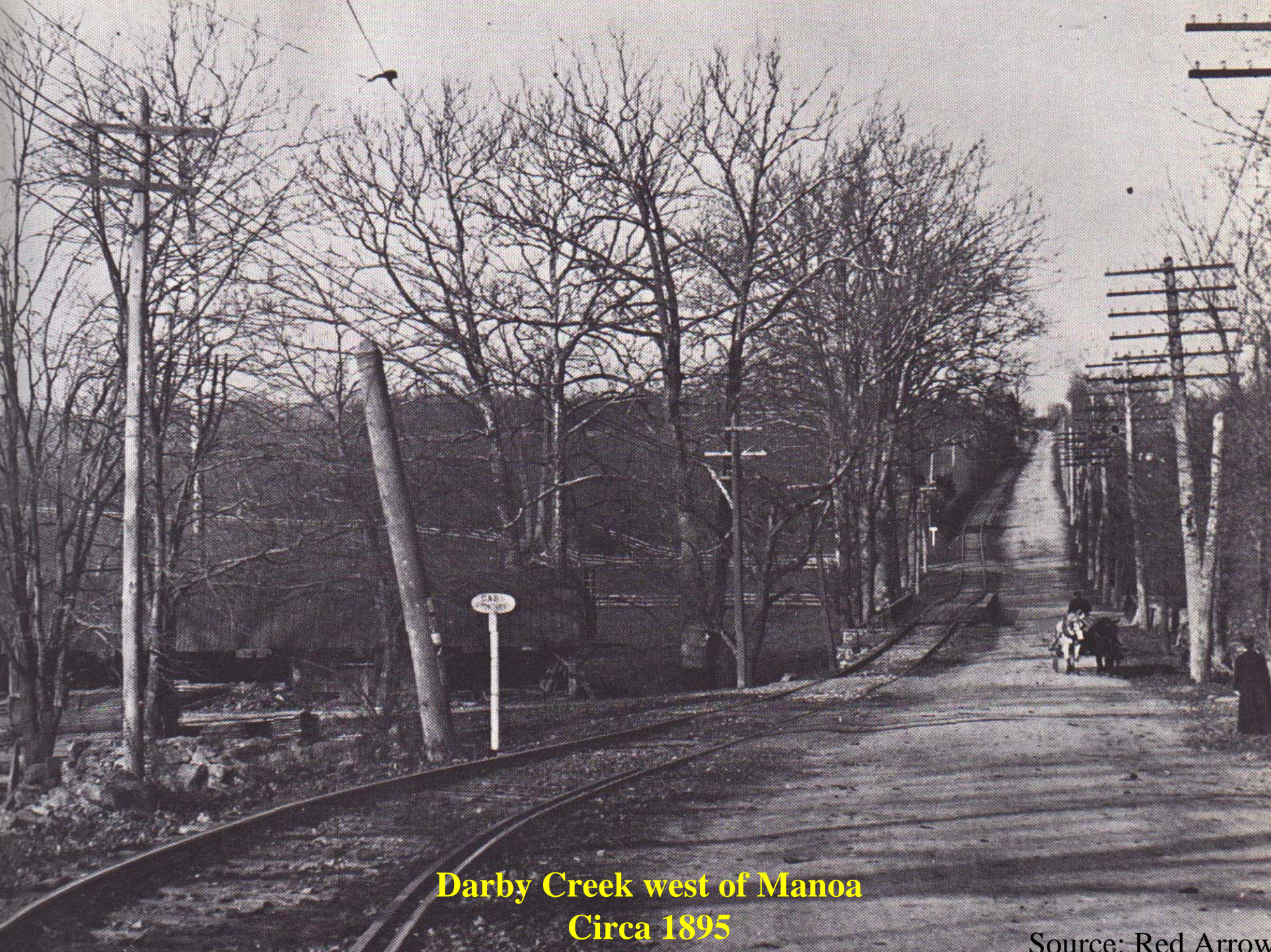


Stormwater 101

Impacts and Issues

Radnor Township Municipal Building
October 23, 2008

Technical slides courtesy of Borton-Lawson Engineering, Inc.



**Darby Creek west of Manoa
Circa 1895**

Source: Red Arrow



State Rd. and Lansdowne Ave.
Upper Darby
1960



**State Rd. and Lansdowne Ave.
Upper Darby
1975**

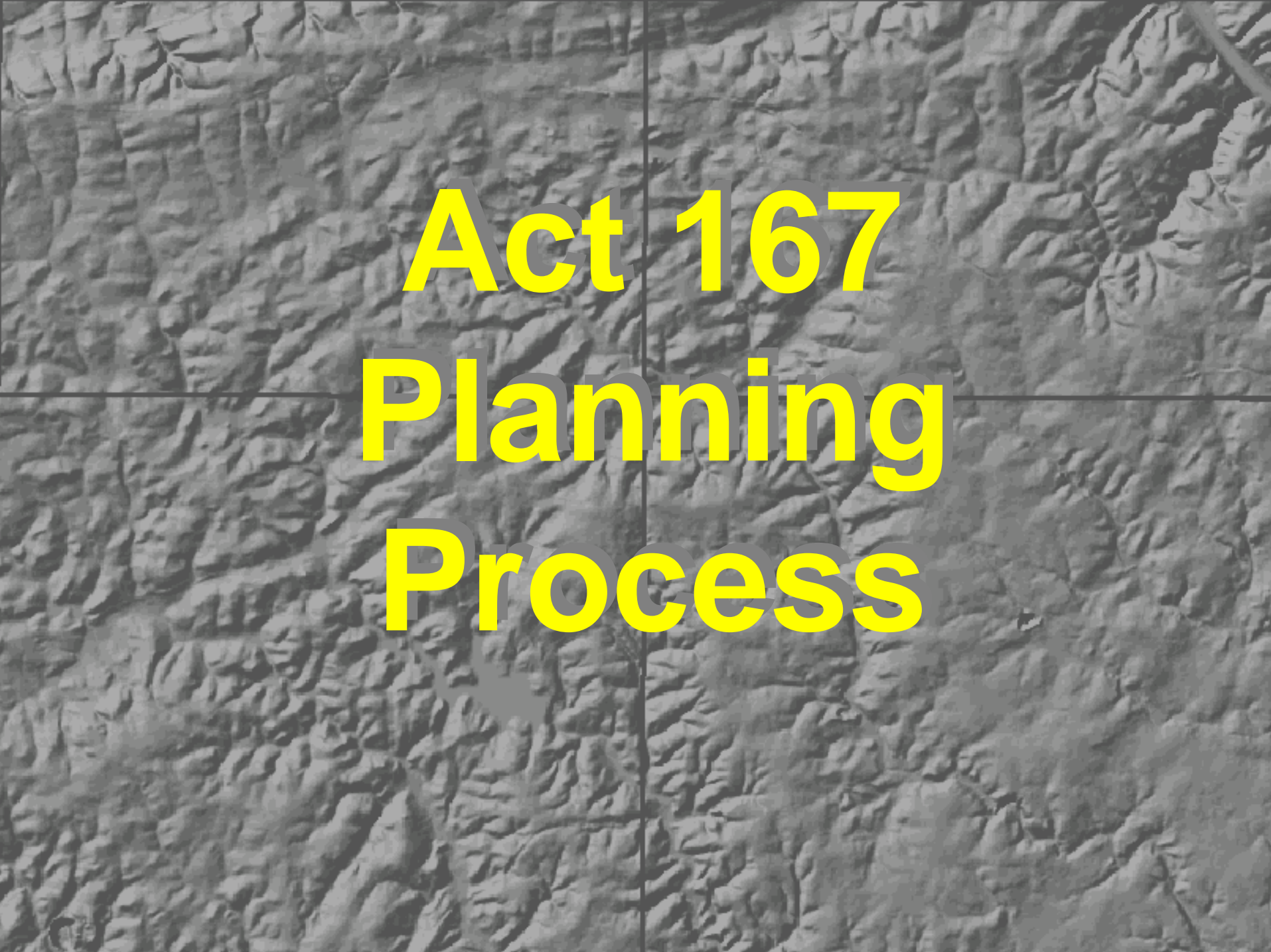


**Then came
Hurricane Agnes
and
Act 167**

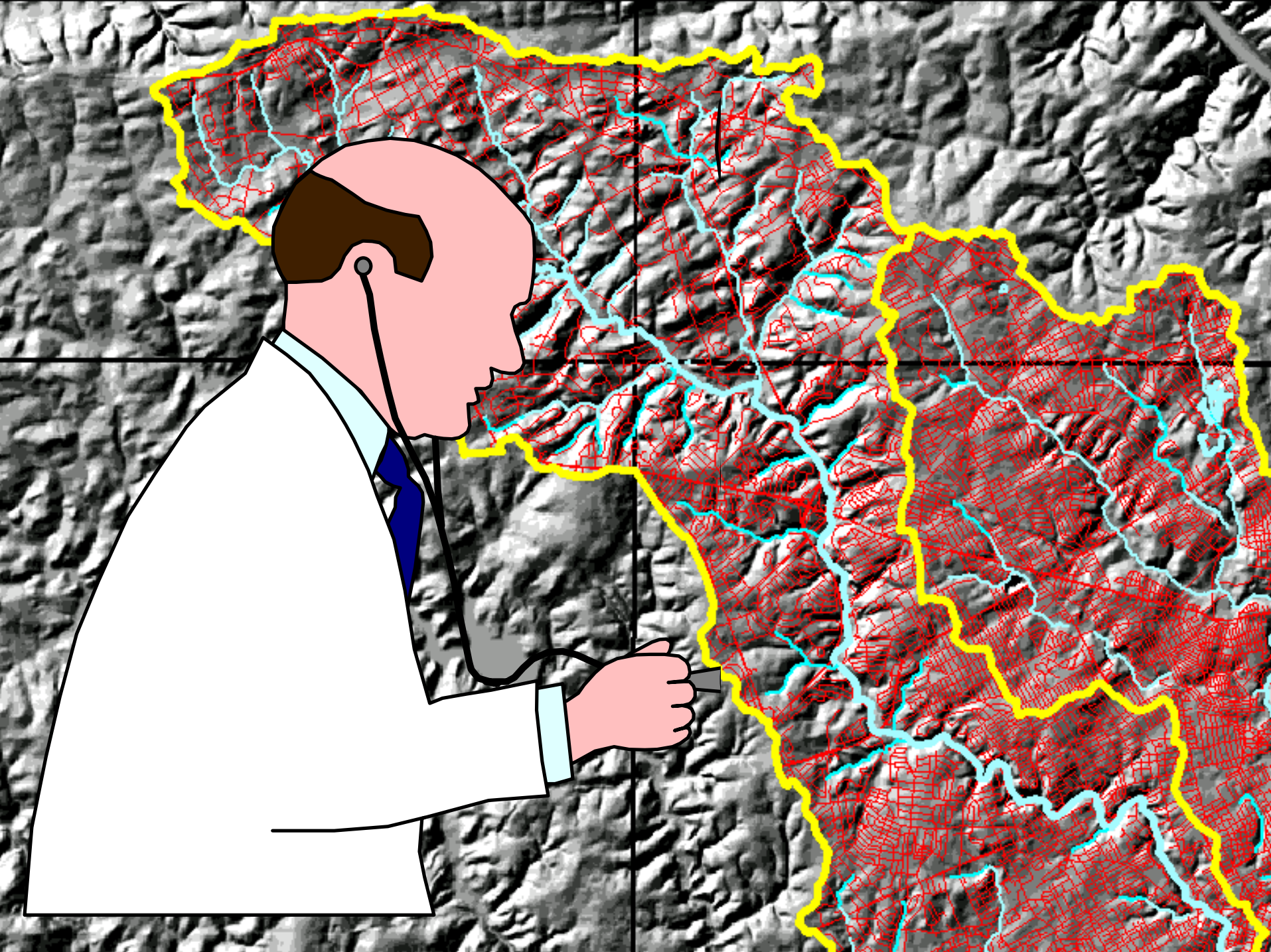
STORMWATER MANAGEMENT ACT

OCTOBER 9, 1978, AS AMENDED May 24, 1984

- **Response to Hurricane Agnes**
- **Sister to Act 166 – Floodplain Management Act**
- **Requires county preparation of watershed-level stormwater management plans**
- **Municipalities are responsible for implementation through adoption the of the model ordinance**
- **Basic Performance Standard – Rate of runoff no greater after than before development**
- **DEP guidance now requires water quality elements and MS4 requirements to be addressed in the plan**

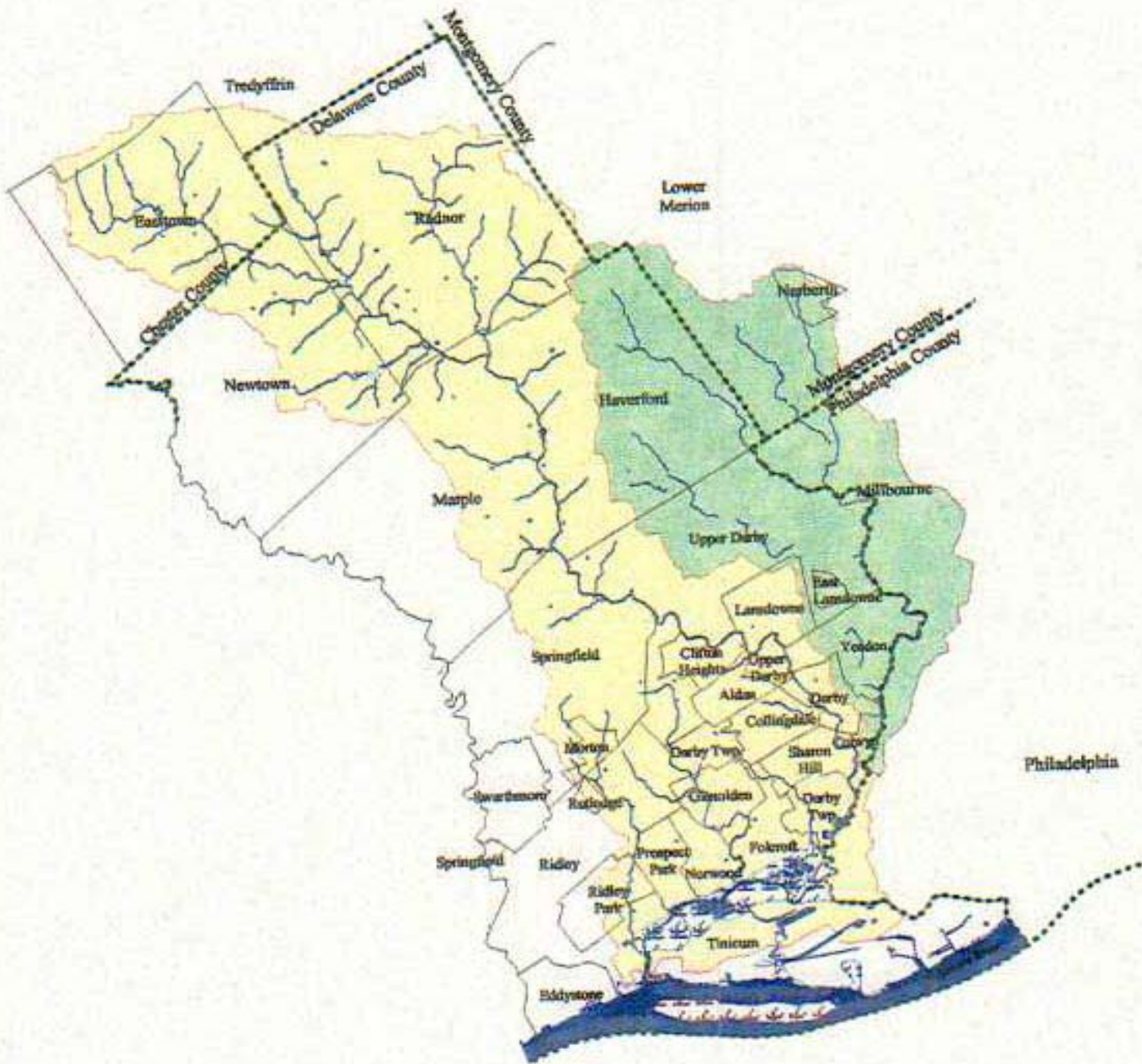
A grayscale topographic map of a rugged, mountainous terrain serves as the background. A white grid is overlaid on the map, consisting of a vertical line and a horizontal line that intersect in the center. The text is centered on this grid.

Act 167 Planning Process



DARBY-COBBS WATERSHED STATISTICS

- **76 Square Miles**
- **4 Counties**
- **31 Municipalities**



GIS

THE OVERLAYING PROCESS

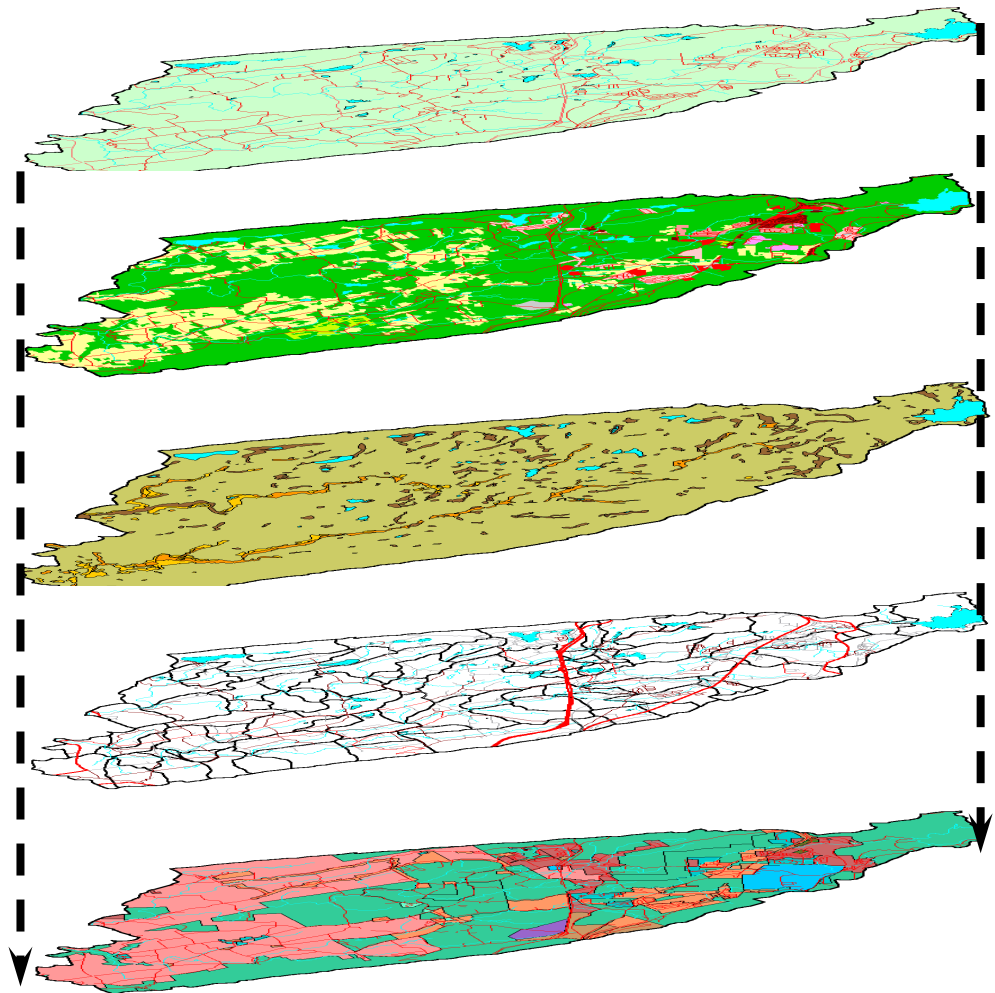
BASE
INFORMATION

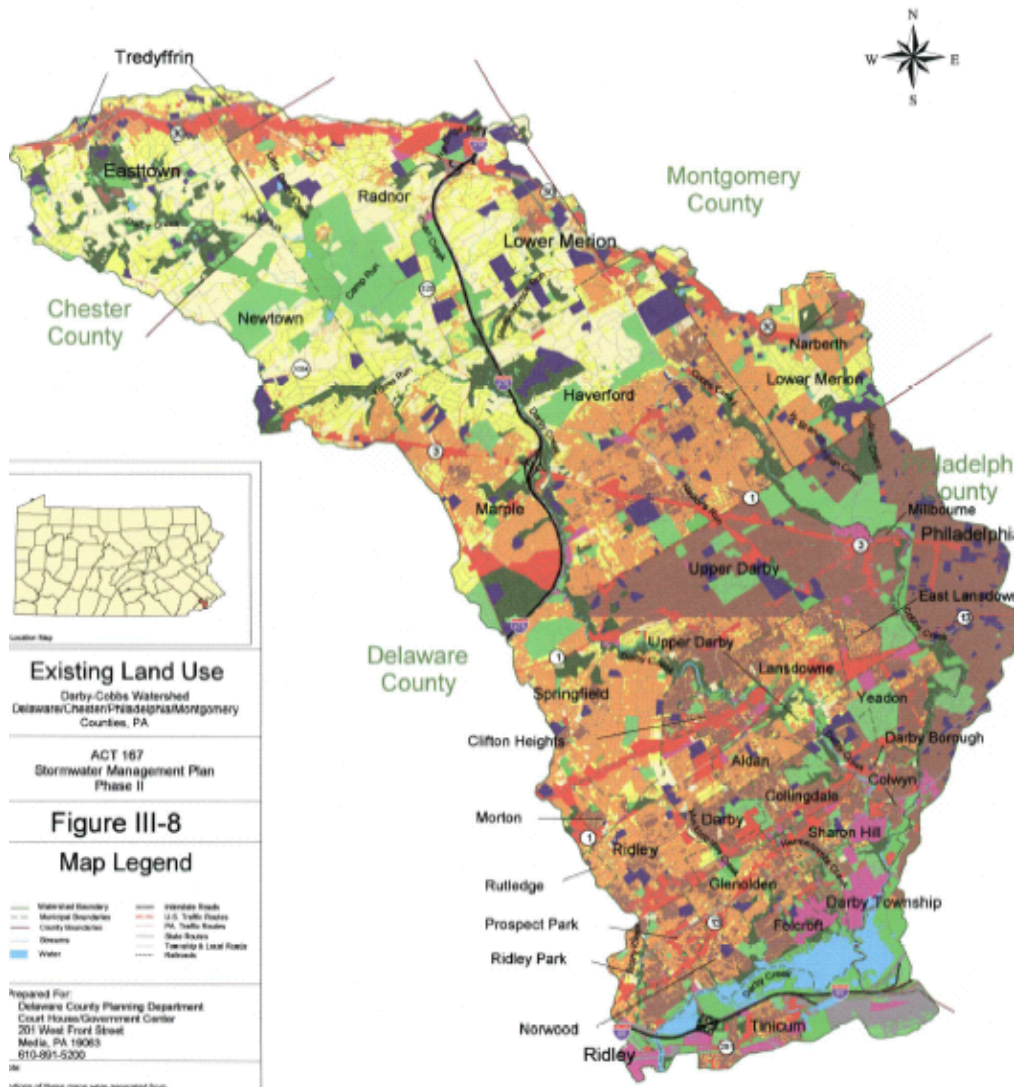
LAND USE

HYDROLOGIC
SOIL GROUPS

SUBWATERSHED
BOUNDARIES

SCS CURVE
NUMBERS





Location Map

Existing Land Use
 Darby-Cobbs Watershed
 Delaware/Chester/Philadelphia/Montgomery Counties, PA

ACT 167
 Stormwater Management Plan
 Phase II

Figure III-8
Map Legend

- Municipal Boundary
- County Boundary
- Interstate Road
- U.S. Traffic Routes
- PA Traffic Routes
- State Routes
- Township & Local Road
- Water
- Railroad

Prepared For:
 Delaware County Planning Department
 Court House/Government Center
 201 West Front Street
 Media, PA 19063
 810-891-5200

Info: These maps were generated from existing data sources as listed below. True as being the case intended for basic mapping purposes or is shown on the maps for spatial reference only. This data did not enter into any computations affecting the results of the hydrologic analysis. John Lawson Engineering has found some inaccuracies in some of this data and has corrected the data in locations where these inaccuracies were obvious. However, it was not a part of the ACT 167 Plan to correct all of the above info.

Map Sources:
 GIS - PennDOT & BGE
 DEM - PennDOT & BGE
 Subdivisions - PennDOT & BGE
 Existing Land Use - DCPD, DCRD, MDCD, BGE

Borton Lawson
 ENGINEERING

111 BROADWAY
 SUITE 200
 PHILADELPHIA, PA 19102
 215-561-1000 Fax: 215-561-1001

100 N. GARDNER ST.
 SUITE 200
 NORWOOD, PA 19074
 610-524-1000 Fax: 610-524-1001

www.bortonlawson.com

Land Use/Land Cover

- COMMERCIAL
- FOREST
- MEADOW
- OPENSPACE
- FARMSTEAD
- INDUSTRIAL
- INSTITUTIONAL
- GRAVEL
- PAVED
- R-A (1/8 Acre or less)
- R-B (1/8 to 1/2 Acre)
- R-C (1/2 to 1 Acre)
- R-D (1 to 4 Acres)

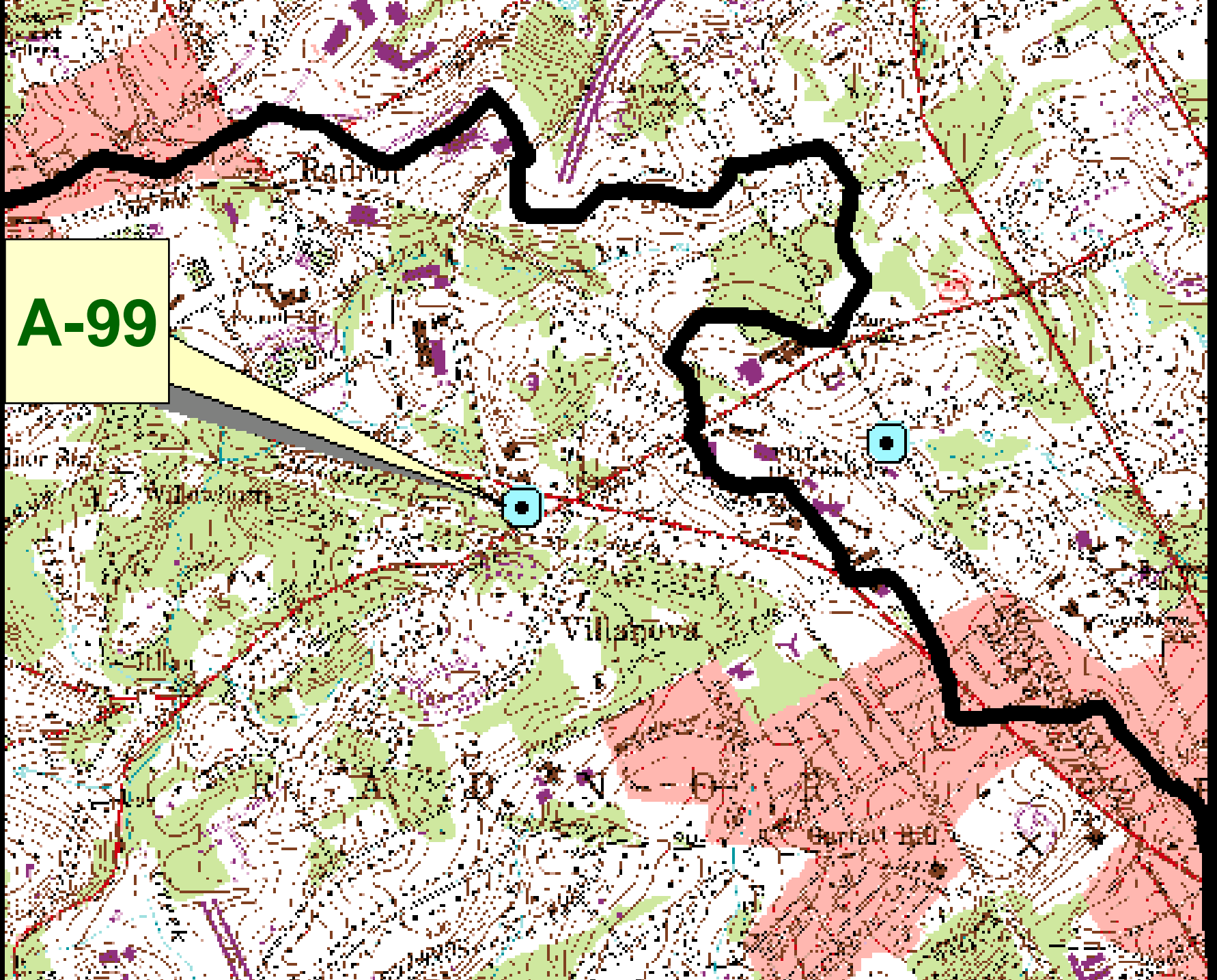


TABLE III-2
Land Use Status by Category

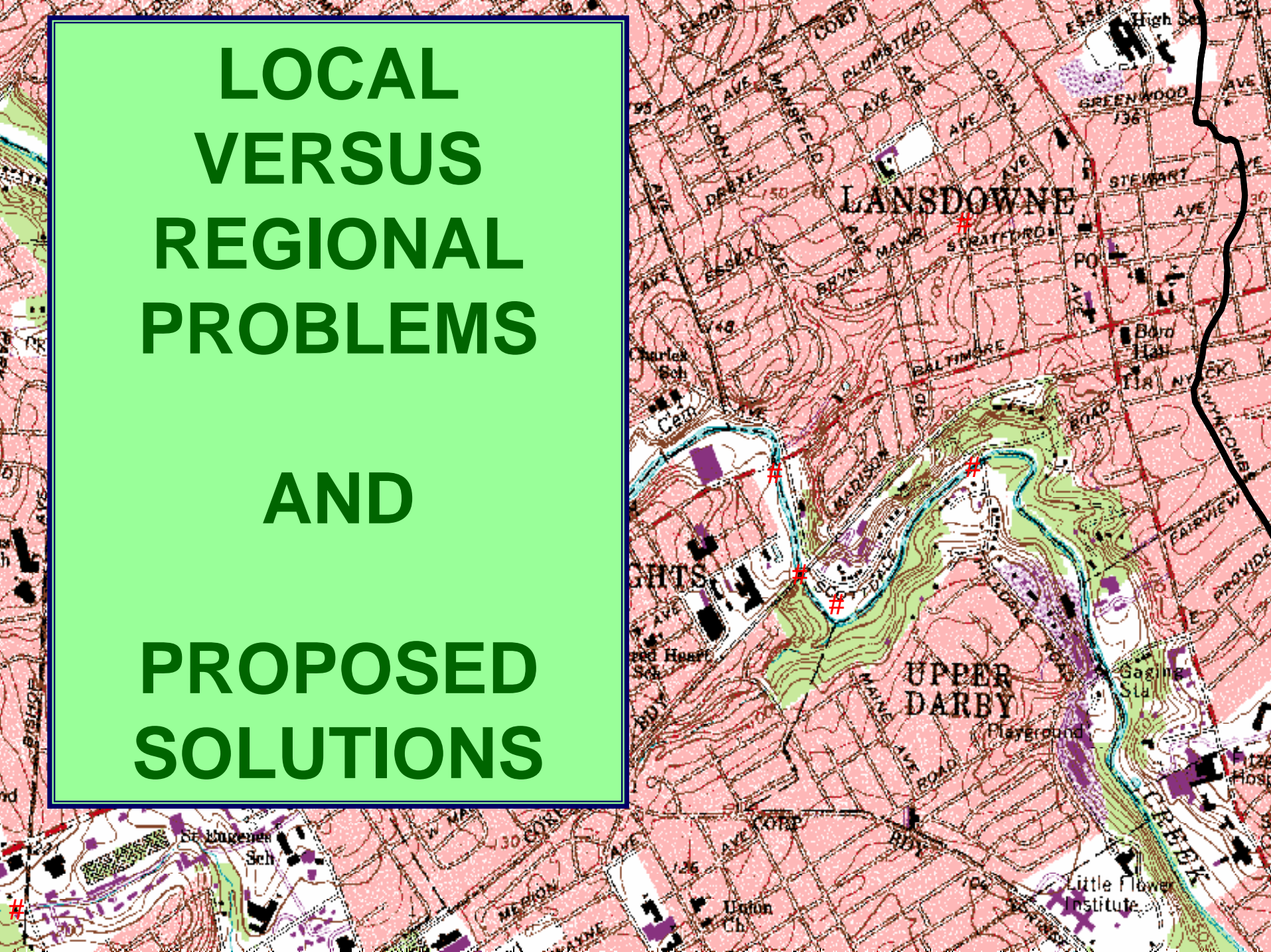
LAND USE	SQUARE MILES	ACRES	PERCENT AREA
Commercial	5.43	3,475.20	7.03
Farmstead	0.02	12.80	0.03
Forest	5.07	3,244.80	6.56
Industrial	1.71	1,094.40	2.21
Institutional	3.90	2,496.00	5.05
Loose Gravel	0.01	6.40	0.01
Meadow	3.13	2,003.20	4.05
Open Space	7.54	4,825.60	9.76
Paved	1.89	1,209.60	2.45
Residential (1 - 4 acre lot size)	8.60	5,504.00	11.13
Residential (1/3 - 1 acre lot size)	10.18	6,515.20	13.18
Residential (1/8 - 1/3 acre lot size)	14.83	9,491.20	19.20
Residential (1/8 acre or less lot size)	13.65	8,736.00	17.67
Water	1.28	819.20	1.66
TOTAL	77.24	49,433.60	100.00

Source: Borton-Lawson Engineering, Inc., 2004

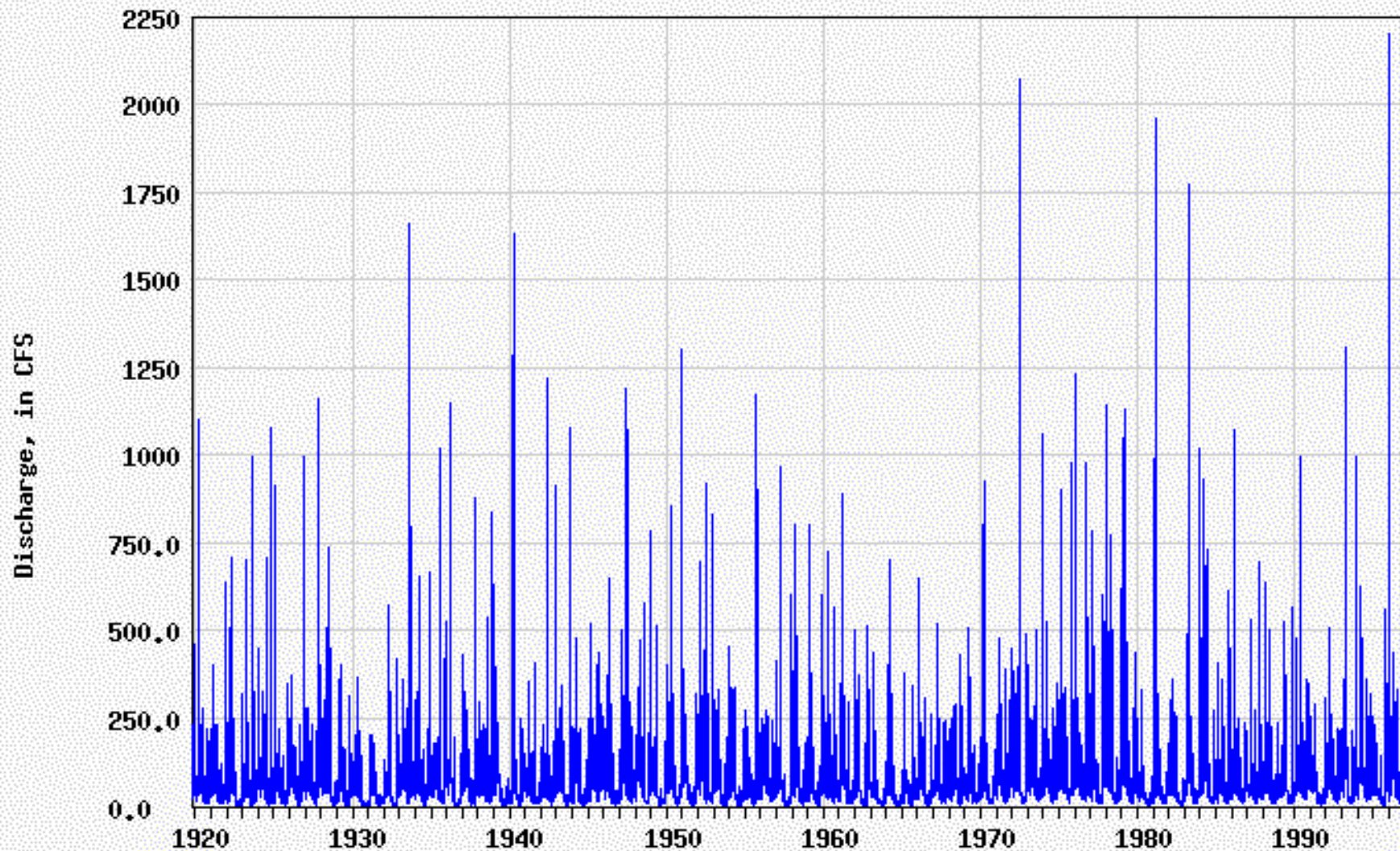
A-99



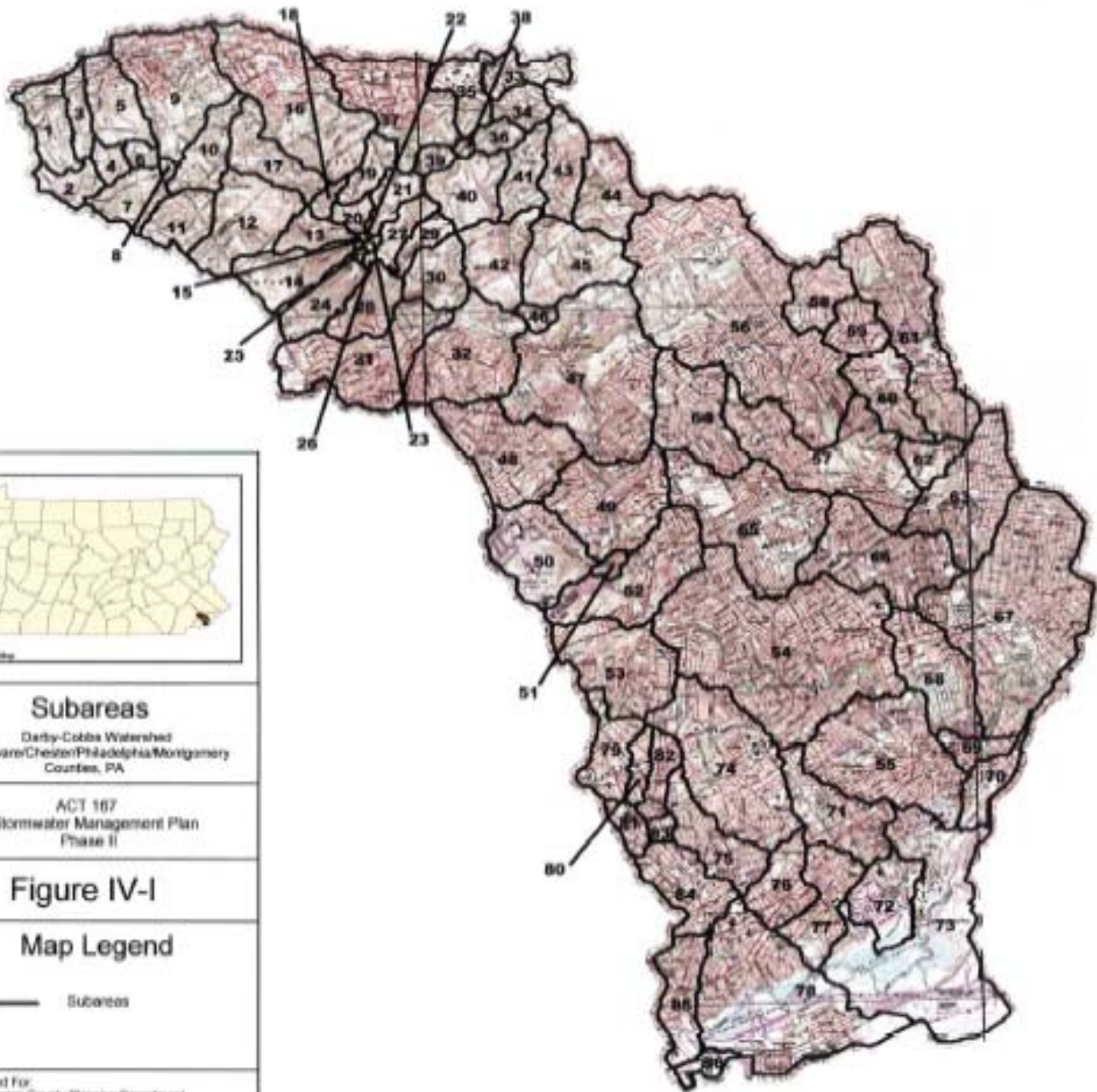
**LOCAL
VERSUS
REGIONAL
PROBLEMS
AND
PROPOSED
SOLUTIONS**



Mapwallopen Creek Near Mapwallopen, Pa.
Station Number: 01538000



Legend: — Discharge, in CFS
— Estimated Discharge, in CFS



Subareas
Darby-Cobbs Watershed
Delaware/Chester/Philadelphia/Montgomery
Counties, PA

ACT 167
Stormwater Management Plan
Phase II

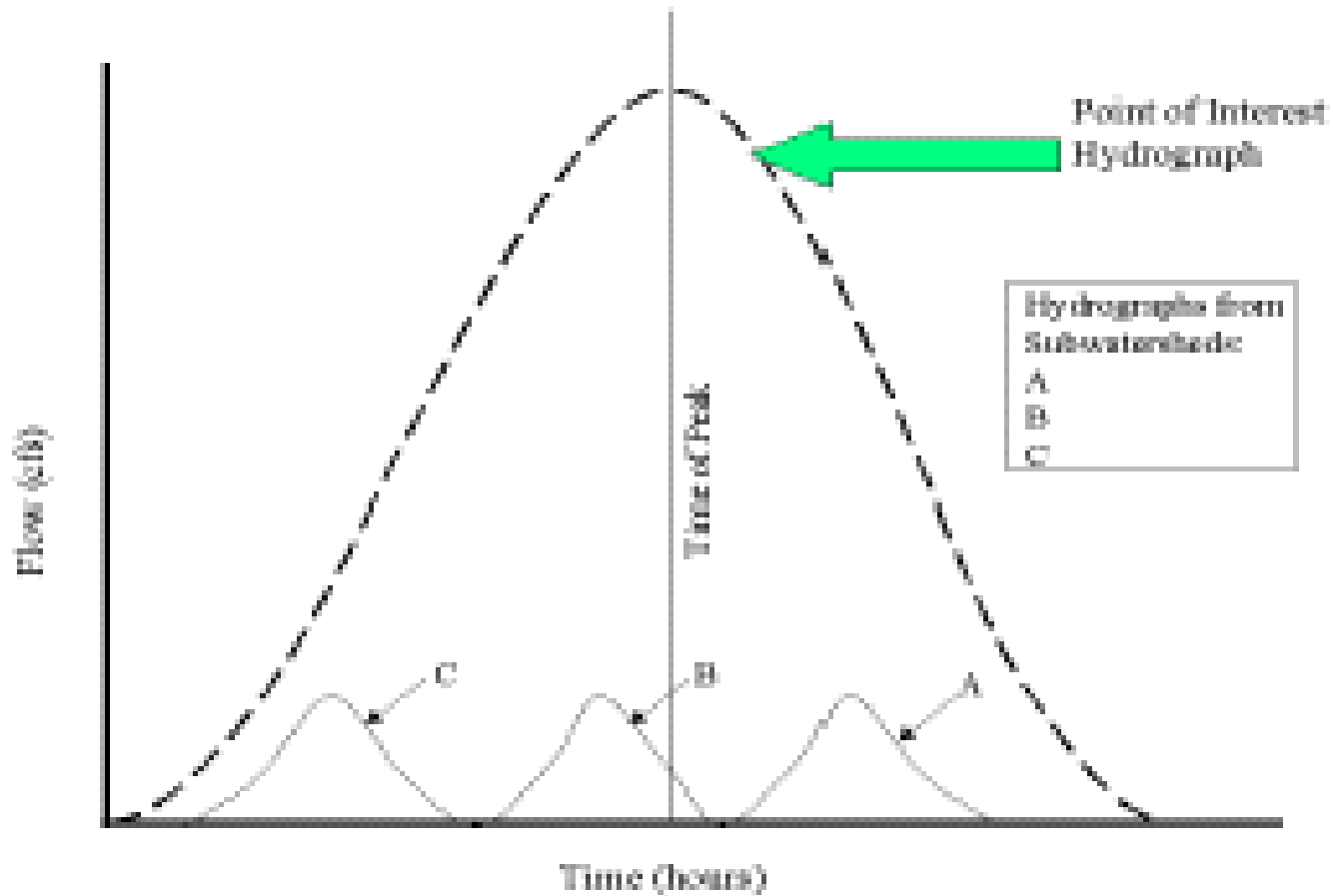
Figure IV-I

Map Legend

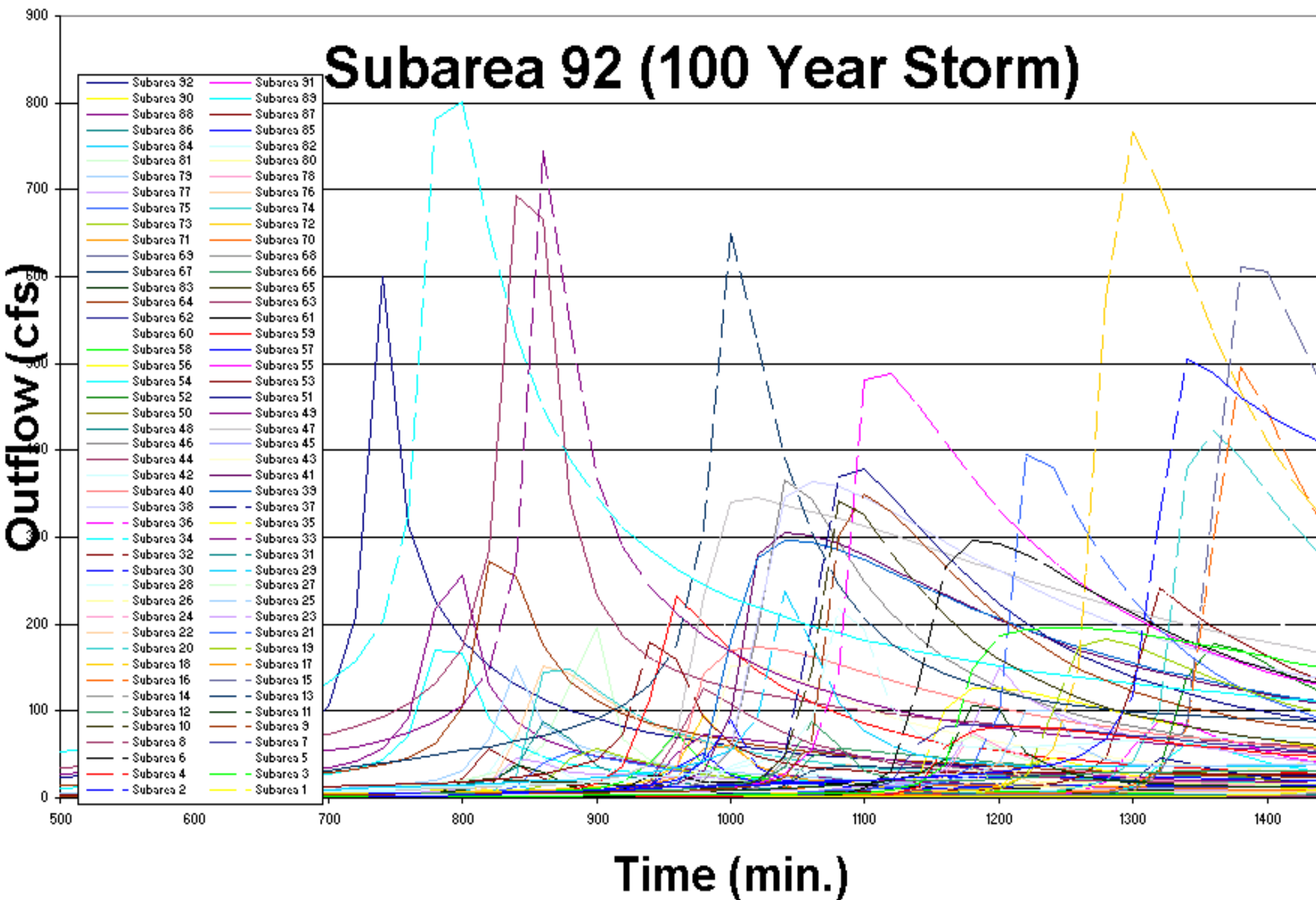
— Subareas

Prepared For:
Delaware County Planning Department
Court House/Government Center
201 West Front Street
Media, PA 19063
610-661-6200

FIGURE V-3
Relative Timing of Subwatershed Hydrographs

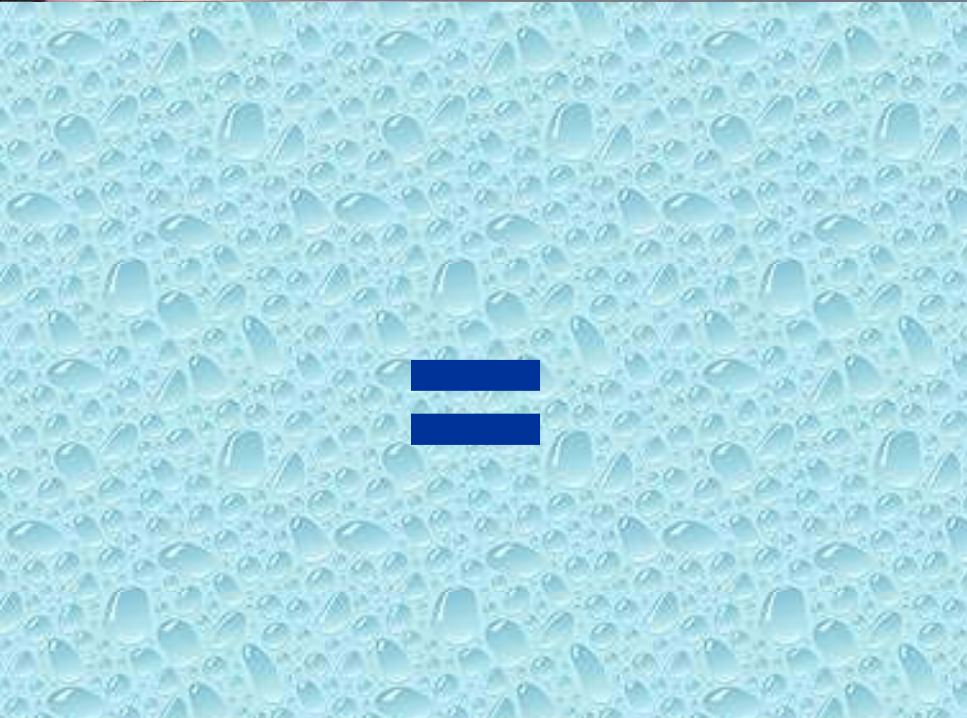


Subarea 92 (100 Year Storm)

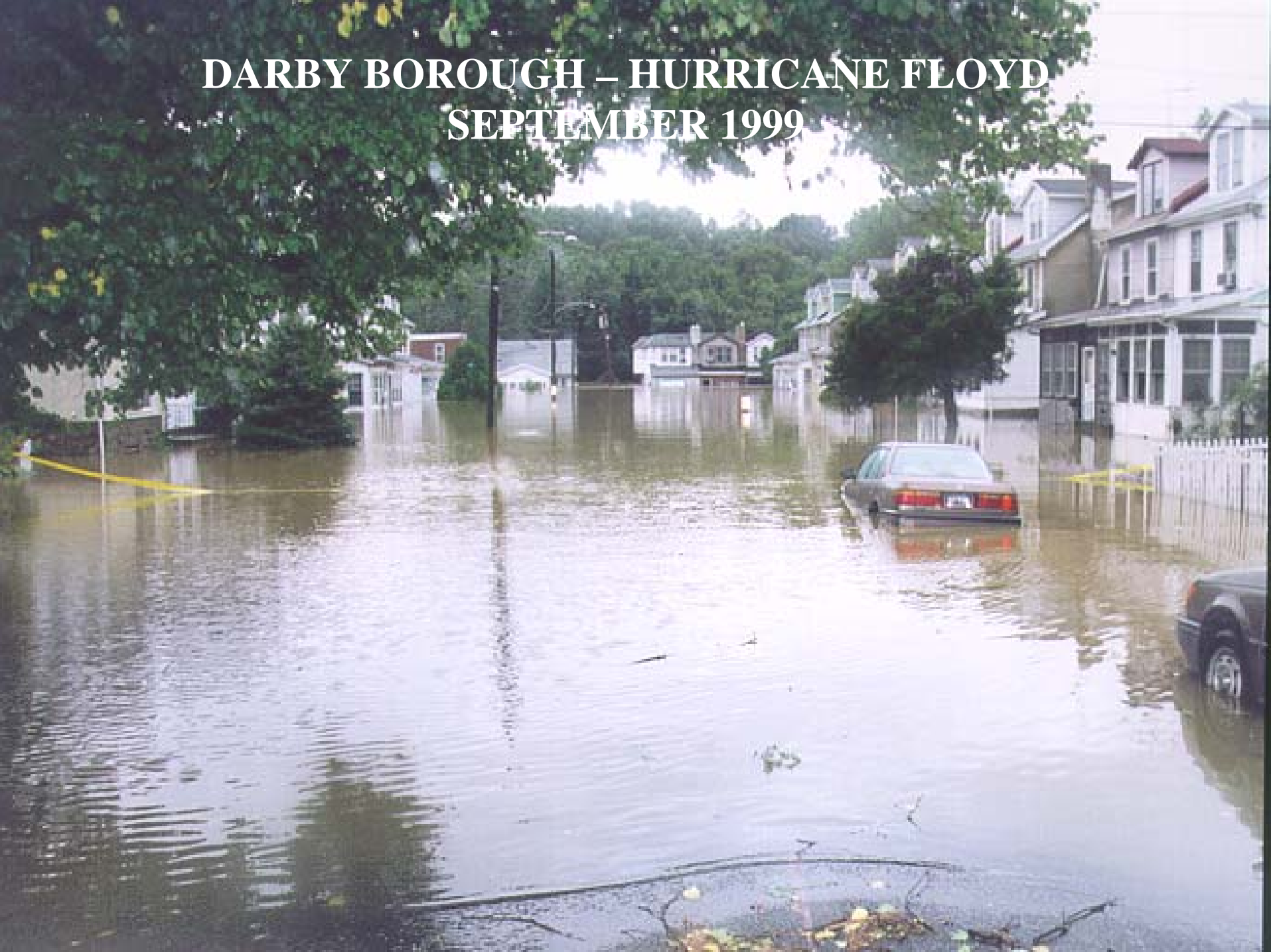




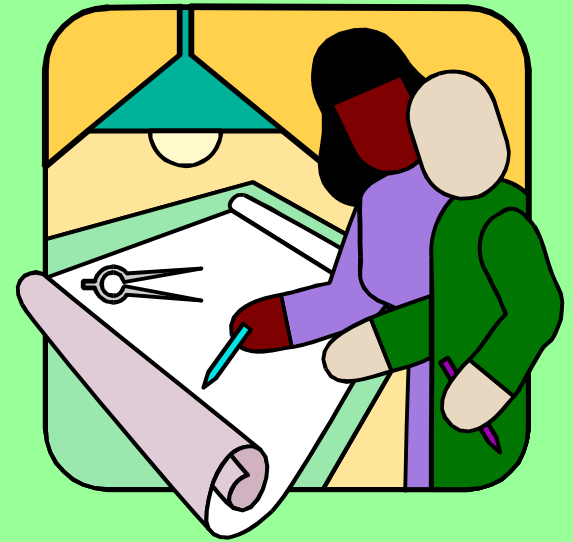
**Too much
impervious
cover**



**DARBY BOROUGH – HURRICANE FLOYD
SEPTEMBER 1999**

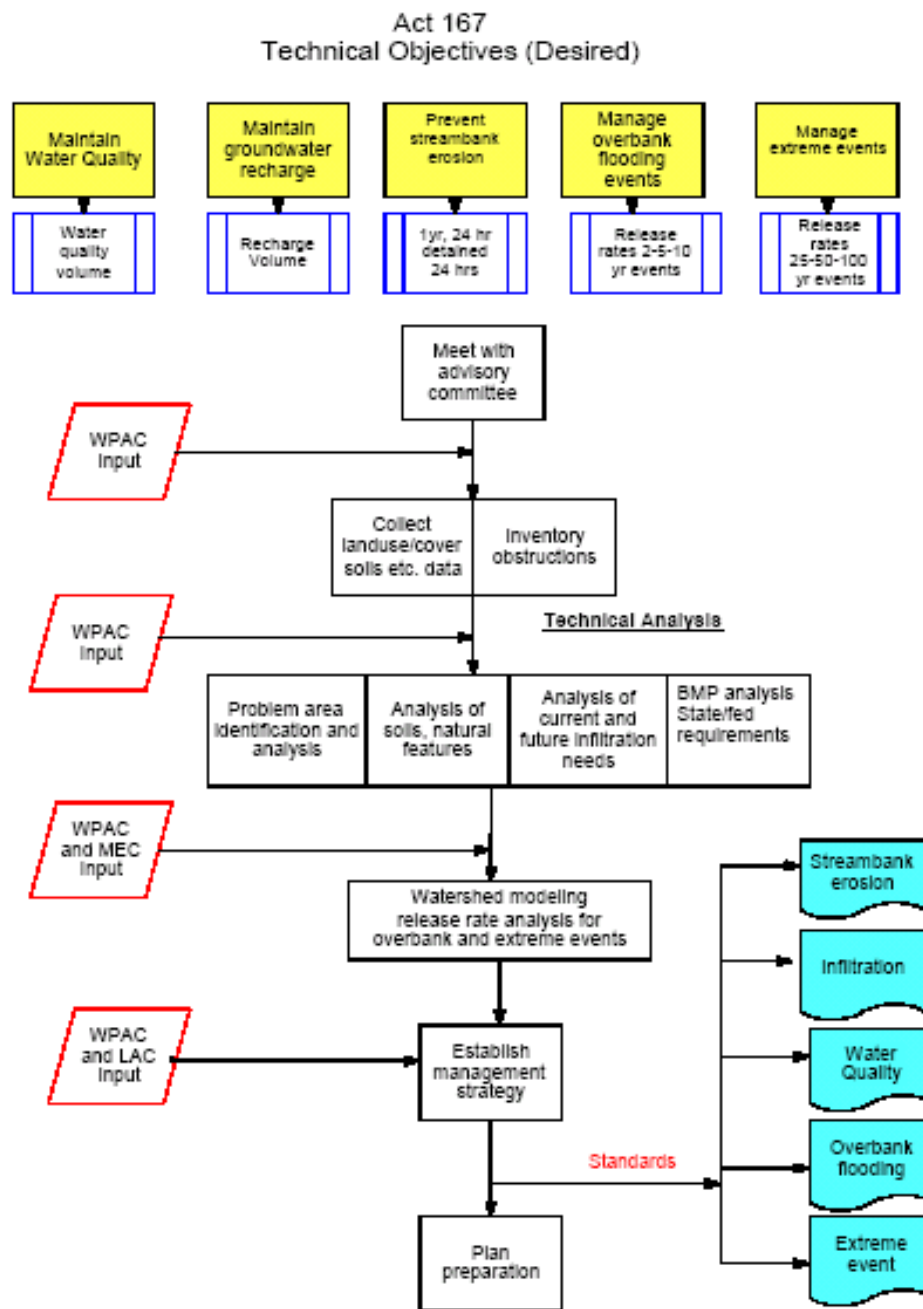


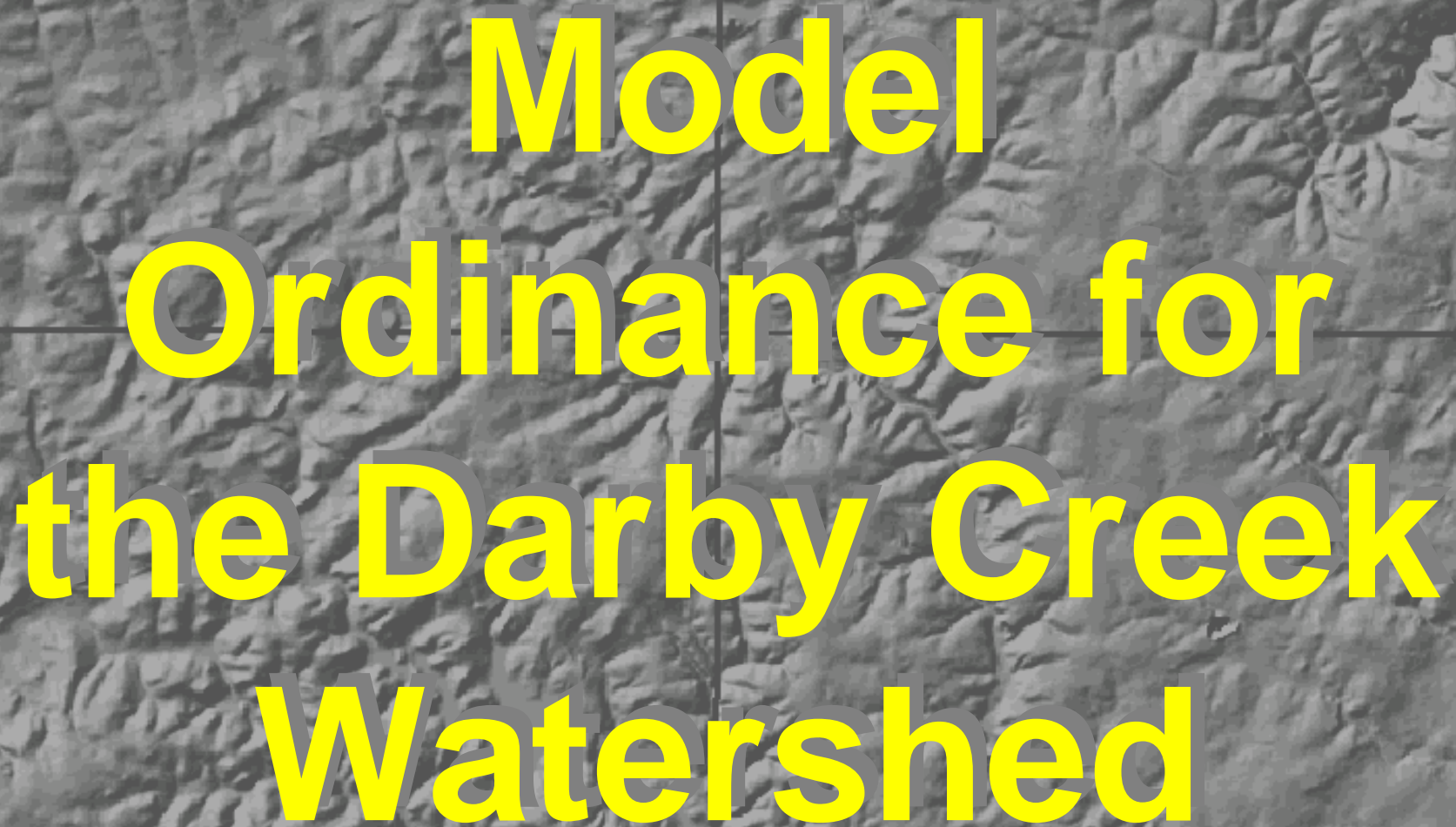
Problems in the Watershed



- Floodplain encroachment
- Undersized storm drains
- Undersized stream channels
- Erosion/Sedimentation
- Water Quality/Pollution
- Others ?????

FIGURE V-1
Process Utilized in Analyzing Five Comprehensive Management Objectives



A grayscale topographic map showing terrain contours and elevation changes. The map is overlaid with a grid of thin black lines. The text is centered over the map.

Model Ordinance for the Darby Creek Watershed

Main Ordinance Objectives:

- Implement nonpoint source pollution removal methodologies**
- Maintain groundwater recharge**
- Reduce channel erosion**
- Manage overbank flood events**
- Manage extreme flood events**

Applicability

The following activities are defined as “regulated activities” and shall be regulated by this Ordinance unless exempted by Section 106:

- A. Land development,
- B. Subdivisions,
- C. Alteration of the natural hydrologic regime,
- D. Construction or reconstruction of or addition of new impervious or semi-pervious surfaces (i.e., driveways, parking lots, roads, etc.),
- E. Construction of new buildings or additions to existing buildings,
- F. Redevelopment,
- G. Diversion piping or encroachments in any natural or man-made channel,
- H. Nonstructural and structural stormwater management BMPs or appurtenances thereto,
- I. Earth disturbance activities of greater than five thousand (5,000) square feet,¹
- J. Any of the above regulated activities which were approved more than five (5) years prior to the effective date of this Ordinance and resubmitted for municipal approval.

Applies to new development and redevelopment!

TABLE 105.1A

ORDINANCE APPLICABILITY FOR THE DELAWARE, CHESTER, AND MONTGOMERY COUNTY PORTIONS OF THE WATERSHED

Ordinance Article or Section	Type of Project	Proposed Impervious Surface				Earth Disturbance	
		0-2,000 sq. ft.	2,000-5,000 sq. ft.	5,000 sq. ft.-1 acre	> 1 acre	5,000 sq. ft. -1 acre	> 1 acre
<u>Article III</u> Drainage Plan Requirements	Development	N/A	Modified	Yes	Yes	Modified	Yes
	Redevelopment	N/A	Modified	Yes	Yes	Modified	Yes
<u>Section 404</u> Nonstructural Project Design	Development	N/A	Yes	Yes	Yes	Yes	Yes
	Redevelopment	N/A	Yes	Yes	Yes	Yes	Yes
<u>Section 405</u> Groundwater Recharge	Development	N/A	Yes	Yes	Yes	N/A	Yes
	Redevelopment	N/A	Yes	Yes	Yes	N/A	Yes
<u>Section 406</u> Water Quality Requirements	Development	N/A	Yes	Yes	Yes	N/A	Yes
	Redevelopment	N/A	Yes	Yes	Yes	N/A	Yes
<u>Section 407</u> Stream Bank Erosion Requirements	Development	N/A	Exempt	Yes	Yes	N/A	Yes
	Redevelopment	N/A	Exempt	Exempt	Yes	N/A	Yes
<u>Section 408</u> Stormwater Peak Rate Control and Management Districts	Development	N/A	Exempt	Yes	Yes	Yes	Yes
	Redevelopment	N/A	Exempt	Yes	Yes	Yes	Yes
Erosion and Sediment Pollution Control Plan Submission to the Conservation District	Earth Disturbance	See Earth Disturbance Requirements	See Earth Disturbance Requirements	See Earth Disturbance Requirements	See Earth Disturbance Requirements	Yes	Yes
		(Refer to municipal earth disturbance requirements, as applicable)					

Major Ordinance Provisions:

Section 404

Nonstructural Project Design

- **Existing Resource and Site Analysis Map (showing environmentally sensitive areas, steep slopes, water bodies, etc.)**
- **Establish buffer (Section 406)**
- **Minimize earth disturbance and impervious surfaces**

Major Ordinance Provisions:

Section 405

Groundwater Recharge

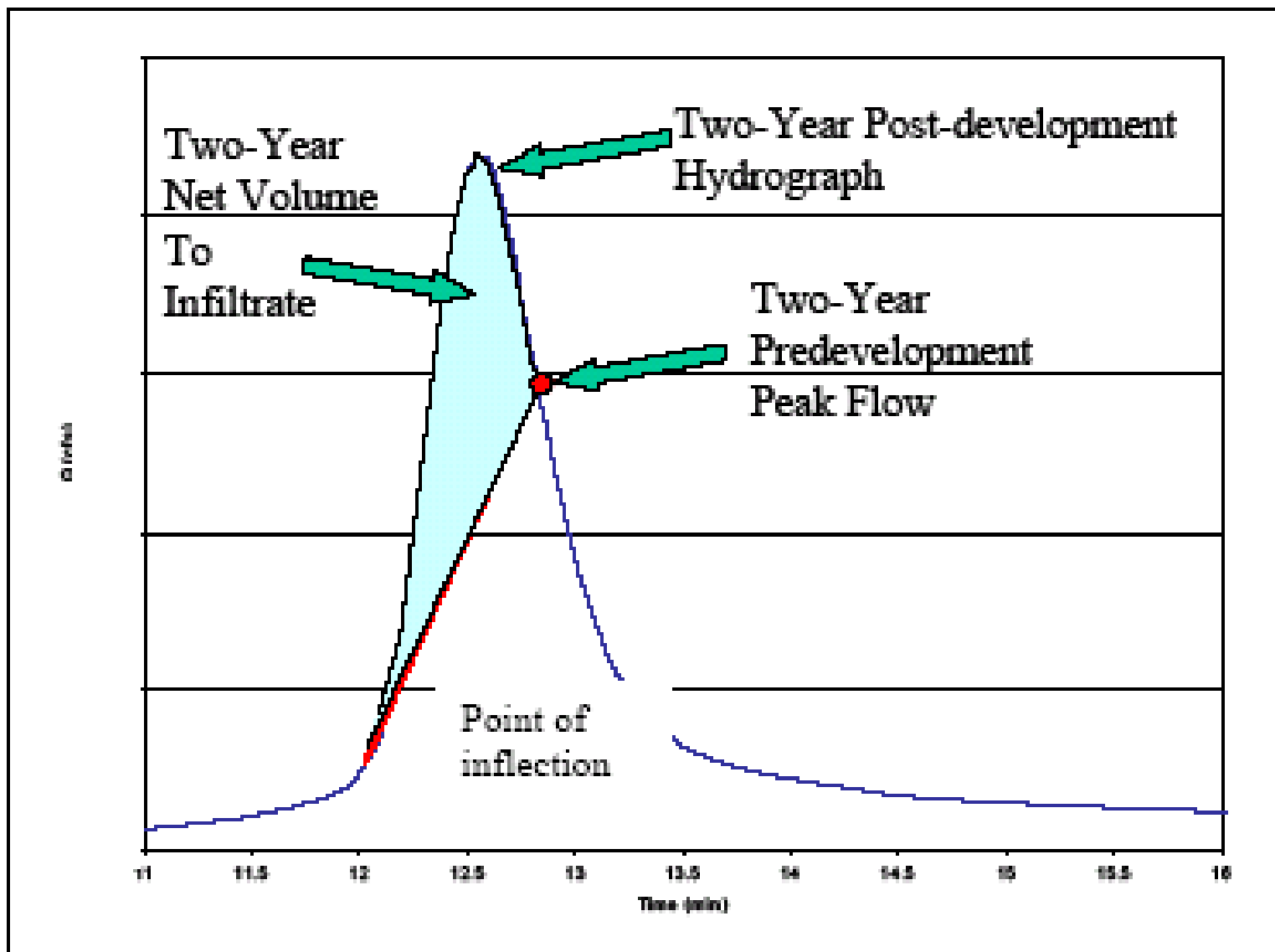
- **Infiltrate first 1” from impervious surfaces**

Section 406

Water Quality

- **Best management practices (BMPs)**
- **50 ft. (recommended) riparian buffer**
 - **native vegetation**

FIGURE V-2
Infiltration Hydrograph



Major Ordinance Provisions:

Section 407

Stream Bank Erosion

- **Detain the 2-yr flow back to the 1-yr flow**

Section 408

Peak Rate Control

- **Control the peak rate from the -2, -5, -10, -25, -50, and 100-year storms**

Major Ordinance Provisions:

ARTICLE VII

Maintenance Responsibilities

- **O & M agreement req. for all facilities installed under the ordinance**

ARTICLE VIII

Prohibitions

- **No discharge of non-rainwater to streams, no roof drains to storm sewers – must be infiltrated**

A grayscale topographic map of a rugged, mountainous terrain serves as the background. A white grid is overlaid on the map, consisting of a vertical line and a horizontal line that intersect in the center. The text is centered on the map.

What Doesn't the Plan/Model Ordinance Do?

**The Plan and Ordinance
*will not:***

**Correct or solve existing
problems!**

**Provide Act 167 funds to
correct existing problems!**



NOW WHAT DO WE DO?

HURRICANE FLOYD - DARBY BOROUGH

September, 1999

QUESTIONS?

Karen Holm

Delaware County Planning Department

610-891-5213

Holmk@co.delaware.pa.us