Act 167 Scope of Study for Armstrong County Stormwater Management Plan

Armstrong County Planning Commission

Armstrong County, Pennsylvania

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Acronyms

Act 167	Pennsylvania Stormwater Management Act
AMD	Acid Mine Drainage BFE
	Base Flood Elevation
BOC	Board of Commissioners
CWF	Cold Water Fishes
FIRMs	Flood Insurance Rate Maps
HQ	High Quality
HQ-CWF	High Quality-Cold Water Fishes
HQ-TSF	High Quality-Trout Stocking
MS4	Municipal Separate Storm Sewer Systems
NPDES	National Pollutant Discharge Elimination System
NFIP	National Flood Insurance Program
PADEP	Pennsylvania Department of Environmental Protection
PCB	Polychlorinated Biphenyls
SWM	Stormwater Management
TSF	Trout Stocking
WWF	Warm Water Fishes
WPAC	Watershed Plan Advisory Committee

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1.0 Introduction

1.1 Purpose

The Pennsylvania Stormwater Management Act (Act 167) requires counties to prepare and adopt watershed-based stormwater management plans in order to address accelerated stormwater runoff caused by development. This plan was prepared in accordance with the Pennsylvania Department of Environmental Protection (PADEP) guidelines for developing a countywide Phase I Act 167 Plan. This plan presents the results of the Phase 1 effort, which includes:

- A summary of County watershed characteristics
- An inventory of relevant problems
- A proposed scope of study, schedule and budget for completion of the Phase 2 Plan project.

1.2 Stormwater Runoff Problems and Solutions

The water that runs off the land into surface waters during and immediately following a rainfall 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, building, or unmanaged cropland). These surface changes can also substantially degrade stormwater runoff water quality, increasing the pollutant load to the rivers and streams. The alteration of natural land cover and land contours to residential, commercial, industrial, and cropland 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, and can also have a negative impact on waste water treatment plant operations. The impacts can be minimized if the practices associated with land use and development incorporate appropriate runoff and stormwater management systems and designs.

Individual land disturbance/development projects have historically been viewed as independent and discrete events, 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 in many different municipalities. However, individual land surface changes can dramatically affect 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, in some cases, loss of life. Therefore, given the cumulative nature of the disturbed land, a comprehensive approach must be taken for a reasonable management strategy to be successful.

When funding becomes available, the Phase II Plan will be developed to assess development patterns, impact to runoff quantity, velocity, and quality. The plan will also analyze projected development in hazard areas, the possible increase of runoff, and future flooding.

If funds become available, the Phase II Plan will be conducted and analyzed. This analysis will facilitate which of the recommendations and BMPs will be adopted as part of the Phase II Plan. BMPs will be used to minimize danger to property and life. The Phase II Plan will be written to properly design, implement, and maintain Erosion and Sedimentation (E&S) BMPs to minimize the potential for accelerated erosion and sedimentation to protect, maintain, reclaim, and restore water quality and designated areas. The plan will be written requiring the persons proposing or conducting earth disturbance to implement and maintain BMPs to minimize accelerated erosion and manage post construction storm water.

1.3 Pennsylvania Stormwater Management (Act 167)

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

1. Inadequate management of accelerated stormwater runoff 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 public health, safety, and welfare and the protection of the people of the commonwealth, their resources, and their environment.

The policy and purpose of Act 167 is to:

1. Encourage planning and management of stormwater runoff in each watershed that is consistent with sound water and land use practices.
2. Authorize a comprehensive program of stormwater management designated to preserve and restore the flood carrying capacity of Commonwealth streams; to preserve, to the maximum extent, practicable natural stormwater runoff regimes and natural course,

current and cross-section of water of the Commonwealth; and to protect and conserve ground waters and groundwater recharge areas.

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

Until enactment of Act 167, stormwater management had been oriented primarily toward addressing the increase in peak runoff rates discharging from individual land development sites to protect property immediately downstream and within the same municipality. Management of stormwater throughout the state paid minimal attention to the effects on locations further downstream or to designing stormwater controls within the context of the entire watershed. Stormwater management has also typically been regulated at the municipal level. Typically, there was little design consistency between adjoining municipalities on what types of storms to control and how to manage the stormwater.

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; recent changes in PADEP Act 167 policy now provide for Act 167 planning efforts on a county-wide basis, and, perhaps most significantly, Act 167 plans are to be prepared in consultation with municipalities located in the county, working through a Watershed Plan Advisory Committee (WPAC). The plans are to provide technical standards and criteria throughout the County's watersheds for the management of stormwater runoff from new land development sites. The Act 167 Plan must now also address retrofits of existing sites to improve existing water quality impairments and existing sources of flooding problems.

The types and degree of controls that are prescribed in the stormwater management plan must be based on the development pattern and hydrologic characteristics of each individual 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 (financial, legal, political, technical, etc.) of the municipalities of Armstrong County.

1.4 Act 167 Planning for Armstrong County

Based on the above history and information, the county-wide watershed planning process for Armstrong County must be designed with the individual watershed characteristics in mind, as well as the technical, political, and economic resources of the County. Phase 1 – Scope of Study presents the concept and approach that has been developed to meet these requirements, as well as the specific requirements of Act 167 for this countywide watershed stormwater management project.

The goal of Armstrong County's Act 167 planning process is to provide a county-wide comprehensive program for the planning and management of stormwater. With coordination from the forty-five (45) municipalities in Armstrong County, the resulting stormwater management ordinance developed in Phase 2 will address stormwater related problems in critical areas throughout the County. Furthermore, as part of Phase 2, all County municipalities must adopt the resulting stormwater management ordinance, or amend and implement ordinances and regulations as necessary to regulate development in a manner consistent with the proposed Plan and the provisions of Act 167. The stormwater management controls addressed in the stormwater management ordinance will collectively have a beneficial impact on the waters of Armstrong County and those "problem" areas that presently remain unmanaged.

1.5 Plan Benefits

1. Consistency in Stormwater Management Planning, Regulation, and Implementation

The purpose and benefit of the study and implementation plan is to provide all the municipalities in the County with an accurate and consistent implementation strategy and procedures for comprehensive stormwater management. Current stormwater management regulations, strategies, and enforcement criteria are almost nonexistent within the County and the few regulations within a few of the municipalities vary widely. Given the nature of storm runoff and its impacts, a critical objective of sound stormwater management planning is to provide for consistency of implementation requirements throughout the watershed. Therefore, the primary objective of the technical study and planning process is to develop a technical and institutional support document to encourage and/or support the consistency of regulations for implementation of effective stormwater management based watershed-wide consideration.

2. Integrated Stormwater Management Plan

Water resources are one integrated resource, connected through the hydrologic cycle. Stormwater runoff is a major component of this cycle. Surface water and groundwater are interconnected. The Armstrong County Stormwater Management Plan will not only address water quantity and peak flows, but will also take a more holistic approach to watershed management by also evaluating the interaction between surface and groundwater, where and how water quality concerns should be addressed, and how stormwater management (or lack thereof) affects stream bank erosion. The result will be a Plan to preserve and enhance Armstrong County's water resources through proper stormwater management.

The plan will strive to achieve the goals and objectives in the County Comprehensive Plan and the Armstrong County Comprehensive Recreation, Park, Open Space and Greenway Plan, specifically the goals and objectives as they relate to Stormwater and Water Quality.

3. Usable Technical Information in GIS Format

The technical and institutional watershed planning approach recommended by the PADEP also provides the municipalities within this watershed with a considerable amount of usable technical information, such as a detailed watershed runoff simulation model, that can be used for numerous other associated purposes by participating municipalities. Consequently, the municipalities and the County will receive beneficial products that can be used for other planning and engineering purposes. For example, land use updates and environmental data management are functions that are necessary for effective planning in a watershed. The technical component of the plan, primarily the water resources geodatabase created for the watershed, will provide the County and municipalities with a tool to perform a range of environmental assessments, such as future water quality impact studies after the plan is completed.

4. Technical Information for Future Hydrologic and Hydraulic Analysis and Regulatory Activities

The County will include all available data and will, after the public participation, determine the highest priority watersheds to study further where limited data is available.

The benefits of the watershed planning process are extensive, even beyond the important functions of developing comprehensive stormwater management strategies and ordinance provisions.

The plan will investigate and provide solutions to correct existing problems. Specifically, the plan will identify and summarize problem areas, provide conceptual solutions to correct these problems, and will specify possible funding streams for project implementation.

1.6 Stormwater Management Planning Approach

In order to implement countywide comprehensive planning and management of stormwater runoff, it was necessary to take a close look at all major watersheds within Armstrong County during Phase 1. Since the goals of the Act itself depend on municipal coordination and participation to provide for the planning and management of stormwater throughout their respective municipality, it is helpful to get “buy-in” endorsement and involvement from each municipality early in the planning process.

In turn, to initiate municipal-level involvement in the overall development of the Plan, a Watershed Plan Advisory Committee (WPAC) was formed and consists of personnel from the Armstrong County Department of Planning and Development, the Armstrong Conservation District, Pennsylvania Department of Environmental Protection, Southwestern Pennsylvania Commission, and representatives from each of the forty-five (45) municipalities located within the County. Two WPAC meetings were held during Phase 1 to introduce the planning process, to distribute Municipal & Agency Storm Water Planning Surveys, and to review the Phase 1 Scope of Study document.

The development process for the stormwater management plan is as follows:

1. Phase 1 – Scope of Study – Establishing procedures used to prepare the Plan. These procedures are determined by an overall survey of:
   - Specific watershed characteristics and hydrologic conditions.
   - Stormwater related problems and significant obstructions.
   - Goals, objectives, solutions, strategies, and estimated costs for the Phase 2 Plan.

2. Phase 2 – The Plan – The technical assessment and development of the model ordinance that includes:
   - Watershed planning.
   - Development of technical standards and criteria for stormwater management.
   - Alternative measures for control.
   - Conceptual solutions for identified problem areas.
   - Identification of administrative procedures for implementation of the plan.
   - Public hearing by Armstrong County.
   - Approval of Plan by PADEP.
   - Adoption of Plan by the Armstrong County Board of Commissioners (BOC).
   - Adoption, implementation, and enforcement of stormwater management ordinances by all municipalities.

1.7 Previous Stormwater Management and Related Planning Efforts

The following relevant documents will provide a valuable source of information for the development of the Plan:

1. Armstrong County Subdivision and Land Development Ordinance 2010
2. Armstrong County Comprehensive Plan 2005
3. Armstrong County Comprehensive Recreation, Park, Open Space and Greenway Plan 2009
4. Act 167 Stormwater Management Plan Glade Run Watershed, 1991
5. Buffalo Creek Watershed Conservation Plan, 2007
6. Cowanshannock Creek Watershed Conservation Plan, 2002
7. Kiski-Conemaugh River Basin Conservation Plan, 1999
8. Lower Crooked Creek Watershed Conservation Plan, 2004
9. Middle Allegheny River Conservation Plan, 2005
10. Redbank Creek Watershed Conservation Plan, 2007
11. Upper Crooked Creek Watershed Conservation Plan, 2001

2.0 General County Description

Armstrong County covers 664 square miles in southwestern Pennsylvania. According to the 2010 U.S. Census, the County had a population of 68,941 people and a population density of 104 people per square mile, which reflects the County's rural character. The largest populations are found in Kiskiminetas Township and East Franklin Township, with populations of 4,800 and 4,082, respectively.

2.1 Political Jurisdictions

The county is comprised of 45 independent municipalities, including 16 boroughs, 1 city, and 28 townships. The municipalities are listed in Table 1 below.

Borough	City	Township	
Apollo	Parker	Bethel	Perry
Applewold		Boggs	Pine
Atwood		Bradys Bend	Plumcreek
Dayton		Burrell	Rayburn
Elderton		Cadogan	Redbank
Ford City		Cowanshannock	South Bend
Ford Cliff		East Franklin	South Buffalo
Freeport*		Gilpin	Sugarcreek
Kittanning		Hovey	Valley
Leechburg		Kiskiminetas	Washington
Manorville		Kittanning	Wayne
North Apollo		Madison	West Franklin
Rural Valley		Mahoning	
South Bethlehem		Manor	
West Kittanning		North Buffalo	
Worthington		Parks	
*Municipal Separate Storm Sewer System (MS4) community			

2.2 NPDES Phase 2 Involvement

National Pollutant Discharge Elimination System (NPDES) Phase 2 requirements apply to operators of municipal separate storm sewer systems (MS4) within urbanized areas as designated by the 2010 census. Select municipalities outside of urbanized areas may also be designated as MS4 communities. Freeport Borough currently is the only municipality in the County that holds an MS4 permit. South Buffalo Township obtained an MS4 waiver for this permit cycle.

2.3 General History and Development

Named after war hero Colonel Armstrong, Armstrong County was formed on March 12, 1800 from parts of Westmoreland, Allegheny, and Lycoming counties, with Kittanning being made the county

seat. The completion of the Pennsylvania Canal in 1828 was a major addition to the county's transportation network, as was the construction of the Pittsburgh, Kittanning & Warren Railroad (later, the Allegheny Valley Railroad) beginning in 1837.

Through the years, the county has produced coal, sand, gravel, glass, clay, brick, steel, iron, natural gas, and quarried stone. Today, Armstrong County's major industries are agriculture, coal mining, brick-making and steel-sheet manufacturing. Growing industries include electro-optics and advanced manufacturing technologies.

Armstrong remains primarily a rural county, but business parks including Northpointe, Manor Township Business Park, Parks Bend Farms, and the West Hills Industrial Park scattered throughout the county continue to attract development. The potential expansion of Route 28 up to the I-80 corridor could also assist in attracting businesses. This will provide employment opportunities for present and future county residents who seek both the beautiful countryside and easy access to Pittsburgh.

2.4 Land Use

Land use is directly tied to stormwater planning and management. The most recent available land use statistics (2010) are summarized in Table 2. As illustrated by the summary table below, the County is primarily undeveloped areas which accounts for 89.4% of the total land area. Within these undeveloped regions, agricultural areas are the second most common land-use, accounting for 26.2% of the total land area. Residential, mixed urban, and industrial areas account for 10.6% of the total land area.

Land Use / Land Cover	Area (miles^2)	% of County
Agriculture	174.2	26.2%
Mixed Urban	5.9	0.9%
Extraction	4.6	0.7%
Industrial	2.0	0.3%
Mixed Forest	370.2	55.7%
Mixed Rangeland	37.2	5.6%
Water	12.7	1.9%
Residential	54.6	8.2%
Transportation, Communication, and Utilities	3.3	0.5%
Total	664.4	100.0%

2.5 Physiography

Armstrong County lies on the Allegheny Plateau. It is characterized by narrow, gently sloping valleys, very steep adjacent hillsides, and narrow ridgetops that vary from gently sloping to moderately sloping. The lowest elevation, 750 feet above sea level, can be found along the Allegheny River in Freeport Borough. The highest point is located in Wayne Township and is 1,720 feet above sea level. The Allegheny River, Redbank Creek, and the Kiskiminetas River form the north and southwestern boundaries of the County.

2.6 Soils

The Soil Survey of Armstrong County, Pennsylvania lists forty-seven soil mapping units for the County. The most common type is WkF (Weikert and Gilpin 25 - 70% slope). This soil type makes up for 27.2% of the soil in Armstrong County. Soils of this type are suited for trees and wildlife habitat. These soils have limitations due to the hazard of erosion due to slope.
GwD (Gilpin-Weikert complex, 15 - 25% slope) is the second most common soil type in the County, making up 10.1% of the land. This type of soil is best used for crops that tolerate drought, as well as being used for hay, pasture, trees, and wildlife habitat. This soil is limited due to coarse fragments and a shallow depth. Being that the Weikert and Gilpin association as well as the Gilpin Weikert complex are both shallow to bedrock and are typically located on steep slopes, these soil formations do not allow for infiltration. Alternative runoff control methods utilizing infiltration will need to be located within other soil types (Rayne-Ernst-Hazelton association and Wharton-Rayne-Cavode association) and on flatter lands. These methods could include vegetated swales, pervious paving, and bioretention cells.

2.7 Water Resources

Rivers and creeks dominate the landscape of Armstrong County. The Allegheny River travels the full length of the County from north to south, eventually emptying into the Ohio River in the City of Pittsburgh. In addition to the Allegheny River, major waterways include the Kiskiminetas River, and Redbank, Cowanshannock, Mahoning, and Crooked Creeks. Reservoirs in the county include Mahoning and Crooked Creek Reservoirs, both of which are operated by the Army Corps of Engineers. Keystone Lake comprises 850 acres and is the largest lake in Armstrong County. The lake is owned and operated by Reliant Energy and is used as a cooling water supply for the Keystone Power Plant and is controlled by the PA Fish & Boat Commission. The entire County is within the Allegheny River watershed, which is part of the larger Ohio River drainage basin.

There are a total of twelve (12) Act 167-designated watersheds partially or entirely within Armstrong County. The Act 167-designated watersheds include: Allegheny River, Blacklegs Creek, Buffalo Creek, Cowanshannock Creek, Crooked Creek, Glade Run, Kiskimenetas River, Little Mahoning Creek, Little Sandy Creek, Mahoning Creek, Pine Creek, and Redbank Creek.

2.7.1 PA Chapter 93 Stream Classifications

Designated uses are one important piece of protecting and understanding water quality in Pennsylvania. Designated water uses establish the reason for protecting the waterways; water

quality criteria define what is required to protect that benchmark. Together, use designations and water quality criteria constitute Pennsylvania Water Quality Standards as defined in Title 25 Environmental Protection, Department of Environmental Protection, Chapter 93.
Table 3 below summarizes Designated Uses in Armstrong County. Warm Water Fishes and Cold Water Fishes account for the majority of the streams in the County, accounting for 48.7% and 26.6% of the total stream length, respectively.

Chapter 93 Classification	Length (Miles)	% of Total
Cold Water Fishes (CWF)	399.0	26.6%
High Quality-Cold Water Fishes (HQ-CWF)	126.2	8.4%
High Quality-Trout Stocking (HQ-TSF)	132.6	8.8%
Trout Stocking (TSF)	111.7	7.4%
Warm Water Fishes (WWF)	731.0	48.7%
Total	1500.4	100.0%

Definitions:

(HQ) High Quality – requires special protection Aquatic Life Classification

(CWF) Cold Water Fishes - Maintenance or propagation, or both, of fish species including the family Salmonidae and additional flora and fauna which are indigenous to a cold water habitat.

(WWF) Warm Water Fishes—Maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.

(TSF) Trout Stocking—Maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.

2.7.2 Impaired Waterways

The following table lists the sources of water quality impairments and extents for those streams within Armstrong County that are on the PADEP 2015 Integrated Non-Attaining List. Per PADEP, this list represents stream assessments for the Clean Water Act Section 305(b) reporting and Section 303(d) listing. PADEP protects four stream water uses: aquatic life, fish consumption, potable water supply, and recreation. This information includes stream segments that have been evaluated for attainment of those uses. If a stream segment is not attaining its uses, it is considered impaired.

There are a total of 265.98 miles of impaired waterways in Armstrong County. These are detailed below in Table 4.

Primary Cause of Impairment	Stream / Reach Name	Impaired Length (Miles)
Acid Mine Drainage	Bear Creek	1.03
	Beaver Run	0.001
	Big Run	1.09
	Cathcart Run	2.51
	Coal Bank Run *	1.19
	Craig Run *	1.13
	Craigs Run	0.65
	Crooked Creek	0.11
	Foundry Run *	0.37
	Fowler Run	0.53
	Hart Run	1.09
	Huling Run	0.65
	Kiskiminetas River *	9.31
	Limestone Run *	0.94
	Little Mudlick Creek	1.66
	Long Run	6.21
	Mahoning Creek	0.05
	Marrowbone Run	0.28
	Middle Run	0.0003
	Nye Branch	1.04
	Pine Run *	5.20
	Redbank Creek *	5.99
	Roaring Run	2.14
	Sugar Creek	5.24
	Sugarcamp Run	2.73
	Thoms Run	0.55
	Town Run *	0.002
	Unnamed *	90.77
	Whisky Run	1.53
	Wildcat Run	0.003
	Total	145.33
Agriculture	Crooked Creek *	1.09
	Glade Run	3.27
	Patterson Creek *	2.54
	Unnamed	15.06
	Total	21.95
Bank Modifications	Big Run	3.72
	Dutch Run	2.76
	Hill Run	2.37
	Kiskiminetas River	0.29
	Knapp Run	1.44
	Pine Run	2.04

	South Branch Plum Creek	0.63
	Spur Run	1.78
	Unnamed	14.21
	Total	29.24
Erosion from Derelict Land	Unnamed	4.39
	Total	4.39
Habitat Modification	Brady Run	1.30
	Campbell Run	1.33
	North Branch South Fork Pine Creek	2.22
	Plum Creek	2.14
	Unnamed	2.40
	Total	9.39
Natural Sources – Water/Flow Variability	Unnamed	0.71
	Total	0.71
On site Wastewater	Buffalo Creek	1.44
	Unnamed	7.28
	Total	9.42
Runoff	Garretts Run	1.67
	Unnamed	1.20
	Total	2.87
Siltation	Buffalo Creek	6.16
	Pine Run	3.13
	Unnamed	6.35
	Total	15.64
Small Residential Runoff	Brady Run	0.55
	Carnahan Run	1.88
	Taylor Run	1.66
	Unnamed	2.40
	Total	6.49
Source Unknown – Cause Unknown	Buffalo Creek	8.84
	Rough Run	0.25
	Unnamed	1.43
	Total	10.52
Source Unknown – PCB	Allegheny River	9.96
	Unnamed	0.08
	Total	10.04

Source: PADEP TMDL page (http://www.ahs.dep.pa.gov/TMDL/). 2/1/2017

* A TMDL has been developed for this impaired stream/watershed.

Existing Dams and Impoundments

Dams that are inspected by the Southwest Office of the Pennsylvania Department of Environmental Protection are:

Dam Name	Municipality
Keystone Dam	Plumcreek Township
David Mine Sedimentation Pond 1	Kiskiminetas Township
David Mine Sedimentation Pond 2	Kiskiminetas Township
David Mine Sedimentation Pond 3	Kiskiminetas Township

Dams under the jurisdiction of the Army Corp of Engineers are:

Name	Municipality
Crooked Creek Dam	Bethel and Manor Townships
Mahoning Dam	Redbank and Wayne Townships

There are two small dams that are not inspected by the Southwest Office of the PA DEP: the first is in Buffalo Creek about 2-3 miles downstream of Worthington just before the Buffalo Bridge; the second is in near downtown New Bethlehem within Redbank Creek. Capacity of existing dams will be reviewed as part of any future studies to take place during Phase 2. Crooked Creek and Mahoning Dams are the only flood control projects within Armstrong County.

Dam safety regulations will be considered whenever storm water detention facilities are recommended to address drainage issues such as significant obstructions as well as state, federal, and local flood control projects located throughout the county.

2.7.3 Abandoned Mine Discharges

Both locally and statewide, Acid Mine Drainage (AMD) is the largest single contributor to impaired water quality. Armstrong County, with 313 sites that cover almost 18,000 acres, ranks 2nd within Pennsylvania for the most abandoned mine sites. A total of 145.3 miles of Armstrong County streams are classified as impaired due to AMD. AMD is the result of water flowing through abandoned coal mines and chemically reacting with rocks and minerals that were exposed during the coal extraction process. AMD-polluted water can turn streams orange and/or white, kill aquatic life, contaminate drinking water sources, and damage the recreational economy. The remediation of streams in Armstrong County that are impacted by AMD is being undertaken by groups such as the Armstrong County Conservation District, the Arrowhead Chapter of Trout Unlimited, Roaring Run Watershed Association, and others.

2.8 Floodplains

Armstrong County has over 19,884 flood prone acres within the 100-year floodplain. There are forty-one (41) municipalities that participate in the National Flood Insurance Program (NFIP). Due to the lack of flood prone areas, the following boroughs do not participate in the NFIP: Atwood, Elderton, Ford Cliff, and West Kittanning.

The revised Armstrong County Flood Insurance Rate Maps (FIRMS) have been adopted and are part of an effort to update FIRMs with the latest technologies and most current data. These changes include, but are not limited to: inclusion of all municipalities on a single set of countywide FIRMs, an updated base map to allow for more accurate determinations of base flood elevation (BFE), and re-delineation of floodplains with elevations. The updated FIRMs were adopted on February 17, 2016. These changes will likely have a significant impact on the number of properties that are located in the floodplain.

2.9 Climate

Armstrong County is located in The Humid Continental Zone. This zone includes four seasons with a wide range of temperatures. Summer temperatures average 71 degrees Fahrenheit, while winter temperatures average 25 degrees Fahrenheit. It is also found that the temperature can range from below zero to over one hundred degrees. The latitude has the biggest influence of the climate in this area; locations further away from the equator receive less direct sunlight and are consequently cooler. The Humid Continental Zone has between 20 - 50 inches of precipitation each year. Evergreens and deciduous trees both grow easily in the Humid Continental Zone, along with most grasses and shrubs due to the warm summers and regular rainfall. Areas with this climate are an excellent location for farming.

3.0 Act 167 Planning for Armstrong County

This section of the Phase 1 – Scope of Study presents the concept and approach that has been developed to meet the Act 167 requirements for this countywide watershed stormwater management project.

3.1 Survey Creation and Distribution

A map based Stormwater Management Plan Survey was distributed by the Armstrong County Planning Department early in the Phase 1 process. All municipalities and other interested citizen groups and public organizations were encouraged to complete the form. The purpose of the Survey was to gather various pieces of information to determine what stormwater issues affect each municipality, and to determine the location of existing problem areas, significant obstructions, and stormwater management facilities.

3.2 Watershed Plan Advisory Committee (WPAC)

The WPAC was formed by the Armstrong County Planning Department, in conjunction with the Armstrong County Conservation District, and consists of the required municipalities, the County Conservation District, and other agency or group representatives appointed by the county.

If a municipality did not appoint a representative to the WPAC, then the head of the governing body was appointed by the County to the WPAC. As an appointed member, that member was provided all correspondence, considered an active member, and their name was included on a list as a member of the WPAC contained within the Plan. The head of each governing body will also be asked to assist their municipality in adoption of the provisions and requirements of the final plan. Table 5 on the following page provides the WPAC representative from each municipality/organization, along with their participation in the SWM Survey.

Municipality/Organization	Name	SWM Survey Returned?
Apollo	Rich Craft	**Y**
Applewold	Mark Feeney	**Y**
Atwood	Gary Rankin	**Y**
Bethel	Jim Riederer	**Y**
Boggs	Jack Zubik	**Y**
Brady's Bend	Ronald Ford	**Y**
Burrell	William T. Headley	**N**
Cadogan	George Edinger, III	**N**
Cowanshannock	Randy Hartzell	**Y**
Dayton	Mark Enterline	**Y**
East Franklin	Barry Peters	**Y**
Elderton	Brenda Wolfe	**Y**
Ford City	Kathy Bartuccio	**Y**
Ford Cliff	Stacy Hartman	**Y**
Freeport	Donald L. Rehner	**Y**
Gilpin	Christine Pastva	**Y**
Hovey	William Powers	**N**
Kiskiminetas	Jack Wilmot, Jr.	**Y**
Kittanning Boro	Wilbur Stitt	**Y**
Kittanning Twp	Bob Conklin	**Y**
Leechburg	Tony Defilippi	**Y**
	Bob Foster	
Madison	George Traister Jr.	**Y**
Mahoning	Terry Yeany	**Y**
Manor	Jim McGinnis	**Y**
Manorville	Nancy Busch	**Y**
North Apollo	Debbie Stankus	**Y**
North Buffalo	Clark Whiteman	**Y**
	Paul Kirkwood (Alt)	
Parker	DuWayne Amsler	**Y**
Parks	Paul R. Duriancik	**Y**
Perry	Ron Eddy	**Y**
Pine	Clyde Moore	**N**
Plumcreek	Gary Gearhart	**Y**
	Blaine Boyer	
Rayburn	Samuel Duncan	**Y**
	Jen Cousins	
	Tracy Jack (Alt.)	
Redbank	Gale Hepler	**Y**
Rural Valley	William Spera	**Y**
South Bend	Robert Coleman	**Y**
	Kim Anderson (Alt.)	**Y**
South Bethlehem	Melvin Blake	**Y**
South Buffalo	Terry Van Dyke	**Y**
Sugarcreek	Doug Cannon	**Y**
Valley	Merle Cessna	**Y**

Washington	Randy Bargerstock	**N**
Wayne	Terry Rupp	**Y**
West Franklin	Darrel Lewis	**Y**
West Kittanning	Robert Venesky	**Y**
Worthington	Barry Seth	**Y**
Arrowhead Chapter of Trout Unlimited	Chad Hough	**N**
Bear Creek Watershed Association	Jerry Macurak	**N**
Buffalo Creek Watershed/ Audubon Society of Western Pa	Briana Shema	**Y**
Cowanshannock Creek Watershed Association	Pam Meade	**Y**
Crooked Creek Watershed Association	Dennis Hawley	**Y**
Kiskiminetas Watershed Association	John Linkes	**Y**
Redbank Watershed Association	Tim Murray	**Y**
Roaring Run Watershed Association	John Linkes	**Y**

Armstrong County Department of Planning and Development	Richard Palilla
	Sally Conklin
	Thomas Swisher
	Brigid Beatty
Pennsylvania Department of Environmental Protection	Jeffrey Fliss
Southwestern Pennsylvania Commission	Erin Kepple Adams
	Abby Stark
	Sara Koenig
	Chris Jacobs
Department of Community and Economic Development	Dan Fitzpatrick

3.3 Watershed Plan Advisory Committee Meetings

Two Watershed Plan Advisory Committee meetings were held during the Phase 1 process. The purposes of the meetings were to exchange information and to provide opportunities for intermunicipal and county agency coordination.

A WPAC meeting was held on October 15, 2014. The presentations included an overview of the Act 167 planning process, plus a summary of the expectations and potential results and outcomes of the plan. The municipal/agency surveys were distributed to the WPAC members, and the meeting concluded with a question and answer period.

The second WPAC meeting was held on March 22, 2016. The purpose of this meeting was to summarize the Phase 1 – Scope of Study, outline the tasks to be completed during Phase 2, and address any comments or concerns of the WPAC from their review of the draft Phase 1 document.

4.0 Stormwater Management Survey Results

Based upon the information received, seven (7) municipalities have erosion regulations and nine (9) have drainage regulations. According to the survey, the concerns of the municipalities are exactly the reverse of the watershed groups: municipalities are concerned about maintaining their existing infrastructure by controlling peak flow and erosion, whereas watershed groups are concerned about water quality and water recharge. Flooding is also viewed as a concern by both groups. During the review of the surveys, flooding went hand-in-hand with the other concerns. Flooding is probably viewed as the cause for the other concerns within the survey. See Tables 6a and 6b below: the number within the table indicates how many people felt each issue is important.

Municipal Rankings within Surveys	
154	Peak Flow
144	Stream Erosion
139	Flooding
126	Water Recharge
122	Water Quality

Watershed Rankings within Surveys	
10	Water Quality
9	Water Recharge
9	Flooding
9	Stream Erosion
8	Peak Flow

What is the most important storm water related issue?

Municipalities

The municipalities list the following as the most important stormwater-related issues to their municipality: (15) flooding, (9) erosion, (6) peak flows, (2) recharging, (2) catch basins, and (1) water quality.

Watersheds

The following are the most important stormwater-related issues to the watersheds:
(1) nutrient loading, (1) increased runoff and (1) flooding.

4.1 Stormwater Problem Prioritization

Upon analyzing the results of the Survey, it was determined that the two most common stormwater problems were peak flow and flooding due to undersized culverts or lack of culverts and heavy rain falls. A number of municipalities stated that flooding was causing roads to be washed out, while others have documented repeated flooding of houses.

Although the Phase 2 Plan effort will initially focus on the primary stormwater problems indentified above, the planning effort will also include further analysis and prioritization of stormwater problem solutions and strategies. This prioritization effort will be based on WPAC input and a more detailed review of the survey information collected during Phase 1. The

identification of problem areas will help in assessing the stormwater management controls needed in the future.

As seen in Figures 2 & 3, areas have been identified as issues and are spread throughout the County. As development continues to spread into the countryside, it will be important to protect life and property by controlling the runoff from new land development.

If funding becomes available, a Phase II Plan will be conducted. As part of this Phase II Plan, modeling will be completed. This modeling will be used to assist in prioritizing the identified "problem areas" as shown on Figure 2. Beyond modeling, the Phase II Plan will take historical data into account, such as frequency of reoccurrence, dollar figure on property damage, and most importantly, whether there has ever been any loss of life.

4.2 Modeling Needs Assessment

Table 7 below provides a summary and rationale for the Modeling Needs Assessment. Modeling is not included in the technical and price proposal for Phase 2 of this study. This work should be included in future updates to the plan that will be prepared in Phase 2 of this study. It was determined to call for modeling when six or more problem areas were within a watershed.

Act 167 Watershed	Detailed Modeling Necessary?	Rationale	Focus of Modeling Effort
Allegheny River	Yes - Partial	Some areas experience recurrent flooding	Modeling of Sugar Creek, Cove Run, Hart Run and Holder Run
Buffalo Creek - Allegheny	Yes	Build-up of debris	Modeling of the watershed
Cowanshannock Creek	Yes - Partial	Heavy rains causing erosion to banks	Focus on bank and channel restoration
Crooked Creek	No	N/A	N/A
Glade Run	No	N/A	N/A
Kiskiminetas River	Yes - Partial	Flooding due to heavy rains	Modeling of Sugar Hollow Run
Little Sandy Creek	No	Minimum growth pressure	NA
Mahoning Creek	No	N/A	N/A
Pine Creek	No	Minimum growth pressure	NA
Redbank Creek	No	Minimum growth pressure	NA

4.3 Recommended High Priority Goals and Objectives for Future Work (Not included in Phase 2 of this study)

- Update the Glade Run Act 167 Plan.
- Hydrologic and hydraulic modeling of Sugar Creek and several of its tributaries located in Brady's Bend Township.
- Hydrologic and hydraulic modeling of Sugar Hollow Run where it flows through Apollo Borough.
- Assess stormwater impacts from those areas identified by the County as Growth Areas. Future development and growth patterns will be refined with the County and other stakeholders before starting the engineering evaluations.
- Assess and verify existing identified obstruction and other structure related stormwater management issues.

If funding ever becomes available to complete the required modeling and analysis that a Phase II requires, the objective of this plan would be to facilitate the development and implementation of a Phase II Plan.

5.0 Phase 2 Scope Discussions

Refer to Appendix C for a copy of the Phase 2 – Scope of Work anticipated to be issued by the PADEP in Armstrong County's Phase 2 Plan.

As part of the Phase 2 work, a Model Ordinance will be created which includes the standards and provisions of the Plan. An important part of the Model Ordinance will be the inclusion of regulations for activities that may affect stormwater runoff. These regulations are not meant to discourage the activities, but rather to ensure that they are completed in a proper manner with due regard to stormwater management.

5.1 General Work Plan

Phase 2 Agreement Upon completion and submission of the Phase I report to PADEP, Armstrong County and PADEP will communicate on funding avenues to complete the Phase 2 portion of the project.

Survey During Phase 2, the County and/or consultant shall address items listed in Act 167 Section 5(b) and 5(c).

Watershed Plan Advisory Committee (WPAC) During Phase 1, a WPAC was formed. The County requested each municipality to appoint at least one person from their individual municipality to the WPAC. These requests were in response to Section 6(a) of the Pennsylvania Management Act (Act 167), which states "The county shall establish, in conjunction with each watershed stormwater planning program, a WPAC 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 to carry out the purposes of the committee."
It is intended that the WPAC will continue to serve as the advisory panel for the overall planning process throughout Phase 2. The committee members will also serve as the primary contact point for the municipalities/organizations that they represent. It is anticipated that each of these municipalities/organizations will continue to have representation in the WPAC.

WPAC Engineering Meeting Certain WPAC meetings will focus on the more technical aspects of the Plan. These elements include technical analysis and development of management criteria. Municipal engineering representatives should attend, and the agenda will focus on the engineering aspects of the Plan as opposed to the more general objectives and overall Plan contents.

WPAC Legal Meetings

Certain WPAC meetings will focus on the legal aspects of the Plan. Municipal solicitors should attend and the agenda will focus on the implementation of the Model Ordinance from a legal and regulatory framework standpoint.

Standards

The Plan will include criteria and standards for a comprehensive stormwater management strategy that includes the elements listed below. The criteria and standards established in the plan will be mandatory for municipal implementation through the local ordinances.

1. Peak Rate Control Management - Implementation of Peak Rate Controls for various subwatersheds will be developed based on collected data, modeling, engineering judgment, and committee input.

2. Volume Control Management - Implementation of Control Guidance 1 and Control Guidance 2 from the Pennsylvania Stormwater Best Management Practices Manual.

3. Water Quality Management - Implementation of non-point source pollution removal methodologies that meet the requirements of:

   - State Water Quality Chapter 93
   - Pennsylvania Clean Streams Law
   - TMDL pollutant reduction (Clean Water Act)

4. Establish stream bank anti-erosion requirements using an analysis of streams and their channels within the watershed.

5. Establish groundwater recharge/infiltration requirements.

6. Establish channel protection requirements based on management of the 2-year design storm with discharge of this volume over 24 hours.

Work Schedule

A work schedule will be developed early in Phase 2. The work schedule will set target dates for various tasks with the intention of completing the project for PADEP review and approval and municipal implementation within the Phase 2 preparation period.

Strategies

Municipal compliance in terms of adapting the Model ordinance will be reviewed as part of the typical subdivision review process. Long- and short-term objectives need to be met and progress must be monitored with all objectives in consideration.

Appendix A - Stormwater Survey Form

Municipal & Agency Storm Water Planning Survey

Person Completing Survey	
Municipality	
Name	
Title	
Phone	
Date Completed	

1. **Does your municipality have?**

	Yes	No	Location/ Date
Erosion Control Regulations			
Drainage Regulations			

2. **The watershed plan will address five key storm water areas. Please indicate how important you believe it is to address each area.**

Consideration		Very Important 5	4	3	2	Not Important 1
Peak Flows	Increased flows from storm water runoff contribute to stream erosion, localized ponding and flooding, may cause damage to infrastructure.					
Water Quality	Dissolved and un-dissolved pollutants washed off the land surface – negative impacts to recreation, aesthetics and in-stream habitat					
Ground Water Recharge	Increased runoff decreases amount of rain that becomes groundwater; decreased groundwater supplies may have negative effects on well water supplies and decrease or dry up stream base flow in dry periods.					
Stream Erosion	Eroding banks and beds may undercut roads and utilities, damage in-stream habitat, clog culverts and bridges.					
Flooding	Larger scale overbank flows such as the .01 annual percent chance of flooding associated with extreme storm events.					

3. **What is the most important storm water related issue to your municipality?**

4. **The following lists the types of storm water related problems your municipality may be experiencing. For each problem type, place a check mark in the column that best describes the severity, frequency and cause. If your municipality is experiencing a problem not listed, please list it in the space marked "other".**

Problem	Severity			Frequency (Years)				Cause				
	Severe	Moderate	None	<1	1-2	3-6	>6	Increased Runoff	Poor/No Drainage	Undersized Structure	Floodplain Development	None
Stream Flooding												
Street Flooding												
Property Flooding												
Soil Erosion												
Sediment in Stream												
Stream bed/bank erosion												
Scour at Outfalls												
Property/ Infrastructure Damage												
Pollution												
Habitat/Resource Damage												
Other												

5. **Do you know of any existing or proposed flood control projects (stream debris removal, stream bank stabilization, etc) in your municipality?**

Yes	No
If yes, please describe the project(s) below:	

6. **Are existing (public or private) storm water management facilities (outfalls, basins, etc.) being maintained in your municipality?**

Yes	No
If yes, please describe the project(s) below:	

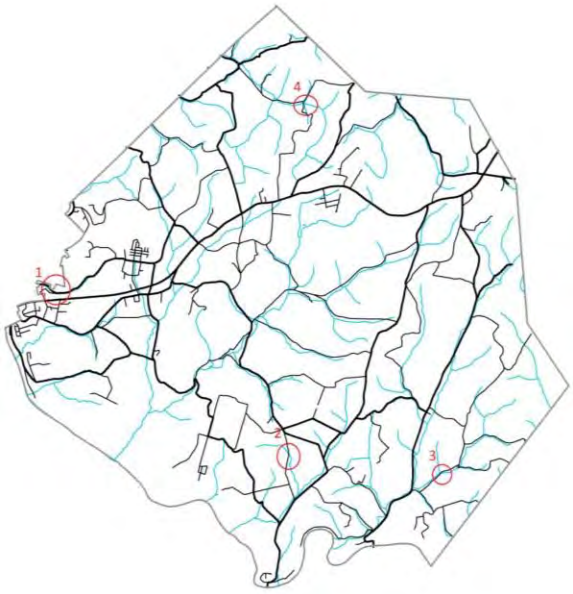
7. **On the attached map, please identify the following storm water related issues in your municipality:**
   - **Storm water problem areas**
     - Areas of ponding after rain events, including erosion, stream channel or bank erosion, property damage, safety concerns, etc.
   - **Obstructions**

- Debris blocking culverts, pipes, and bridges that restrict stream flow and cause ponding or flooding upstream from the structure.

- **Areas where you predict storm water problems developing in the next 10 years**
  - New or proposed development sites

Number each issue, beginning with the number 1. Once identified, please describe the issues on the storm water spreadsheet with the corresponding number.

Below is a sample map and information spreadsheet of storm water problem areas.



Sample information spreadsheet

	Issue			
Number	Storm water problem	Obstruction	Problems in the next 10 years	Cause/Description
1	Erosion			Flooding has eroded stream bank
2		Blocked culvert		Debris in stream at culvert
3			8 lot subdivision	New housing development
4	Ponding			After any rain event

Should you have any questions about this survey or about the information being requested, please do not hesitate to call: Thomas Swisher, Armstrong County Department of Planning and Development, 724-548-3223

Please return the completed survey via Fax: 724-545-7050

Email: tjswisher@co.armstrong.pa.us; or regular mail

Appendix B - Stormwater Survey Summary

Survey Results

Municipality	Erosion Regulations 1=yes	Drainage Regulations 0=no	Peak 5 very importan	Water Quality	Recharge	Stream Erosion	Flooding 1 not so important
Apollo	1	1	5	4	1	4	5
Applewood	0	0	5	3	3	5	3
Atwood	0	0	0	0	0	0	0
Bethel	0	0	5	5	5	5	5
Boggs	0	0	1	2	1	2	3
Bradys Bend	0	0	5	3	4	5	5
Burrell	0	0	0	0	0	0	0
Cadogan	0	0	0	0	0	0	0
Cowanshannock	0	0	5	4	5	4	4
Dayton	0	1	5	5	5	5	5
East Franklin	0	0	4	4	2	4	4
Elderton	0	1	4	2	2	1	1
Ford City	0	0	3	3	3	3	3
Ford Cliff	0	0	5	5	3	3	2
Freeport	0	0	5	5	5	5	5
Gilpin	0	0	5	5	3	3	3
Hovey							
Kiskiminetas	0	1	4	3	2	4	5
Kittanning Boro	0	0	4	5	5	4	5
Kittanning Twp	0	0	4	3	4	4	3
Leechburg	1	1	5	3	1	1	2
Madison	0	0	1	1	5	1	1
Mahoning	0	0	5	3	4	5	3
Manor	1	0	5	3	4	5	4
Manorville	0	0	4	3	4	3	4
North Apollo	1	1	5	1	3	2	3
North Buffalo	1	1	5	4	3	5	5
Parker	0	0	2	2	2	3	3
Parks	0	0	5	5	5	5	5
Perry	0	0	1	1	1	5	1
Pine							
Plumcreek	0	0	5	5	5	5	5
Rayburn	1	0	5	3	4	5	5
Redbank	0	0	0	0	0	5	5
Rural Valley	0	0	4	3	5	3	3

South Bend	0	0		5	1	2	5	5
S. Bethlehem	0	0		2	2	4	3	4
South Buffalo	1	1		5	4	2	4	5
Sugarcreek	0	1		3	3	3	3	3
Valley	0	0		0	0	0	0	0
Washington								
Wayne	0	0		5	5	5	5	5
West Franklin	0	0		5	4	4	5	4
West Kittanning	0	0		5	4	3	2	2
Worthington	0	0		3	1	4	3	1
TOTAL	**7**	**9**		**154**	**122**	**126**	**144**	**139**

Watershed			**Peak**	**Water Quality**	**Recharge**	**Stream Erosion**	**Flooding**
Arrowhead Bear Creek Buffalo Creek			0	0	0	0	0
Cowanshannock Crooked Creek			4	5	5	5	4
Kiski Redbank Roaring Run			4	5	4	4	5
TOTAL			**8**	**10**	**9**	**9**	**9**

Appendix C

Phase 2 Scope of Work
(Actual scope may differ when issued by the PADEP)

There are three (3) major work elements required to prepare the PLAN. These are:

1. Project Administration
2. Preparation of the PLAN
3. Managing Public Participation including the Plan Advisory Board

Those responsible for delivering, assisting, or approving these elements are identified below.

The Armstrong County Department of Planning and Development shall be considered as the COUNTY and shall assume all responsibilities deemed to be assumed by the County. The County, with the help of the selected consultant, will accomplish the technical and nontechnical components of the PLAN.

The final Act 167 Phase II Report and associated Model Ordinance shall be considered as the PLAN.

The Pennsylvania Department of Environmental Protection shall be considered as the DEPARTMENT.

The selected planning/engineering firm shall be considered as the CONSULTANT.

The Phase II contract between the COUNTY and the DEPARTMENT shall be considered as the AGREEMENT.

Project Organization & Administration

The COUNTY, with input from the CONSULTANT, is responsible for overall administration of all work required to complete the PLAN. This includes, but is not limited to all of the administrative efforts described in this section of the Agreement.

Project administration includes, but is not limited to, the following activities:

- Organize and/or attend meetings.
- Define a framework for accomplishing all tasks associated with preparation of the PLAN.
- Prepare and submit invoices and progress reports pursuant to the terms and conditions specified in this AGREEMENT.
- Manage the work schedule for the completion of the PLAN.
- Participate in telephone discussions.
- Attend to COUNTY budgeting and organizational matters.
- Initiate this AGREEMENT between the DEPARTMENT and the COUNTY.
- If the COUNTY employs a consultant, the COUNTY shall initiate selection of the consultant and, upon selection, prepare and initiate contracts between the COUNTY and the Consultant.
- Prepare and conduct the Phase 2 start-up meeting among the DEPARTMENT, the COUNTY and the COUNTY'S selected consultant (if any consultant is used).
- Manage work according to the budget established herein.

- Participate in other activities, as appropriate, regarding the preparation and submission of the PLAN.

Preparation of the PLAN

The COUNTY is responsible for overseeing the preparation and submission of the PLAN to ensure that the PLAN will meet all applicable requirements as identified herein. This work includes Tasks 1 through 3, plus associated subtasks, as described below.

Task A

A.1 Data Collection; Data Review; Data Analysis; Goals, Objectives and Requirements

This task involves work to gather, review and analyze data and information regarding existing and future conditions in the watershed. The data collection will be accomplished by gathering available information from local, state and federal agencies.

The level of effort expended for this task will be commensurate with the objectives and purposes of the PLAN. Existing data will be reviewed and updated as necessary and incorporated into the PLAN in the most appropriate manner, e.g. by copy or by reference.

Data to be collected may include, but may not be limited to (and will be based on available information including the results of the questionnaires collected during Phase I):

1. Comprehensive land use plans;
2. Existing municipal ordinances;
3. Existing and anticipated stormwater problems, including quality and quantity problems, impaired stream segments, and previously proposed solutions;
4. Existing and proposed flood control projects;
5. A listing of existing and proposed stormwater collection and control facilities, including a designation of those areas to be served by stormwater collection and control facilities within a 10-year period, an estimate of the design capacity and costs of proposed facilities, a schedule and the 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, where this information is readily available;
6. Storm sewer outfalls;
7. Soils;
8. Geology;
9. Significant flow obstructions;
10. Topographic mapping;
11. Aerial photographs;
12. Engineering and planning studies;
13. Streamflow data;

14. Floodplain information.

Field investigations will be accomplished to gather or confirm the data, only when necessary. This task also includes review and evaluation of the data this is collected for consistency and usability in the PLAN.

Problem Area Inspection, Summary, and Proposed Solutions

When necessary, field investigations will be performed to evaluate areas with significant problems in terms of water quality or quantity. The PLAN will summarize these problem areas, identify and evaluate proposed solutions, and identify the preferred solution based on feasibility, benefits, and costs. In addition, the PLAN will identify strategies for funding the preferred solutions.

This task will be coordinated closely with the results of the data questionnaires collected from the municipalities during Phase 1.

The preferred solutions to the problems identified in the PLAN will be the solutions that best satisfy the regulatory requirements in Pennsylvania Code Title 25 and the Clean Streams Law to protect, maintain, reclaim, and restore water quality. These preferred solutions will be incorporated into the technical standards and criteria of the PLAN, into the PLAN's Model Ordinance, and into priorities for implementation of action items.

Review of Existing Plans, Studies, Reports, and Programs

A comprehensive review of related documents and/or programs will be performed and a coordinated list of the goals and objectives from each of the documents will be developed.

Goals, Objectives, and Requirements of the PLAN

The goals, objectives, and requirements for the PLAN will incorporate the policy, purpose, and requirements in Act 167, requirements in the Pennsylvania Clean Streams Law, requirements in the State Water Quality Standards, requirements to address water quality impairments pursuant to stream impairment data listed pursuant to Sections 305 (b) and 303 (d) of the Clean Water Act, pollutant reduction requirements in TMDLs, and the list of problems identified by the COUNTY and the PAC. The PLAN shall be prepared in a manner consistent with the approved Phase 1 Report, (i.e. the Scope of Work). Inclusively, the goals, objectives, and requirements of the PLAN will be called hereinafter the PURPOSE of the PLAN.

Anticipated Product

The work product for this task includes a summation of the information listed above, organized in such a way as to establish and support the PURPOSE of both short-term and long-term watershed planning (including updates to the PLAN).

A.2 Municipal Ordinance Reviews and Evaluations

This task involved the evaluation, comparison, and tabulation of existing municipal ordinances. The purpose of the table is to present a summary of changes to ordinances that will be necessary in each municipality to implement the PLAN as required by Act 167. The table also will be helpful during the preparation of the Model Ordinance(s) for the PLAN.

Anticipated Product

The product of this task will be a table showing a summary and comparison of existing stormwater management provisions in existing municipal ordinance.

A.3 Data Preparation for Technical Analysis

This task involves the work to transfer data into a geographic information system (GIS) that will be used during the technical analysis associated with preparation of the PLAN and for presentation of graphical content in the PLAN.

The level of effort expended for this task will be commensurate with the goals, objectives, and requirements of the PLAN. Data will be incorporated into the PLAN in the most appropriate and efficient manner, e.g. by copy or by reference.

Detailed GIS data layers will be prepared only to the extent necessary for the technical analyses and graphical content of the PLAN:

1. Base Mapping – Existing base map information (roads, streams, municipal boundaries, text., etc.) will be compiled into a base map showing the indexed watersheds with the COUNTY. Data will be projected into the coordinate system preferred by the COUNTY.
2. Soils information – Digital County soil data will be utilized. Soil data will be obtained from the NRCS. Original overlay mapping will be prepared only where necessary to support the hydrologic modeling.
3. Digital Elevation Models – Existing USGS digital elevation models (DEMs) will be used to obtain elevation and slope information for areas where detailed hydrologic modeling will be performed.
4. Digital Raster Graphics (DRGs) – Existing ortho digital USGS topographical maps will be used to locating and displaying obstructions and problem areas, where necessary.
5. Wetlands – Wetlands data will be compiled from the National Wetlands Inventory (NWI) Maps.
6. Geology – Existing digital geologic maps will be used for the watersheds within the COUNTY. Geologic features pertinent to the watershed, i.e., limestone, sandstone, etc., will be considered in hydrologic models, where necessary, and incorporated into PLAN by reference, or by copy, as necessary.
7. Obstructions – Locations and critical attributes of obstructions associated with significant stormwater problems will be shown on the appropriate base map.

8. Problem Areas, Flood Control Structures, Stormwater Management Facilities, etc. – The locations and critical attributes of these items, when they are expected to produce a significant effect on stormwater runoff, will be shown on the appropriate base map.
9. Floodplains – FEMA Q3 data will be incorporate into the PLAN by reference, or by copy when necessary. Floodplains in other areas will be identified in the PLAN and shown on the base map when necessary.
10. Environmental Characteristics – Environmental characteristics, such as open-space, buffers, etc. that are expected to produce a significant effect on stormwater runoff will be displayed on the appropriate base map when necessary.

A summary of data sources will be supplied (simplified Metadata) and will include data type (coverage, shapefile, image) source, projection, and year.

Delineation of Sub-areas

Designated watersheds will be delineated on a base map at a scale that results in a manageable map size and adequate detail. When necessary for preparation of the PLAN, watersheds will be broken into sub-areas in a manner consistent with the guidance that accompanies the applied models. Sub-areas delineated for hydrologic modeling purposes should not be less than 5 square miles in area; however, areas of less than 5 square miles may be used when necessary based on engineering judgement.

The delineation of sub-areas may be based on the following:

1. The guidance associated with the applied model and sound engineering judgement.
2. The location of identified problems related to the PURPOSE of the PLAN.
3. The location of obstructions; primarily bridges, culverts, or stormwater control facilities with a significant effect on stormwater runoff.
4. Other points of interest, such as stream gages or water quality monitoring stations, locations of water quality impairment or concern, anticipated future flood project sites.

Where significant effects on stormwater runoff are produced, this task also may include delineation and mapping of:

1. Storm sewer systems: areas where storm sewer systems.
2. Existing state, federal or local flood protection and stormwater management facilities.
3. Stormwater related problems – areas indicated in the municipal data questionnaires, as being susceptible to flooding problems or as not meeting state water quality standards.

Anticipated Product

The product will be completed GIS watershed data layers and maps. The maps completed for this task will be preliminary and will be modified and finalized as a part of the final plan preparation efforts.

Task B – Technical Analysis

The technical analysis consists of developing alternative strategies to manage stormwater runoff consistent with PURPOSE of the PLAN. This will be accomplished under the following subtasks.

B.1 Evaluate Water Quality, peak flow, stream stability, and groundwater recharge requirements as follows:

Water quality, peak flow, stream stability, and groundwater recharge requirements are satisfied by the Methods in Section 303 of DEP's draft Model Ordinance (copy provided separately). If other methods are to be utilized, the PLAN shall provide:

1. A water quality capture volume computational methodology acceptable to DEP to meet State Water Quality Standards pursuant to Chapter 93 regulations;
2. A streambank erosion standard (for example, detain 1 year, 24-hour storm event and discharge over 24-hour to 72-hour period from the end of the storm). This work may involve an analysis of the erodibility of soils in and along streams and their channels within the watersheds;
3. Methodologies for computing stormwater capture volumes for groundwater recharge and infiltration;
4. Methodologies for control of peak runoff rates for the 1-, 2-, 5-, 10-, 25-, 50- and 100-year storm events.

Methodologies must be applicable for design of post construction stormwater management BMPs as well as retrofit BMPs that may be required to address existing stormwater problems. The methodologies need to ensure that retrofits as well as new development projects are consistent with the PURPOSE of PLAN.

B.2 Modeling

This task involves the use of detailed hydrologic modeling, quantitative computations and evaluations necessary to analyze runoff characteristics of watersheds under existing and future conditions to evaluate alternative solutions to identified existing or anticipated future problems and meet the PURPOSE of the PLAN. It will establish the need and the level of stormwater quality and peak rate controls for the 1-, 2-, 5-, 10-, 25-, 50- and 100-year 24 hour events (25 and 50- year events are optional). Sub-areas delineated for hydrologic modeling purposes should not be less than 5 square miles in area; however, areas of less than 5 square miles may be used when necessary based on engineering judgement.

Modeling should be based on rainfall data from NOAA Atlas 14, or equivalent.

Hydrologic models should be calibrated using rain gage records, stream gage records, USGS regression models for Pennsylvania, and anecdotal historical information. If HEC-HMS is used, the internal optimization routines should be used to the greatest extent practical.

The purposes of hydrologic modeling include development, evaluation, and selection of standards and criteria for the regulation of development and activities that may affect stormwater runoff for watersheds or sub-watersheds where implementation of DEP's draft Model Stormwater Management Ordinance alone is unlikely to be sufficient to meet the PURPOSE of the PLAN.

B.3 Compilation of All Technical Standards

Standards and criteria will be compiled and presented to show:

1. A detailed list of specific standards and criteria for stormwater control;
2. Where within watersheds the various standards and criteria apply;
3. A list of applicable stormwater management controls methodologies and the design procedures associated with each;
4. Performance criteria for design of stormwater management facilities;
5. Locations where cluster or regional stormwater management facilities will be required;
6. Cost estimates for construction of new stormwater management facilities to correct existing problems;
7. A summary of funding sources for new facilities;
8. An analysis of what problems will, and what problems will not, be solved by implementation of the PLAN; and

Standards and criteria will be consistent to the greatest practical extent within municipalities and across the COUNTY.

Charts, tables and graphs will be prepared and presented to show the results of modeling including an explanation of how the proposed technical standards and criteria meet the PURPOSE of the PLAN.

B.4 Implementation of Technical Standards and Criteria

The final standards and criteria will be incorporated into a model municipal stormwater management ordinance that will be included in the PLAN.

Task C – Plan Preparation and Implementation

C.1 Plan Report Preparation

The products of each previous task will be included in the PLAN. The PLAN will contain provisions as necessary to meet the PURPOSE of the PLAN. Whenever appropriate, material readily available from existing sources should be included by reference only, not by copy. In each case, and for each watershed, the level of detail should be commensurate with the PURPOSES of the PLAN and the strategies anticipated for managing stormwater runoff in a manner consistent with the PLAN. The

contents of the PLAN shall comply with the requirements of 1978 Act 167. At a minimum, the PLAN must include the following list of items paraphrased from Section 5 of ACT 167. In cases where the information is readily available from existing sources, the PLAN may include the required content either by reference or by copy, whichever is more efficient:

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 that significantly affect stormwater management and flooding within the watershed(s);
3. An assessment of projected and alternative land development patterns in the watershed(s), and the potential impact of runoff quantity, velocity and quality;
4. An analysis of present and projected development in the flood hazard areas, ands 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 stormwater collection systems and their impacts on flooding or stormwater runoff;
7. An assessment of alternative runoff control techniques and their efficiencies in each watershed identified;
8. An identification of existing and proposed State, Federal and Local flood control projects located in the watersheds and their design capacities;
9. An identification of flood plains and flood hazard areas within the watersheds;
10. Criteria and standards for the control of stormwater runoff from existing and new development that is necessary to minimize dangers to property and life and carry out the purposes of the Act;
11. Priorities for implementation of action within each watershed identified;
12. Provisions as are reasonably necessary to manage stormwater such that development or activities in each municipality within the watersheds do not adversely affect health, safety, and property in other municipalities within each watershed identified and in basins to which the watersheds are tributary; and
13. Consider and be consistent with other existing municipal, county, regional and State environmental and land use plans.

In addition, the PLAN will identify;

1. Impaired stream segments within the County's watersheds;
2. The type and nature of impairment;

C.2. Recommended Outline

The recommended outline for the PLAN is as follows;

VOLUME I: Executive Summary of the PLAN

VOLUME II: THE PLAN

Section I – Introduction

Section II – Act 167 Watershed Level Stormwater Management Planning and Implementation

Section III – Watershed Characteristics

1. Present Land Use
2. Projected Land Developments
3. Significant Obstructions
4. Stormwater and Flood Management Systems
5. Stormwater Problems

Section IV – Technical Analysis – Modeling

1. Quality and Quantity of resent and Future Storm Runoff

Section V – Results of Modeling

1. Interpretation and Evaluation of Models
2. Technical Standards and Criteria for Control of Stormwater Runoff

Section VI – Runoff Control Strategies

Section VII – Analysis of Existing Municipal Ordinances

Section VIII – Model Stormwater Ordinances

Section IX – Action Items and Follow-Up

1. Action Items and Priorities for Implementation of the PLAN
2. An analysis of what problems will, and what problems will not, be solved by implementation of this PLAN;

Section X – Provisions for Review, Revision, and Updating the PLAN

Plates/Figures:

1. A base map showing the watershed delineation and political subdivisions, roadway network and the location as referenced to the county.
2. Existing land use.
3. Future land use.
4. Hydrologic soil groups.
5. Development and floodplains.
6. Watershed sub-areas used for hydrologic analysis including information on applicable management facilities.
7. Stream obstructions, flooding and drainage problem areas.
8. Areas where storm sewer networks exist (if available) and location of storm sewer outfalls.

9. Additional information as determined by the County.

Tables:

1. Runoff characteristics of the watershed.
2. Rainfall values for various frequency durations.
3. Peak flow values at points of interest for mean annual 2-, 5-, 10-, 25-, 50- and 100-year storm events for various durations, and for present and future conditions.
4. Sub-areas and corresponding management strategy information.

VOLUME III, Appendixes

The following data will be included in Volume III:

1. Recommended design storms for significant obstructions;
2. A list (or table) of significant stormwater obstructions including their locations, sizes, calculated capacities and any particular information which may seem helpful to the use of the plan;
3. Any special information concerning stormwater control facilities, BMPs, and other issues.

VOLUME IV, Technical Appendixes

The following data will be included in Volume IV:

1. Input data and results of model runs;
2. Background hydrologic data;

Anticipated Product

The final product will be the adopted and approved COUNTY Stormwater Management PLAN. The final PLAN will consist of four parts: Volumes I through IV. The report and all supporting data will be submitted to DEP by the COUNTY in hard copy and in native digital format. The final PLAN also will be provided in electronic pdf format.

C.3 Plan Adoption and Submission to DEP

Prior to the COUNTY's public hearing, the COUNTY will produce one hardcopy of the PLAN for each member of the PAC, plus four hardcopies for DEP, plus ten additional hardcopies. The COUNTY also will provide DEP with one electronic copy. The involved municipalities, PAC members and Department will review the PLAN and provide comments to the COUNTY. The COUNTY shall allow 120 days for return of comments. The COUNTY will tabulate and respond to all comments received. After consideration of the comments and responses, the COUNTY will revise the PLAN accordingly.

Prior to the COUNTY's public hearing on the PLAN, the COUNTY will hold a PAC meeting to present the final version of the PLAN.

The COUNTY will hold a public hearing for the PLAN. A notice for the public hearing will be published at least two weeks before the hearing date. The notice will contain a brief summary of the principal provisions of the PLAN and a reference to the places within each affected municipality where copies of the PLAN may be examined or purchased at cost. The COUNTY will review the comments received at the public hearing and appropriate modifications to the PLAN will be made.

The COUNTY Board of Commissioners, or Council, will vote on the PLAN as a resolution, for the purpose of adoption. The resolution needs to be carried by an affirmative vote of at least a majority of the members of the governing body, and must refer expressly to the maps, charts, textual matter and other materials that constitute the Plan. This action will be recorded on the adopted PLAN.

After adoption, the COUNTY will submit to DEP a letter of transmittal, two paper copies, and two electronic media copies of the adopted PLAN, the comments received from the official planning agency and governing body of each municipality, comments from the County Planning Commission, comments from regional planning agencies (Section 6 (c) of Act 167), the responses-to-comments document prepared by the COUNTY, the public hearing notice and minutes of the public hearing (Section 8 (a) of Act 167), and the resolution of adoption of the PLAN by the COUNTY (Section 8 (b) of Act 167). The letter of transmittal will state that the COUNTY has complied with all requirements of Act 167 and it will request official approval of the adopted PLAN. Subsequent to DEP's approval of the PLAN, 100 final copies of the PLAN will be printed by the COUNTY. Two printed copies and two electronic copies of the final PLAN will be provided to DEP. The final electronic copy will include all supporting data in native digital format and the final PLAN also will be provided in electronic pdf format.

Hard copies of all backup material including technical analyses and models of watersheds or sub-watersheds will be retained at the COUNTY's offices.

Anticipated Product

The product of this task will include the official documentation regarding PLAN adoption and implementation process, including the necessary documentation from the COUNTY certifying the adoption of the PLAN, and the actual adopted PLAN.

III. Plan Advisory Committee, Public Participation, and Implementation Workshops

The following paragraphs describe the various activities that will be conducted by the COUNTY to facilitate public participation in the preparation and implementation of the PLAN. These activities include meetings of the Plan Advisory Committee (PAC), the public hearing conducted by the COUNTY, the municipal workshops, the public workshop (s) and a public information pamphlet. The relative timing and purpose of these activities are summarized in Table 1.

Discussions, presentations, and handouts on implementation of the PLAN, including various stormwater BMPs, will be an agenda item, from time to time, for regularly scheduled advisory committee meetings.

Task A: Plan Advisory Committee

A Plan Advisory Committee (PAC) will be established to provide an opportunity for dialogue with, and participation of, each municipal government, the County Conservation District, other interest groups such as watershed associations, and the public.

The COUNTY will conduct PAC meetings to provide information on the planning process and to gather data and advice from the members of the PAC to ensure that the plan is consistent with the PURPOSE of the PLAN and the needs of the municipalities and the COUNTY.

Task B: Pamphlet

A pamphlet tailored to the PLAN will be prepared to provide guidance to municipal officials and to the public regarding implementation of the PLAN.

Task C: Municipal Implementation Workshops

The COUNTY will conduct municipal workshops to provide information to municipalities regarding their obligation to implement the PLAN. The workshops will cover procedures to adapt, enact, administer and enforce the stormwater management ordinance as well as municipal obligations to implement other action items in the PLAN. The workshops will address availability of resources to implement the PLAN, establishment of fees for stormwater management, and other issues related sources of funding. Alternatives for pooling resources including municipal authorties and intergovernmental cooperative agreements will be presented and discussed.

The municipal implementation workshops will be conducted within three months following DEP's approval of the PLAN.

Task D: Public Implementation Workshops

The COUNTY will provide implementation workshops to the public regarding implementation of the PLAN within 6 months following DEP's approval of the PLAN

The workshops will cover goals and benefits of the PLAN and information on the responsibilities of residents to meet the PLAN's requirements.

Appendix D – Cost Estimate

Since 2009, there have been no appropriations for Act 167 grants; therefore, a cost estimate is not necessary and none are included within this document.

No modeling will be completed as part of Phase 2 unless funding becomes available. We will identify and rank areas for modeling if funding ever becomes available.

Appendix E - Timeline

A more detailed work schedule setting target dates for the completion of various tasks would be developed at the beginning of the Phase II project. The schedule would be developed by Armstrong County and the consultant (if used) with the completion of the project in time for PADEP review prior to the end of the contract period, generally within two years of commencing Phase II. Below is a proposed work schedule.

Proposed Phase 2 Schedule

Milestone	**Estimated Completion Date**
Execute PADEP/Armstrong County Phase 2 Agreement	Unknown Start Date
WPAC Meeting	Year 1, Start of Phase 2
Field Visits of Problem Areas	First 6 Months
Analysis and Evaluation of Problem Areas	On-going
WPAC Meeting	Year 2
Draft Phase 2 Plan	Year 2
Draft Modeling Ordinance	Year 2
WPAC Meeting	Year 3
Finalize Phase 2 Report, Model Ordinance and Exhibits	Year 3
WPAC Meeting	Year 3
WPAC Legal Meeting	Year 3
BMP Workshop	Year 3
Public Hearing	Year 3
Board of Commissioner Approval	Year 4
Phase 2 Report Submission to PADEP	Year 4
Municipal Implementation	Year 4
Public Information Workshops	Year 4
Assist Municipalities with Ordinance Adoption	Year 4
PADEP Agreement Deadline	Year 4

References

Armstrong County Comprehensive Plan. April 2005
http://www.co.armstrong.pa.us/files/cd/accp_2005.pdf

Armstrong County Natural Heritage Inventory. April 2010

Armstrong Park, Recreation, Open Space and Greenway Plan. June 2009
http://www.co.armstrong.pa.us/comprehensive-recreation

Flood Hazard Mapping Fact Sheet – Armstrong County. FEMA. https://www.rampp-team.com/documents/pennsylvania/armstrong_pa_fact_sheet_revised.pdf

National Flood Insurance Program Community Status Book. FEMA. https://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book

Soil Survey of Armstrong County, Pennsylvania, United States Department of Agriculture Soil Conservation Service. February 1977

Two Old Mines Tell Different Clean Up Tales. Pittsburgh Post Gazette. July 9, 2006. http://www.post-gazette.com/news/environment/2006/07/09/Two-old-mines-tell-different-cleanup-tales/stories/200607090200

CHAPTER 93. WATER QUALITY STANDARDS
http://www.pacode.com/secure/data/025/chapter93/chap93toc.html