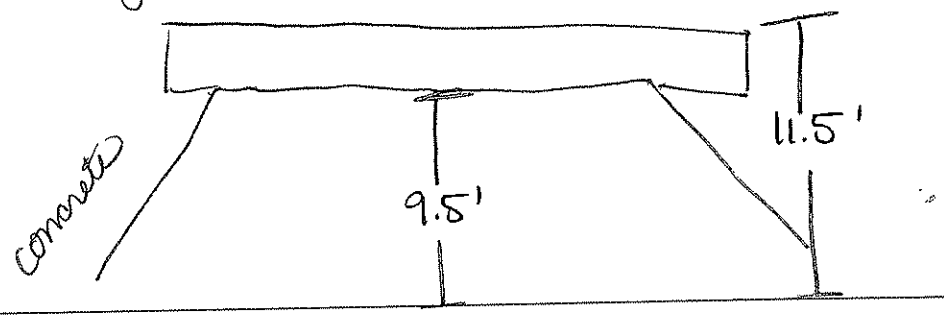


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s):	Amy B Jay Megan		
Structure ID/Number:	17	Date:	10/27/09
Stream Name:	Hickory Run	County:	Lawrence
Watershed:	Hickory Run		
Photo ID:	50 51 52 53 54 55		
Latitude:	40° N 57.305	Longitude	80° W 25.903

Remarks/diagrams: Bridge



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 11.5'
Depth (inv. To stream bed) 9.5'
Bank Full Width (where poss.) 50'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

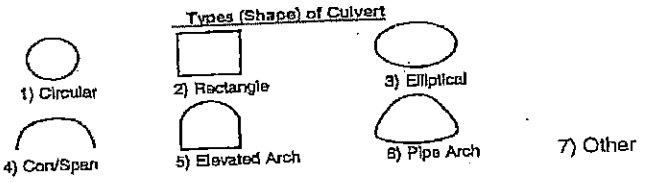
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure: 9.5'
Width of opening (abutment) 26'
Width of opening (obstruction) 36'

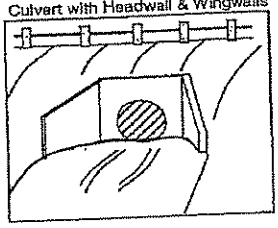
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

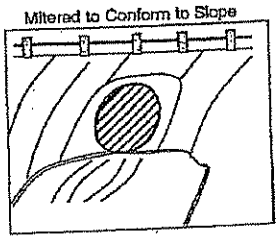


Inlet/Outlet Type

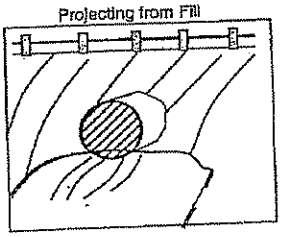
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

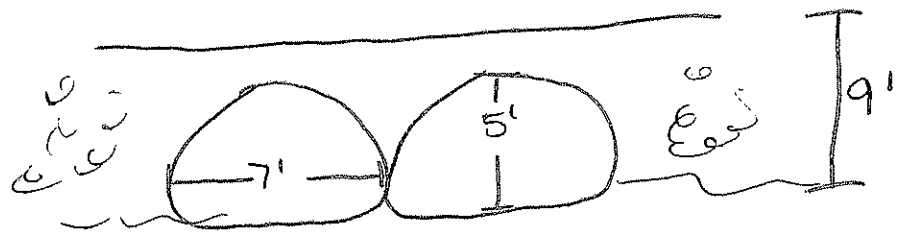


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s):	AMY MEZOIAN		
Structure ID/Number:	18	Date:	10/27/09
Stream Name:	HICKORY RUN	County:	LAWRENCE
Watershed:	HICKORY RUN		
Photo ID:	56 57 58 59		
Latitude:	40° N 57.1100	Longitude	80° W 25.838

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter 5' HIGH 7' WIDE
Number of Barrels: 2

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [x] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: 35'
Mannings n: _____
Depth to Crown: 9'
Depth (inv. To stream bed) 5'
Bank Full Width (where poss.) 8'

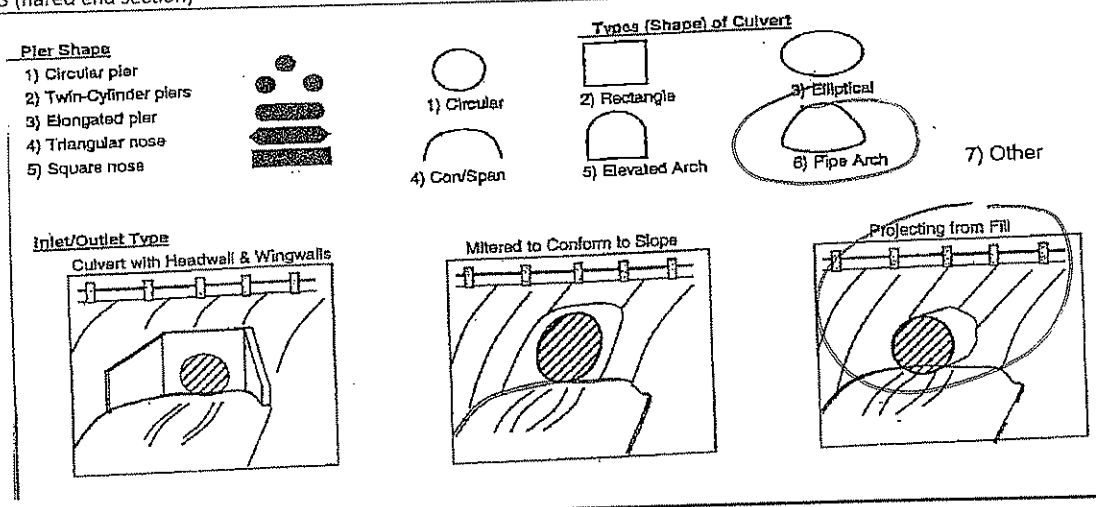
Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:
- Type: _____

0° (circle) 45° 90°

- [x] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: _____
Width of opening (abutment) _____
Width of opening (obstruction) _____

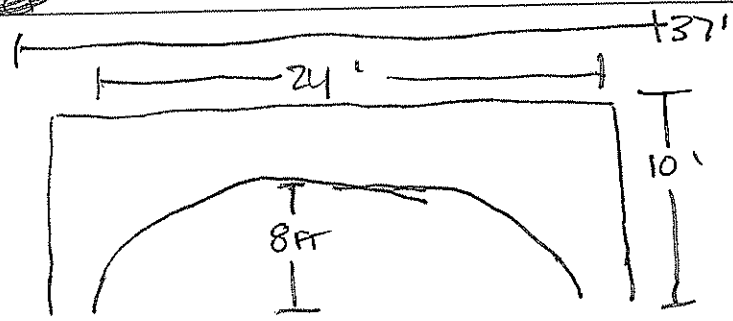


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 19	Date: 10/7/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 60 61 62 63 64	
Latitude: 40° N 57.103	Longitude 80° W 20.075

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [✓] Other: Arched Concrete Culvert

Entrance Coefficient:	
Exit Coefficient:	
Length:	31'
Mannings n:	
Depth to Crown:	10'
Depth (inv. To stream bed)	8'
Bank Full Width (where poss.)	23'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:
- Type: _____

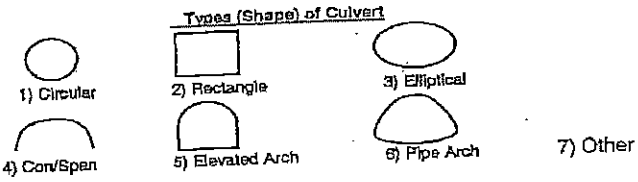
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 8'
Width of opening (abutment) 24'
Width of opening (obstruction) 37'

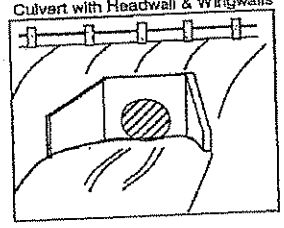
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

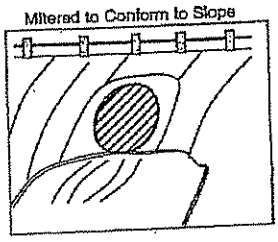


Inlet/Outlet Type

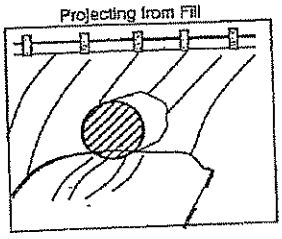
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

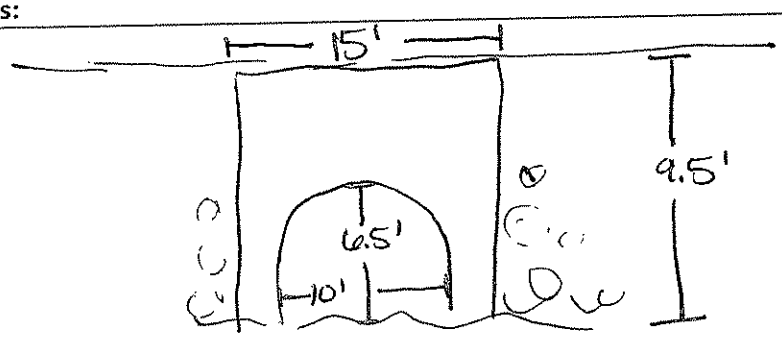


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Meg Jay	
Structure ID/Number: 20	Date: 10/27/09
Stream Name:	County: LAWRENCE
Watershed: Manning	
Photo ID: 65 66 67 68 69 70	
Latitude: 40° 57.103	Longitude 80° 26.075

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter 6.5' HIGH x 10' WIDE
Number of Barrels: 1

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [X] Other: ARCHED CONCRETE

Entrance Coefficient:
Exit Coefficient:
Length: 41'
Mannings n:
Depth to Crown: 9.5'
Depth (inv. To stream bed) 6.5'
Bank Full Width (where poss.)

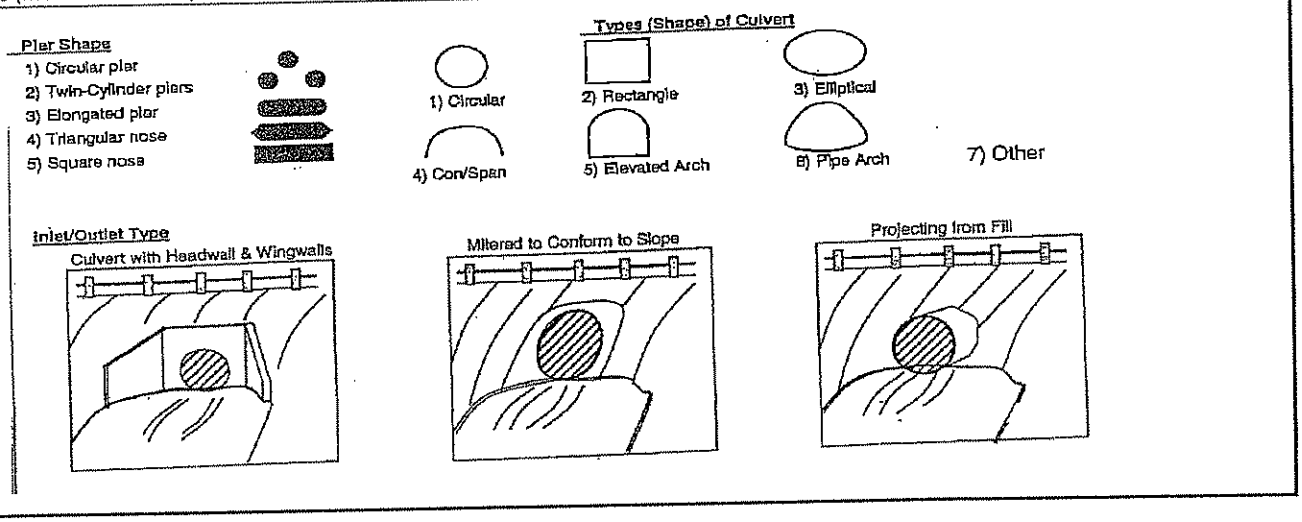
Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type:

0° 45° 90° (circle)
- [ ] Projecting
- [X] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)



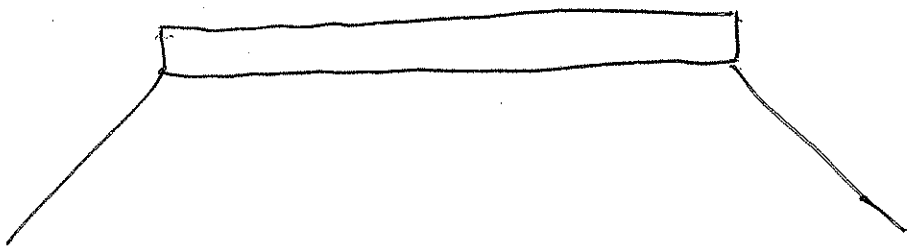
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 21	Date: 10/28/09
Stream Name:	County: Lawrence
Watershed: Hickory Run	
Photo ID: 71 72	
Latitude: 46° 57.283	Longitude 80° 23.076

Remarks/diagrams: Bridge -off 18 S



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)

- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient:	
Exit Coefficient:	
Length:	40'
Mannings n:	
Depth to Crown:	16'
Depth (inv. To stream bed)	15'
Bank Full Width (where poss.)	58'9"

Inlet/Outlet Type:

- [ ] Headwall
- [ ] Wingwalls:

Type: _____

0° 45° 90° (circle)

- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers

Number of Piers	X
Width	
Width of Opening (c to c)	

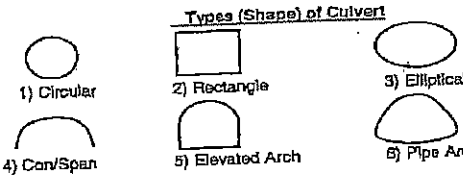
Bridge Measurements

Center of stream to bottom of structure:	15'
Width of opening (abutment)	69'4"
Width of opening (obstruction)	89'

Pier Shape

1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

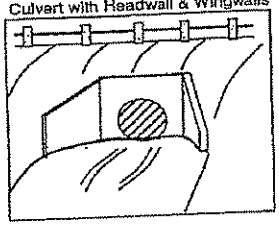
Types (Shape) of Culvert



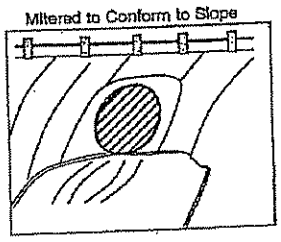
7) Other

Inlet/Outlet Type

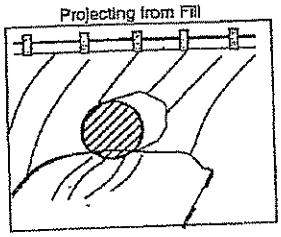
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



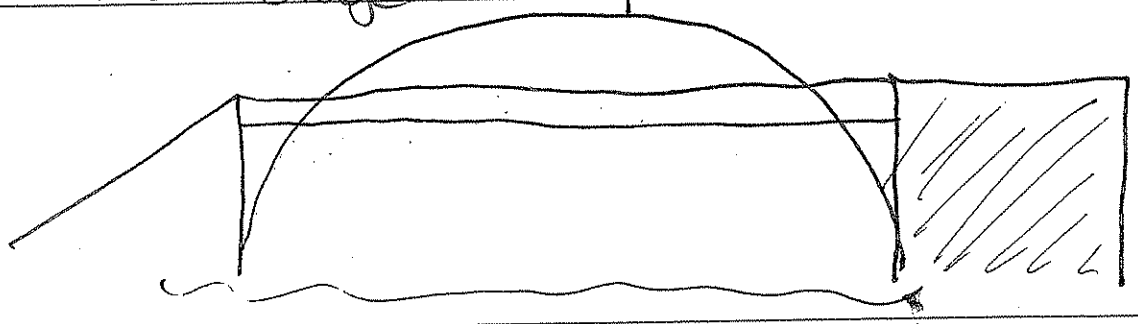
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 22	Date: 10/23/09
Stream Name:	County: Lawrence
Watershed: Hickory Run	
Photo ID: 73 74 75 76	
Latitude: 40° 57.454	Longitude 80° 22.833

Remarks/diagrams: Bridge - Wampum Rd



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient:	
Exit Coefficient:	
Length:	26'8"
Mannings n:	
Depth to Crown:	12'8"
Depth (inv. To stream bed)	11'
Bank Full Width (where poss.)	72'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

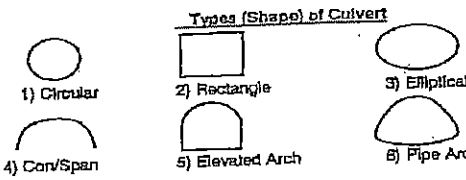
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure: 11'
Width of opening (abutment) 103'
Width of opening (obstruction) 48'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

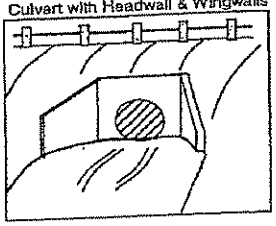
Types (Shape) of Culvert



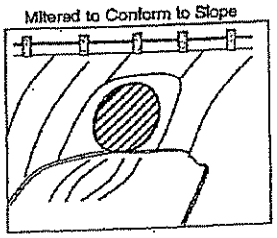
7) Other

Inlet/Outlet Type

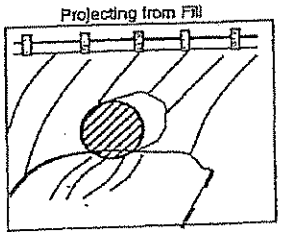
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

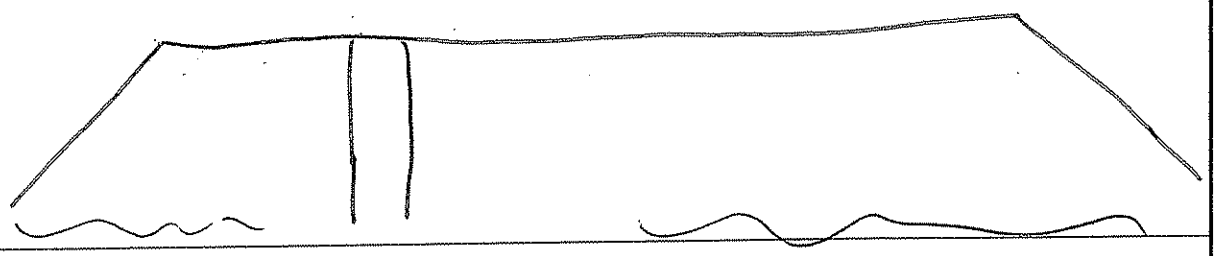


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s):	Amy, Jay, Meg		
Structure ID/Number:	23	Date:	10/28/09
Stream Name:	MAHONING RIVER	County:	LAWRENCE
Watershed:	MAHONING		
Photo ID:	77, 78, 79		
Latitude:	40° N 57.699	Longitude	80° W 22.821

Remarks/diagrams: Bridge - Wampum Road



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: 38'
Mannings n: _____
Depth to Crown: 32'
Depth (inv. To stream bed) 31'
Bank Full Width (where poss.) 247'

STREAM SURFACE

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

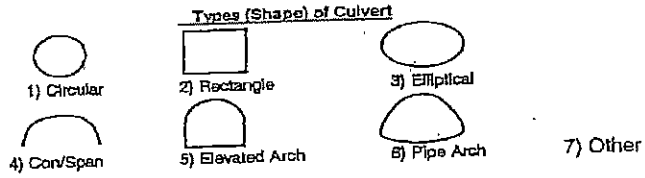
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers 1
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 131'
Width of opening (abutment) 376' 247'
Width of opening (obstruction)

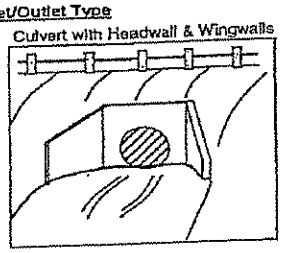
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

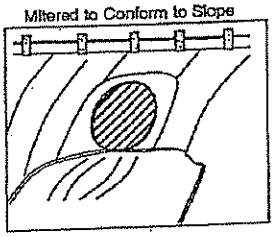


Inlet/Outlet Type

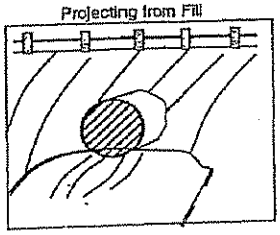
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



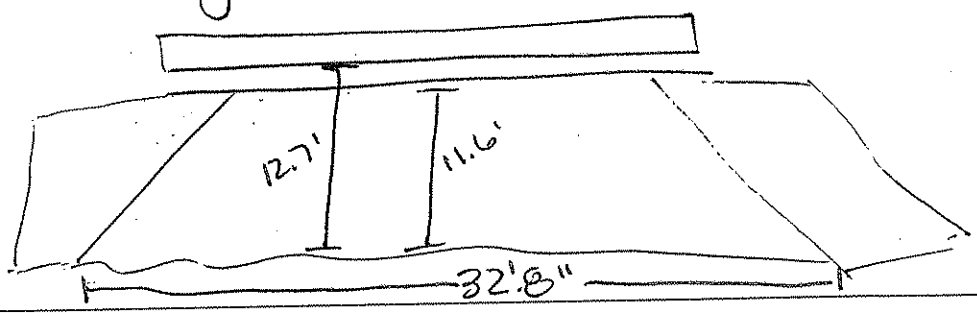
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Meg
Structure ID/Number: 24
Stream Name: Beaver
Watershed:
Photo ID: ~~77~~ 80, 81, 82
Latitude: 40° 55.294

~~Date:~~ Lawrence
County: 10/29/09
Longitude 80° 22.400

Remarks/diagrams: Bridge NEW



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: 43.9'
Mannings n: _____
Depth to Crown: 12.7'
Depth (inv. To stream bed) 11.6'
Bank Full Width (where poss.) 32'8"

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type: _____

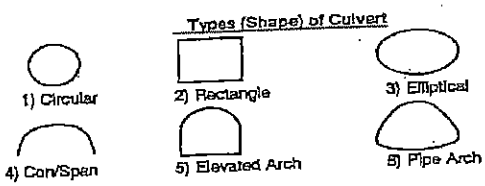
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 11.6'
Width of opening (abutment) 67.6'
Width of opening (obstruction) 32'8"

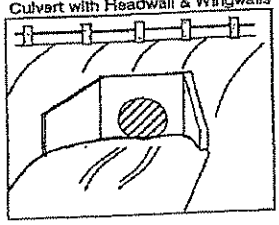
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

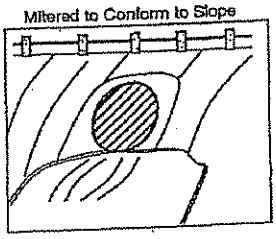


Inlet/Outlet Type

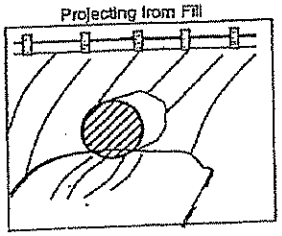
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



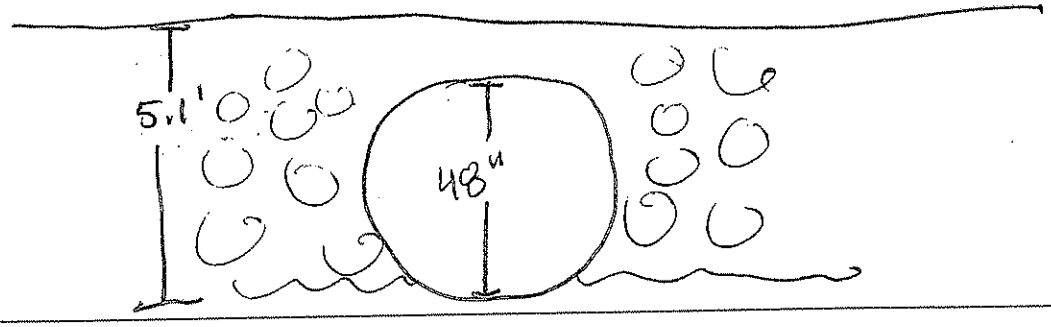
Projecting from Fill



Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Mog	
Structure ID/Number: 25	**Date:** 10/28/09
Stream Name: TRIB TO SUGAR	**County:** LAWRENCE
Watershed: SNEJ - SUGAR CK	
Photo ID: 84,85,86,87,88	
Latitude: 40° 55.833	**Longitude** 80° 30.553
MT JACKSONRD - 108	
Remarks/diagrams: Culvert	



Culvert Type: (please circle the type as shown below)

Diameter 48"
Number of Barrels: 1

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [x] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 41'
Mannings n:
Depth to Crown: 5.1'
Depth (inv. To stream bed) 4'
Bank Full Width (where poss.) 6.5'

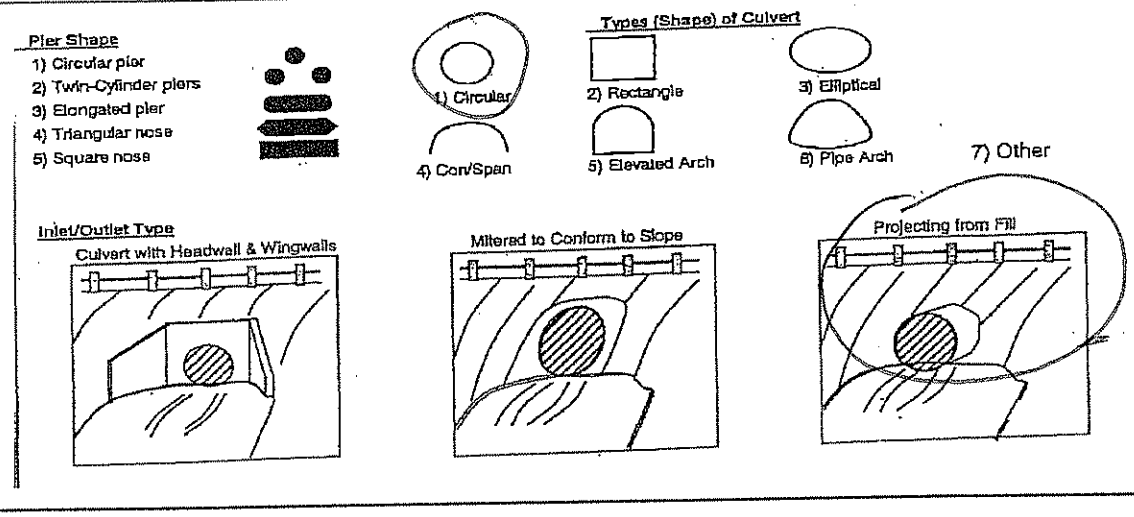
Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type:

0° 45° 90° (circle)
- [x] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

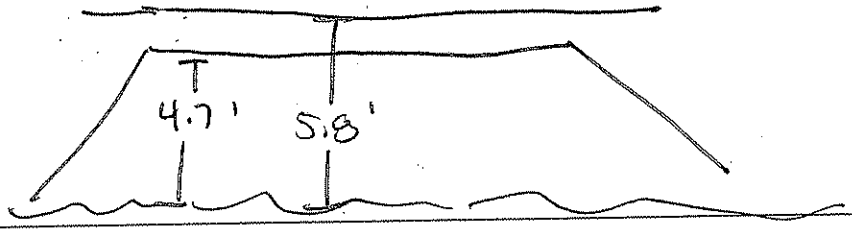


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s):	Amy Meg		
Structure ID/Number:	210	Date:	10/28/09
Stream Name:	Sugar Creek	County:	Lawrence
Watershed:			
Photo ID:	89 90 91 92		
Latitude:	40° 55.685	Longitude	80° 27.968

Remarks/diagrams: ~~Culvert~~ BRIDGE



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient:	
Exit Coefficient:	
Length:	23'
Mannings n:	
Depth to Crown:	5.8'
Depth (inv. To stream bed)	4.7'
Bank Full Width (where poss.)	11.5'

Inlet/Outlet Type:
- [ ] Headwall
- [x] Wingwalls:

Type: _____

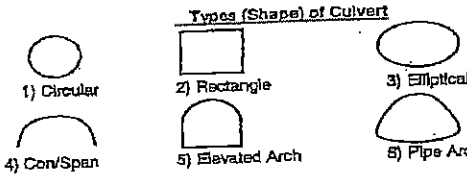
0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure: 4.7'
Width of opening (abutment) 11.5'
Width of opening (obstruction) 13'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

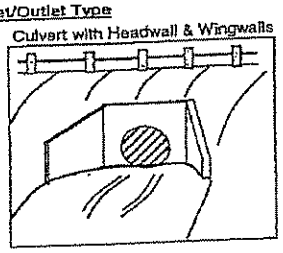
Types (Shape) of Culvert



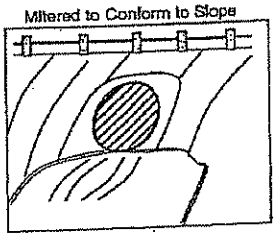
7) Other

Inlet/Outlet Type

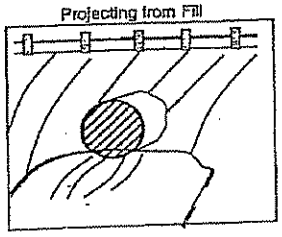
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

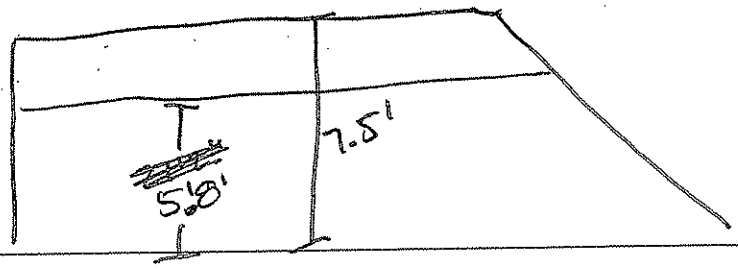


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Meg	
Structure ID/Number: 27	Date: 10/28/09
Stream Name: SUGAR CK	County:
Watershed: " "	
Photo ID: 93 94 95 96	
Latitude: 40° 55.545	Longitude 80° 28.125

Remarks/diagrams: Brunots



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient:	
Exit Coefficient:	
Length:	23'6"
Mannings n:	
Depth to Crown:	7.5'
Depth (inv. To stream bed)	5.8'
Bank Full Width (where poss.)	20'6"

Inlet/Outlet Type:
- [ ] Headwall
- [x] Wingwalls:

Type: _____

0° 45° 90° (circle)

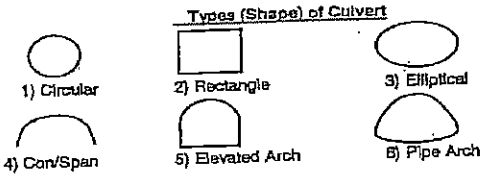
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment) 27'2"
Width of opening (obstruction) 38'11"

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

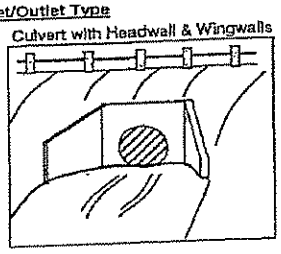
Types (Shape) of Culvert



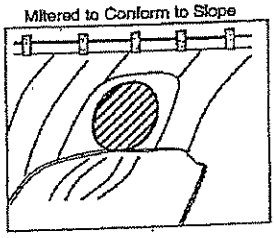
7) Other

Inlet/Outlet Type

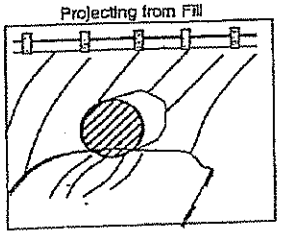
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



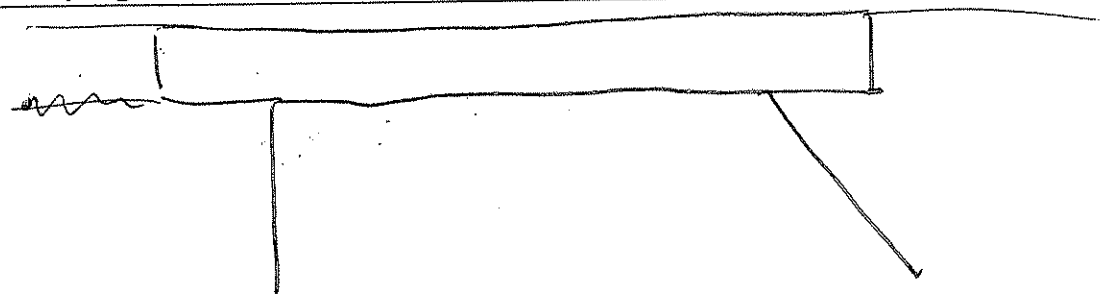
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s):	AMN Meg		
Structure ID/Number:	28	**Date:**	10/28/09
Stream Name:	SUGAR	**County:**	LAWRENCE
Watershed:			
Photo ID:	97 98 99		
Latitude:	40° 55.612	**Longitude**	80° 28.235

Remarks/diagrams: BRIDGE



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: 24'
Mannings n: _____
Depth to Crown: 9'
Depth (inv. To stream bed) 5.9'
Bank Full Width (where poss.) ~~27.5'~~ 12' 7"

Inlet/Outlet Type:
- [ ] Headwall
- [x] Wingwalls:

Type: _____

0° 45° 90° (circle)

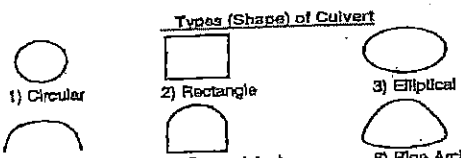
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: _____
Width of opening (abutment) 22' 11"
Width of opening (obstruction) 29' 1'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

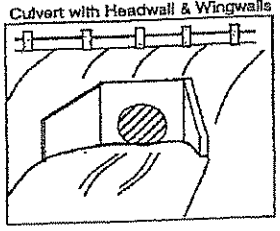
Types (Shape) of Culvert



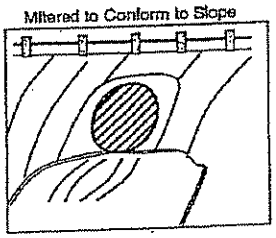
7) Other

Inlet/Outlet Type

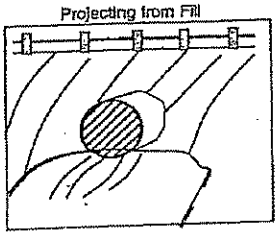
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill



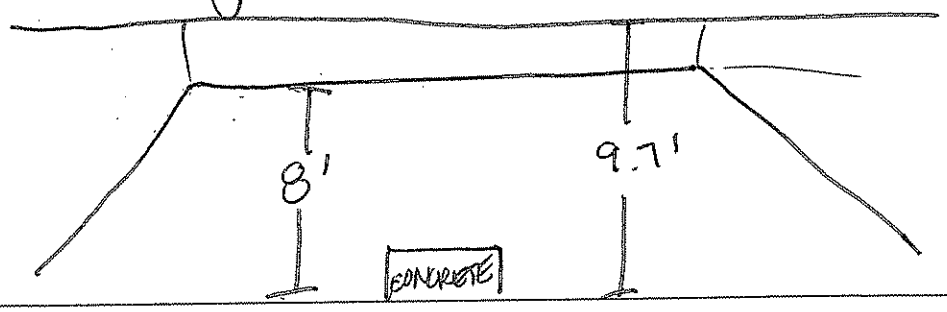
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy Meg	
Structure ID/Number: 29	**Date:**
Stream Name: SUGAR CK	**County:**
Watershed:	
Photo ID: 100 101 102	
Latitude: 40° 55.279	**Longitude** 80° 28.048

Remarks/diagrams: Bridge



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient:	
Exit Coefficient:	
Length:	22'9"
Mannings n:	
Depth to Crown:	9.7'
Depth (inv. To stream bed)	8'
Bank Full Width (where poss.)	26'

Inlet/Outlet Type:
- [ ] Headwall
- [x] Wingwalls:

Type: _____

0° 45° 90° (circle)

- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers

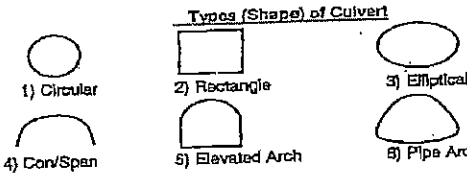
Number of Piers	
Width	
Width of Opening (c to c)	

Bridge Measurements

Center of stream to bottom of structure:	
Width of opening (abutment)	18'
Width of opening (obstruction)	26'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

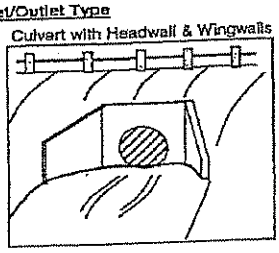
Types (Shape) of Culvert



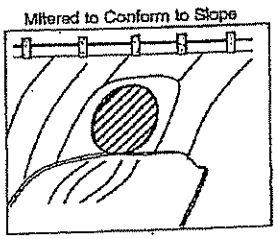
7) Other

Inlet/Outlet Type

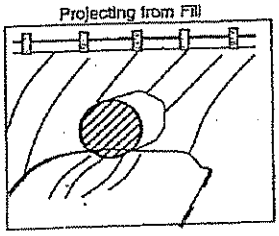
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

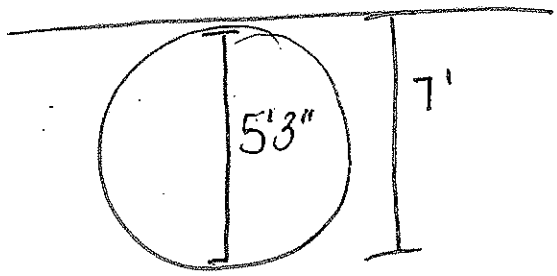


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy / Meg	
Structure ID/Number: 30	Date: 10/28/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 103 104 105	
Latitude: 40° 54.091	Longitude 80° 28.467

Remarks/diagrams: Culvert Round



Culvert Type: (please circle the type as shown below)

Diameter 64"
Number of Barrels:

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [x] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other:

Entrance Coefficient:
Exit Coefficient:
Length: 51'
Mannings n:
Depth to Crown: 7'
Depth (inv. To stream bed) 5'3"
Bank Full Width (where poss.) ~~7.5~~ 5.5'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:

Type:

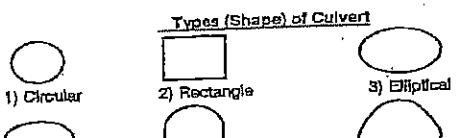
0° 45° 90° (circle)
- [x] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

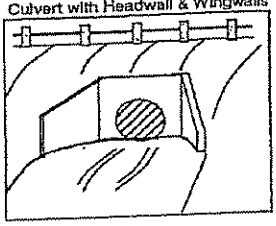
Types (Shape) of Culvert



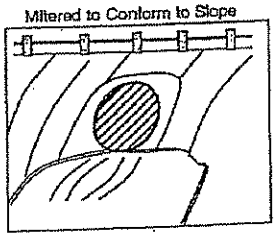
7) Other

Inlet/Outlet Type

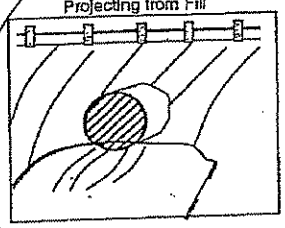
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

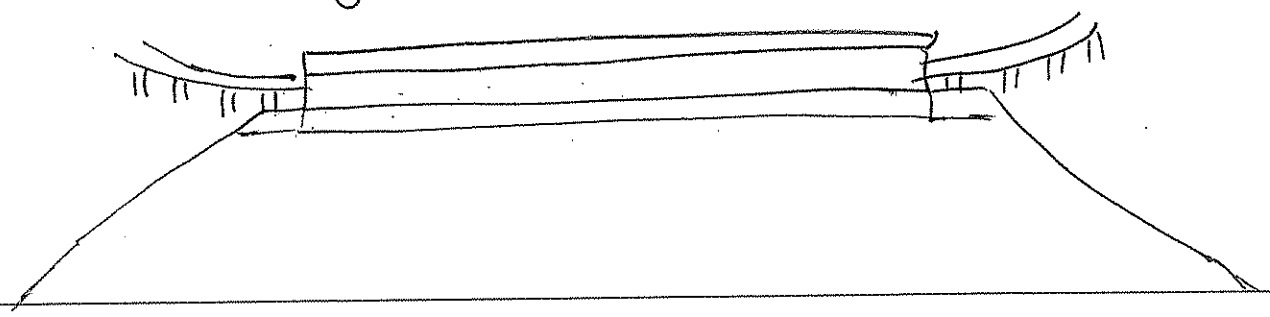


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Meg	
Structure ID/Number: 31	Date: 10/28/09
Stream Name: SUGAR CK	County: La
Watershed:	
Photo ID: 106	
Latitude: 40°N54.622	Longitude 80°W29.038

Remarks/diagrams: Bridge - Marania Rd.



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient: _____
Exit Coefficient: _____
Length: 26'
Mannings n: _____
Depth to Crown: 9.5'
Depth (inv. To stream bed) 9'
Bank Full Width (where poss.) ~~[illegible]~~ 31'11"

Inlet/Outlet Type:
- [ ] Headwall
- [x] Wingwalls:

Type: _____

0° 45° 90° (circle)

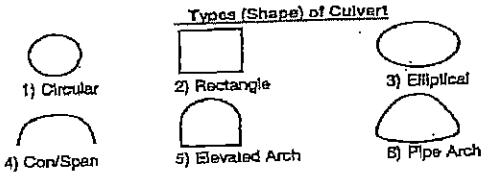
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers _____
Width _____
Width of Opening (c to c) _____

Bridge Measurements
Center of stream to bottom of structure: 9'
Width of opening (abutment) 31'11"
Width of opening (obstruction) 49'10"

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

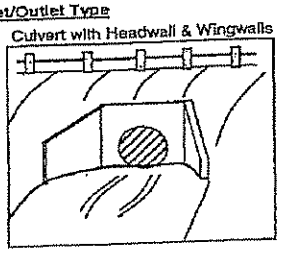
Types (Shape) of Culvert



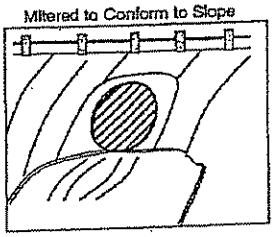
7) Other

Inlet/Outlet Type

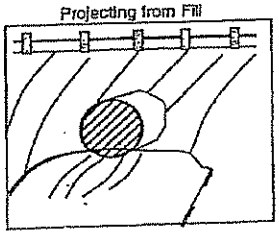
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

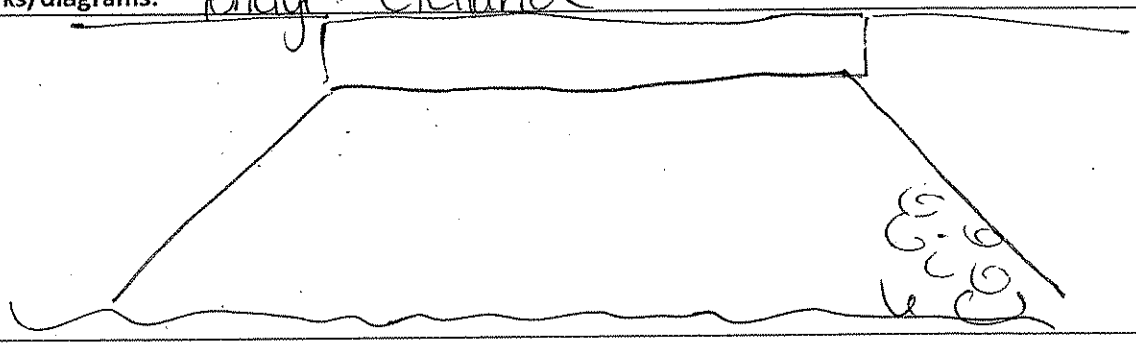


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Imley	
Structure ID/Number: 32	Date: 10/28/09
Stream Name: Hickory Run	County: Lawrence
Watershed:	
Photo ID: 108 109 110 111 112 113 114	
Latitude: 40° 57.331	Longitude 80° 24.5826

Remarks/diagrams: Bridge - Clelland



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient:	
Exit Coefficient:	
Length:	27'
Mannings n:	
Depth to Crown:	18.4
Depth (inv. To stream bed)	17.2
Bank Full Width (where poss.)	40'

Inlet/Outlet Type:
- [ ] Headwall
- [x] Wingwalls:

Type: _____

0° 45° 90° (circle)

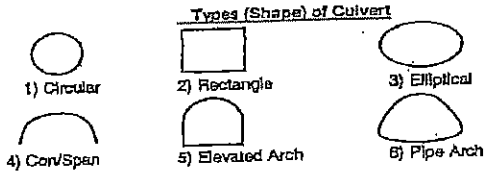
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure: 17.2
Width of opening (abutment) 59'
Width of opening (obstruction) 73'

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

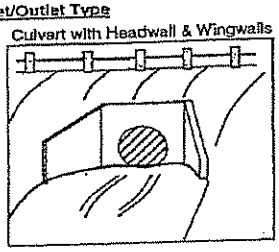
Types (Shape) of Culvert



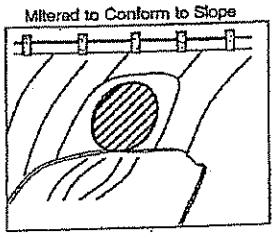
7) Other

Inlet/Outlet Type

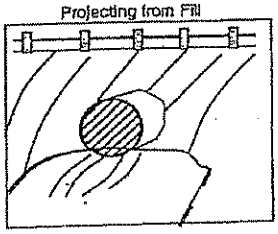
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

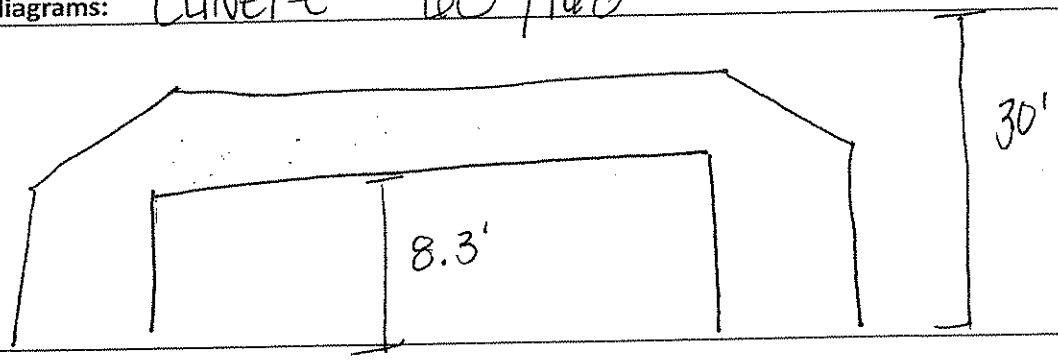


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Meg
Structure ID/Number: 104
Date: 11/5/09
Stream Name:
County: Lawrence
Watershed:
Photo ID: 109
Latitude: 40° 55.107
Longitude 80°23.177

Remarks/diagrams: Culvert - 160 / 168



Culvert Type: (please circle the type as shown below)

Diameter 16'
Number of Barrels:

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [x] Other: Boxed

Entrance Coefficient:
Exit Coefficient:
Length: 100'
Mannings n:
Depth to Crown: 30'
Depth (inv. To stream bed) 8'.3
Bank Full Width (where poss.) 12'

Inlet/Outlet Type:
- [x] Headwall
- [x] Wingwalls:

Type:

0° 45° 90° (circle)

- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

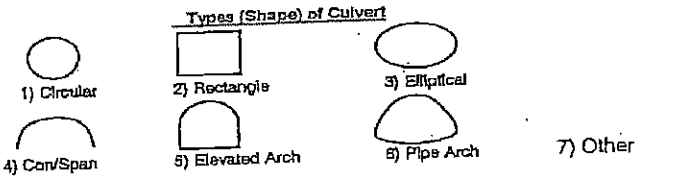
ENDWALL

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

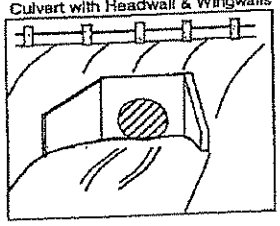
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

Types (Shape) of Culvert

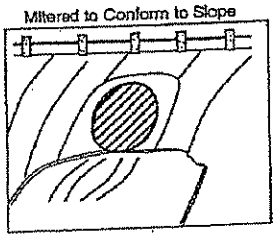


7) Other

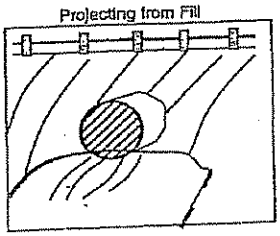
Inlet/Outlet Type
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

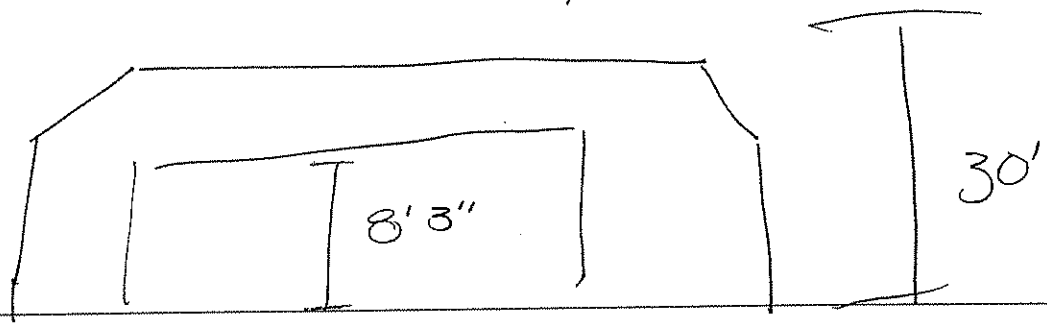


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s):	Amy, Meg, Jay		
Structure ID/Number:	~~FD~~ 168	Date:	11/5/09
Stream Name:		County:	Lawrence
Watershed:			
Photo ID:	70		
Latitude:	40° 55.111	Longitude	80° 23.224

Remarks/diagrams: Culvert - 60/168



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: Boxed

Entrance Coefficient:	
Exit Coefficient:	
Length:	90
Mannings n:	
Depth to Crown:	30'
Depth (inv. To stream bed)	8' 3"
Bank Full Width (where poss.)	12'

Inlet/Outlet Type:
- [x] Headwall
- [x] Wingwalls:

Type: _____

0° 45° 90° (circle)

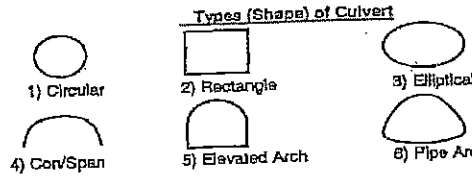
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)

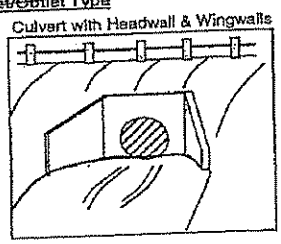
Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nosa

Types (Shape) of Culvert

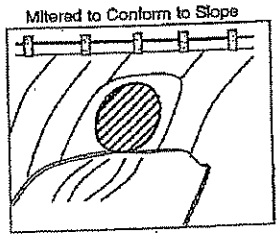


7) Other

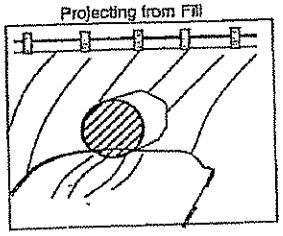
Inlet/Outlet Type
Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill

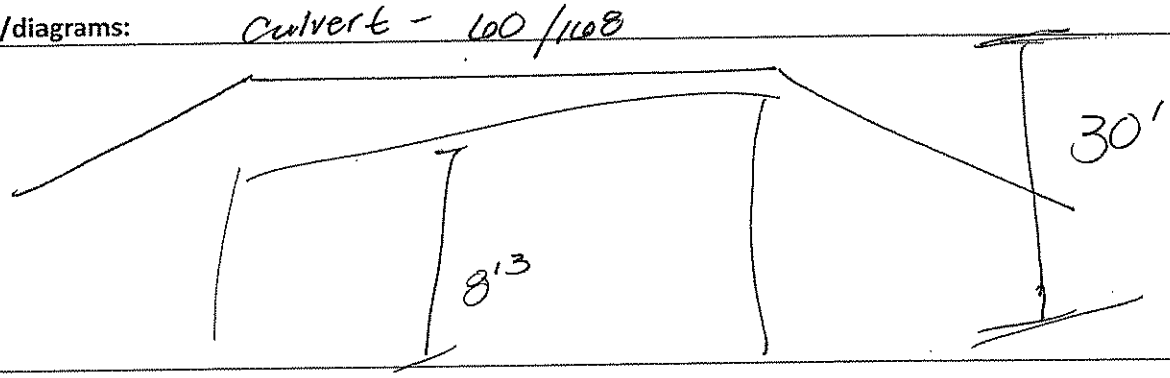


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Megan	
Structure ID/Number: 060	Date: 11/5/09
Stream Name:	County: Lawrence
Watershed:	
Photo ID: 71, 72, 73	
Latitude: 40° 55.142	Longitude 80° 23.067

Remarks/diagrams: Culvert - 60 / 108



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [x] Other: Boxed

Entrance Coefficient:	
Exit Coefficient:	
Length:	~~[illegible]~~ 200'
Mannings n:	
Depth to Crown:	30'
Depth (inv. To stream bed)	8.3
Bank Full Width (where poss.)	12

Inlet/Outlet Type:
- [x] Headwall
- [x] Wingwalls:

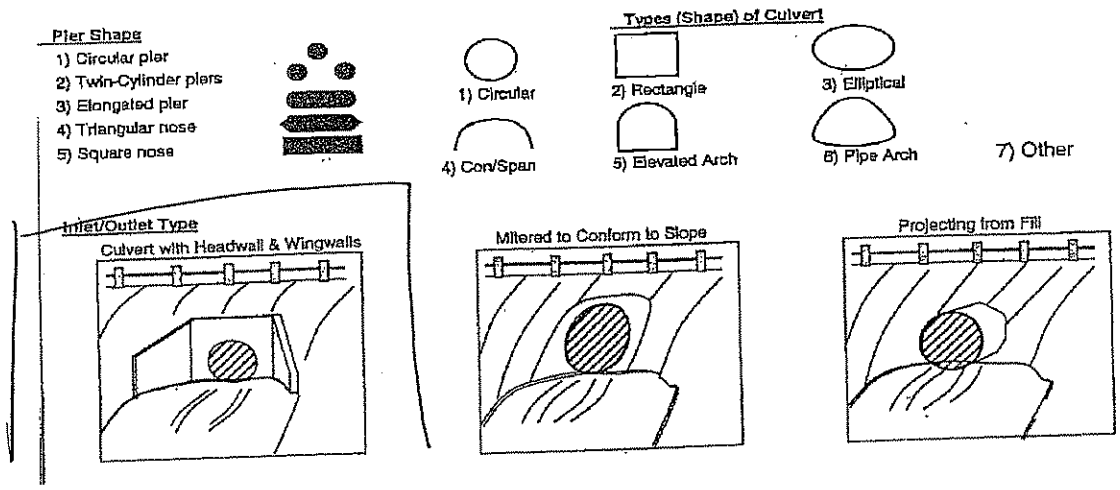
Type: _____

0° 45° 90° (circle)

- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers
Width
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure:
Width of opening (abutment)
Width of opening (obstruction)



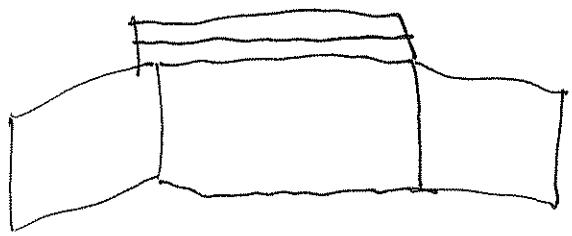
Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet

08-1300-0135

Collector(s): Amy, Jay, Meg	
Structure ID/Number: 67	Date: ~~Lawrence~~ 11/5/09
Stream Name:	County: Lawrence
Watershed: Beaver	
Photo ID: 67, 68	
Latitude: 40° 54.260	Longitude 80° 23.595

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

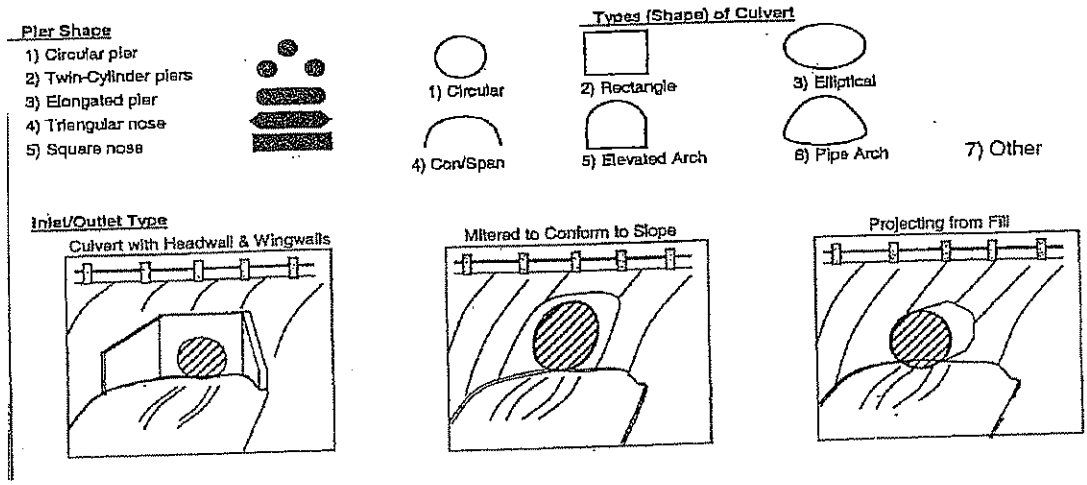
Entrance Coefficient: _____
Exit Coefficient: _____
Length: _____
Mannings n: _____
Depth to Crown: 11'
Depth (inv. To stream bed) _____
Bank Full Width (where poss.) 25'

Inlet/Outlet Type:
- [ ] Headwall
- [ ] Wingwalls:
- Type: _____

0° 45° 90° (circle)
- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers
Number of Piers 0
Width N/A
Width of Opening (c to c)

Bridge Measurements
Center of stream to bottom of structure: 10.2'
Width of opening (abutment) 28'
Width of opening (obstruction) 39'

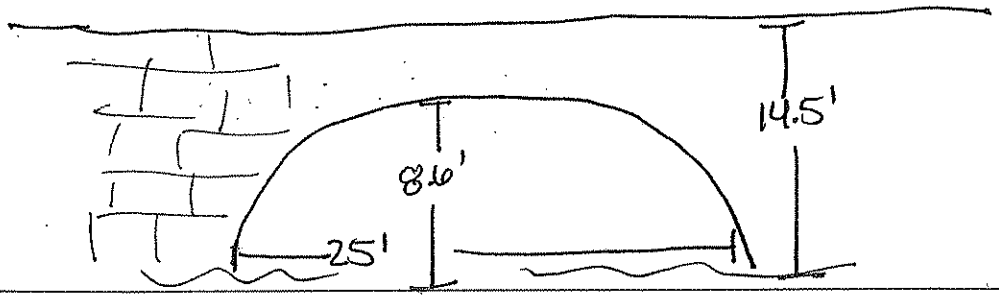


Kimball
L. Robert Kimball & Associates

Lawrence County- ACT 167 Plan Phase II Data Collection
Structure Data Collection Sheet
08-1300-0135

Collector(s): Amy Jay Meg	
Structure ID/Number: 33	Date: 11/3/09
Stream Name: McCLURE	County: Lawrence
Watershed: McCLURE	
Photo ID: 115, 116, 117, 118	
Latitude: 41° 7.031'	Longitude 80° 19.957'

Remarks/diagrams:



Culvert Type: (please circle the type as shown below)

Diameter _____
Number of Barrels: _____

Material: (select one)
- [ ] RCP (Reinforced Concrete Pipe)
- [ ] CMP (Corrugated Metal Pipe)
- [ ] Steel
- [ ] DIP (Ductile Iron Pipe)
- [ ] VCP (Vitrified Clay Pipe)
- [ ] Other: _____

Entrance Coefficient:	
Exit Coefficient:	
Length:	
Mannings n:	
Depth to Crown:	14.5'
Depth (inv. To stream bed)	8.6'
Bank Full Width (where poss.)	23'

Inlet/Outlet Type:
- [ ] Headwall
- [x] Wingwalls:

Type: _____

0° 45° 90° (circle)

- [ ] Projecting
- [ ] Flush with Slope
- [ ] MES (mitered end section)
- [ ] FES (flared end section)

Piers

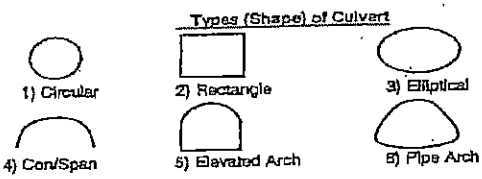
Number of Piers	
Width	
Width of Opening (c to c)	

Bridge Measurements

Center of stream to bottom of structure:	8.6'
Width of opening (abutment)	25'
Width of opening (obstruction)	50.2"

Pier Shape
1) Circular pier
2) Twin-Cylinder piers
3) Elongated pier
4) Triangular nose
5) Square nose

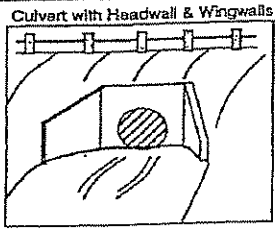
Types (Shape) of Culvert



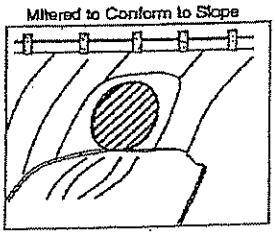
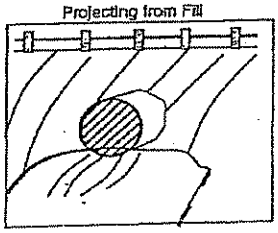
7) Other

Inlet/Outlet Type

Culvert with Headwall & Wingwalls



Mitered to Conform to Slope



Projecting from Fill