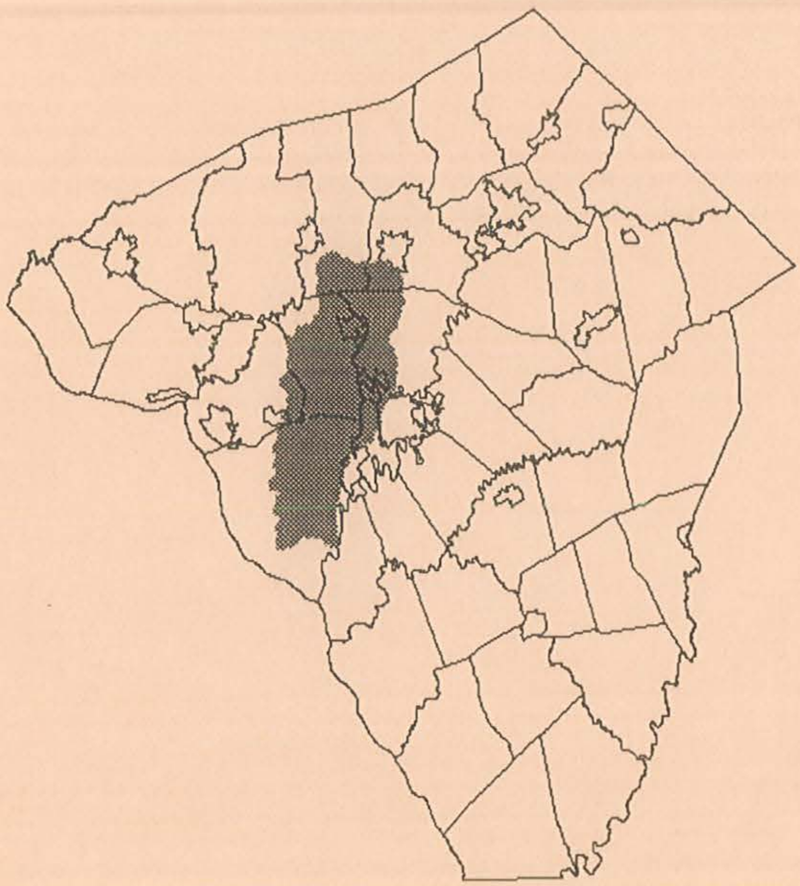
ACT 167
WATERSHED STORM WATER MANAGEMENT PLAN

VOLUME I - EXECUTIVE SUMMARY

LITTLE CONESTOGA CREEK WATERSHED



LANCASTER COUNTY, PENNSYLVANIA
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PREPARED FOR:

LANCASTER COUNTY COMMISSIONERS
50 NORTH DUKE STREET
LANCASTER, PA 17602

VOLUME I - PLAN CONTENTS

VOLUME I

SECTION I

INTRODUCTION

A. Introduction

The Little Conestoga Creek Watershed is located in the central portion of Lancaster County, adjacent to the Conestoga River.

Large portions of this watershed are developed, but vast areas are still undeveloped with a potential for extensive growth under existing zoning. The effects of this potential growth and development on drainage, flooding, and erosion problems are a major concern for municipal officials and affected property owners. Extensive commercial/industrial growth along U.S. Routes 30, 462, 72, 741 and 23 can result in accelerated storm water runoff which has the potential of causing flooding and erosion problems for property owners along Little Conestoga Creek. Stream water quality can also become degraded as impervious areas grow throughout the watershed.

B. Storm Water Management

Storm water management entails bringing surface runoff caused by precipitation events under control. In past years, storm water control was viewed only on a site-specific basis. Recently, local perspectives and policies have changed, with the realization that proper storm water management can only be accomplished by evaluating the comprehensive picture (i.e. by analyzing what adverse impacts a development located in a watershed's headwaters may have on flooding downstream). Proper storm water management reduces flooding, soil and stream bank erosion and sedimentation and improves the overall quality of the receiving streams.

Storm water management requires cooperation between the state, county and local officials and involves proper planning, engineering, construction, operation and maintenance. This includes educating the public, local officials and developers and requires program development, financing, revising policy, developing workable criteria and adopting ordinances. The Little Conestoga Creek Watershed Storm Water Management Plan, prepared under the Pennsylvania Storm Water Management Act, will enable continued development to occur within the Watershed, utilizing both structural and nonstructural measures to properly manage storm water runoff in the watershed.

SECTION II

ACT 167

A. Storm Water Management Act

The Pennsylvania General Assembly, recognizing the adverse effects of inadequate management of excessive rates and volumes of storm water runoff resulting from development, approved the Storm Water Management Act, P.L. 864, No. 167, October 4, 1978. Act 167 provides for the regulation of land and water use for flood control and storm water management purposes. It imposes duties and confers powers to the Department of Environmental Protection (DEP), municipalities and counties and provides for enforcement and appropriations. The Act requires the DEP to designate watersheds and develop guidelines for storm water management and model storm water ordinances (the designated watersheds were approved by the Environmental Quality Board July 15, 1980, and the guidelines and model ordinances were approved by the Legislature May 14, 1985). The Act provides for grants to be appropriated by the General Assembly and administered by the Department for 75% of the allowable costs for preparation of official storm water management plans and administrative, enforcement and implementation costs incurred by any municipality or county in accordance with Chapter III - Storm Water Management Grants and Reimbursement Regulations (adopted by the Environmental Quality Board August 27, 1985).

Each county must prepare and adopt a watershed Storm Water Management Plan for each of its designated watersheds in consultation with the municipalities, and will periodically review and revise such plans at least every five years when funding is available. Within six months following adoption and approval of a watershed storm water plan, each municipality is required to adopt or amend, and implement ordinances and regulations as are necessary to regulate development within the municipality in a manner consistent with the applicable watershed storm water plan and the provisions of the Act.

Developers are required to manage the quantity, velocity, and direction of resulting storm water runoff in a manner which adequately protects health and property from possible injury, and must implement control measures that are consistent with provisions of the watershed plan and the Act. The Act also provides for civil remedies for those aggrieved by inadequate management of accelerated storm water runoff.

B. Purpose of the Study

There is increased sentiment statewide, as well as local recognition, that a sound and effective storm water management plan should be a diversified multiple-purpose plan. This plan should address the full range of hydrologic consequences resulting from development instead of simply focusing on controlling site-specific peak flow, without consideration of tributary timing, flow volume reduction, base flow augmentation, water quality control and ecological protection.

Managing storm water runoff on a site-specific basis does not meet the requirements of watershed-wide storm water management objectives. The timing of flood peaks for each subbasin within a watershed contributes greatly to the flooding potential of a particular storm. Each storm water control site within a subbasin should be managed by evaluating the comprehensive picture. The overall objective of the Plan is to maintain peak flows throughout the watershed to existing conditions as the watershed becomes developed.

By developing the Little Conestoga Creek Watershed Storm Water Management Plan, reasonable regulation of development activities can be administered to control accelerated runoff and thus protect the health, safety and welfare of the public. The Plan shall include recognition of the various rules, regulations and laws at the federal, state, county and municipal level. Once implemented, the Plan will aid in reducing costly flood damages by reducing the source and cause of local uncontrolled runoff. The Plan will make municipalities and developers more aware of comprehensive planning in storm water control and will also help maintain the quality of both the Little Conestoga Creek and its tributaries.

C. Plan Format

The plan format of the Little Conestoga Creek Storm Water Management Plan consists of Volume I, Executive Summary, Volume II, Plan Content, and the Technical Appendices. Volume I provides an overview of Act 167 and Watershed Level Storm Water Management.

Volume II provides the purpose of the study, data collection, identification of existing problems, present conditions, projected and alternative land development patterns and the model ordinance. Volume II also assesses the impact of managing storm water by utilizing the criteria and standards set forth in this Plan.

The Technical Appendices provide all of the supporting data, procedures, parameters and watershed modeling.

SECTION III

LITTLE CONESTOGA CREEK WATERSHED CHARACTERISTICS

The Little Conestoga Creek is located in the eastern portion of Lancaster County and contains twelve municipalities in the County as listed below.

LITTLE CONESTOGA CREEK WATERSHED - MUNICIPALITIES

LANCASTER COUNTY

1. Manor Township
2. West Hempfield Township
3. East Hempfield Township
4. Penn Township
5. Manheim Township
6. Warwick Township
7. Lancaster Township
8. Lancaster City
9. East Petersburg Borough
10. Mountville Borough
11. Millersville Borough
12. Lititz Borough

A. Drainage Area

Little Conestoga Creek drains a total surface area of approximately 64 square miles.

The major tributaries to the Little Conestoga Creek are the West Branch, Brubaker Run, Millers Run and Swarr Run.

B. Land Use

Land use in the watershed consists of approximately 46% crop land, 5% woodland, 9% pasture land, and 5% open space. Approximately 10% of the area is used for commercial and industrial use, 25% residential use and 1% farmsteads.

Although the land use in the Little Conestoga Creek Watershed is diversified, large portions of the land is undeveloped with the potential for extensive future development.

Routes 30, 462, 741, 72 and 23 are the major transportation arteries within the Watershed. Most areas of commercial and industrial development potential exist near these routes. Residential development exists throughout the Watershed.

C. Topography and Stream Bed Profile

The topography of the watershed is characterized nearly level to moderate sloped well-drained soils in undulating broad valleys formed in residuum from limestone. The highest point in the Watershed is an unnamed hill near Manheim with an elevation of 560 feet above sea level U.S.G.S. datum. The lowest point occurs at the Conestoga River confluence with an approximate elevation of 185 feet. There are no major impoundments in the watershed. Many small farm ponds and retention basins do exist. They range in size from ⅓ to 1 acre. The streams generally have shallow beds which causes bottom land flooding during prolonged rains, typically in the spring of the year. Currently, most of the bottom land is farmed. The average stream bed slope of the Little Conestoga Creek is approximately 0.50 percent.

D. Soils

Soil properties influence the process of runoff generation and are therefore classified into four hydrologic soil groups, A through D. The A soils have the lowest runoff potential and are typically sands and gravels whereas the D soils have a high runoff potential and are typically clay soils. The majority of the soils in the watershed are of the B and C hydrologic soil group.

The Letort-Pequea-Conestoga and the Duffield-Hagerstown soils account for 95% of the soils in the watershed. These soils are nearly level to steep well-drained soils formed in residuum of limestone. The Manor-Chester-Glenelg soils account for most of the remaining 5%. These soils are nearly level to very steep well-drained soils on broad ridge tops and side slopes; formed in residuum from mica schist, schist, gneiss and quartzite. This soil makes up an area in western East Hempfield Township and most of the area in West Hempfield Township. There is a small area of Bedington on the ridge tops in Penn and Warwick Townships. Bedington is a nearly level to moderately sloped well drained soil, on dissected ridgetops and side slopes; formed in residuum from acid shale.

E. Climate

Lancaster County is generally cool and humid. The average annual precipitation is about 45 inches.

Major rain producing storms, other than hurricanes, tend to have the same general characteristics. They are slow moving storms from the south or southwest with an abundance of moisture that has been transported from the Gulf of Mexico and resupplied with Atlantic Ocean moisture by a strong, nearly stationary, Bermuda High. At the same time, there is frequently a blocking high pressure area to the northeast of Pennsylvania.

Intense local flash floods are most likely to occur in squall lines just to the east of a slow moving north-south oriented cold front. These are usually warm weather phenomena where afternoon heating adds to the instability of the already unstable, moist air mass.

Large magnitude floods occurred in June 1972 and September 1975. Lesser floods occurred in November and December 1993 and January 1996.

F. Description of Data Collection

1. Topography: The base map was developed using Lancaster County GIS data. The data was gathered for the County at a scale of one inch equals two hundred feet. The vertical interval is five feet. The coverages used for this project included land use, roads, contours, soils, streams, municipal boundaries, zoning, urban growth boundaries, and parks and open space. Subwatersheds were determined for the modeling process.

2. Geology: Geology plays a major role in this study. Ninety-five percent of the basin has underlying carbonate geology. This was taken into consideration when the modeling process was completed.

3. Soils: Soils derived from the underlying bedrock (residual soils) have various drainage properties depending upon the type of bedrock from which they evolved. Soils derived from limestone shales and siltstones may be fairly well-drained. S.C.S has nationally classified soils into four hydrologic soil groups, A through D. Hydrologic soil group A is the most pervious with the least amount of natural runoff while soils in hydrologic group D are tight, low permeable soils with high runoff rates.

4. Land Cover/Land Use: Existing land use was determined from 1993 Lancaster County GIS data. The land use coverage was delivered using the modified Anderson Level II procedure.

G. Significant Obstructions

Approximately 140 structures were field verified and analyzed with HY-8.

The obstruction capacities were then compared to the peak flow at that point derived through the modeling process for each design storm duration and frequency. Flood frequency relationships were then developed for each obstruction and are recorded in tabular form on the Pipe/Structure Capacity Map. From these flood-frequency relationships, those obstructions found to be significant were determined. A significant obstruction is defined as "any structure or assembly of materials which would impede, retard, cause ponding or diversion of storm water runoff or erosion of surrounding land or stream banks."

H. Projected and Alternative Land Development Patterns in the Watershed

1. Projected Land Development Patterns

Most of the townships within the watershed are predominantly suburban in nature and largely undeveloped. A majority of suitable land in the Boroughs and the City has been developed. Overall, potential development pressures will be significant based on existing zoning.

Future development within the Little Conestoga Creek Watershed will most likely occur where public facilities are available. Commercial and industrial development will most likely be confined to industrial parks or areas where public water and sewer are or will soon be available.

2. Impact of Runoff From Future Development

A Future Land Use Map was developed using existing zoning and UGB's in conjunction with physical limitations (wetlands, floodplain, topography). The potential impact of additional runoff was then evaluated by placing the future land use conditions into the computer model and re-running the model. A comparison of the predicted future conditions flows with and without control of post-development flows versus the existing conditions flows for the 100-year, 24-hour storm can be found in Appendix A.

SECTION IV

WATERSHED TECHNICAL ANALYSIS - MODELING

A. Watershed Modeling

An initial step in the preparation of this Storm Water Management Plan was the identification of the storm water runoff simulation model to be utilized. A number of widely accepted computer models are available each of which has its own forte; however, for this study, it was necessary to select a model which:

- Could model design storms of various durations and frequencies to produce routable hydrographs which could be combined.

- Was adaptable to the size of subwatersheds in this study.

- Could evaluate specific physical characteristics of the rainfall-runoff process.

- Was capable of utilizing GIS coverages to provide model input.

The model comparison yielded the decision that the Geostorm GIS "front end" for TR-20 would be utilized for the following reasons:

- TR-20 had been developed by the hydrology branch of the Soil Conservation Service (SCS) specifically for the analysis of the timing of surface flow contributions to peak rates at various locations in a watershed.

- The data requirements make it easily adaptable for input from GIS.

- Input parameters provide a flexible calibration process.

- It has the ability to analyze reservoir or detention basin routing effects and location on the watershed.

- It is accepted by the Pennsylvania Department of Environmental Protection.

B. Calibration Process

In order to model a watershed with confidence and reliability, the chosen computer model should be calibrated against actual field data or actual storm events. There are, however, no recording stream gauges located on the Little Conestoga Creek, therefore, stream flow records for particular storm events are nonexistent. The model runs were checked using the detailed studies completed for FEMA. Some correlation was found, but the limited hydrology analysis completed for the FEMA study could not be used as the only calibration check for the model. The model was also determined to be consistent with other studies in the watershed. The model provided similar flows as did the Corps of Engineer's study of Swarr Run completed in the 1980's and the documentation used to enact the Manheim Township Storm Water Ordinance.

C. Modeling Process

The Little Conestoga Creek Watershed was subdivided into 132 subwatersheds for modeling purposes. Considerations in the subdivision process were: location of obstructions, known flooding, drainage or erosion problems, zoning, and tributary confluences. The most downstream point of each of these areas was considered a "point of interest" in which increased runoff was analyzed for its potential impact.

The watershed was modeled to determine the hydrologic response for the 2, 5, 10, 25, 50 and 100-year storm events for the 24-hour storm..

The modeling process addressed:

- peak discharge values at 132 locations along the stream and its tributaries;
- time to peak for the above discharges;
- runoff contributions of individual subareas at all downstream locations;
- flow values contained in the channel and overflow values; and
- overall watershed timing.

The modeling process assumed the 100 year floodplain to be in the same condition as today. Lancaster County has a history of significant flooding. This is a result of the low slope meandering streams which exist in the County. It is imperative that the floodplains be kept free and clear, as assumed in this model, in the future to alleviate increased flooding of the existing development. The plan highly suggests no encroachment into the 100 year floodplain be allowed.

The potential for future development of this watershed required a model approach which could analyze the effects of different levels of development. The County has developed a "tool" (actually a computer program) which allows the modification of the hydrological model for this watershed to be adjusted between existing and future development by subwatershed and to adjust the model beyond the existing zoning and look at a total build out scenario. This tool allows the hydrologist to change the percentage release rates for each individual subwatershed and allows the results to be evaluated in a few minutes. In essence, this tool allowed the County to look at over 150 different release rate scenarios to develop this plan. The County determines two release rate scenarios which would protect each and every subwatershed from increased storm water flows. The first required six different release rates throughout the watershed. These release rates varied from 30 to 100 percent of the pre-development runoff rates. The second utilized a release rate of 50 percent of pre-development storm water flow rate. The WPAC decided this across the broad release rate would be the easiest to implement and control and was the most equatable for this basin. The tool is capable of running on any 486 or better PC with 16 MB of RAM. The "tool" will be made available to the Municipal Engineers, and others for use in complying with this plan.

After adoption of the plan, this tool will allow the County to determine the effects of zoning changes, when requested, and provide solutions if the proposed zoning change will have an adverse impact on the watershed. Since all zoning changes are reviewed by the Lancaster County Planning Commission, the need to reevaluate the plan can occur as each change is requested and not every five years as suggested by the Act. It appears from the analysis completed that the proposed 50 percent release rate should work for total buildout assuming the existing agricultural zoning is developed into medium density residential and all other areas are developed as now zoned. Changes to the plan may be required if large areas are rezoned commercial/industrial from existing less dense zoning.

SECTION V

STANDARDS AND CRITERIA FOR THE CONTROL OF STORM WATER

A. Performance Standards

1. <u>"Match Pre-existing Hydrograph"</u>

   Developers and/or landowners have the option to provide infiltration facilities or utilize other techniques which will allow the post-development hydrograph to match the pre-existing hydrograph for the site. This will be most useable for small subdivisions.

2. <u>Description of Performance Standard Districts</u>

   In performing the tasks for the Little Conestoga Creek Watershed Plan under Act 167, the goal was to provide a runoff control strategy which should be implemented so as not to increase stormwater runoff anywhere in the Little Conestoga Creek basin. It was also important to determine to what extent storm water detention would be required in individual subareas. Specific goals were to try to have no increase in storm water flows at any point of interest and to maintain as few different release rate areas. After more than 150 different combinations, it was found that a release rate of 50 percent of the pre-existing flow rates in all areas provided results which were not significantly different (3 percent) than any variable release rate scenario. The variable release rate scenarios evaluated for this basin indicated that most of the development potential of the basin exists in the middle and upper portions of the basin. A release rate of fifty percent of the pre-existing runoff rate was required so the tributaries and the main branch were not impacted. According to the model, by the time increased release rates could be allowed, there is limited development. The area where increased release rates could be allowed are below Charlestown Road. This area is mainly zoned Rural and is limited to 1 acre residential development. In an effort to be fair and to allow for the ease of implementation, it was decided that all areas would be required to meet the 50 percent of the pre-development runoff. The rural area lends itself to infiltration control measures which would allow proposed development to meet the pre-existing hydrograph by infiltration and not be required to provide reduced discharge rates.

3. Sub-Regional (Combined Site) Storage

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

The goal should be the development and use of the most cost-effective and environmentally-sensitive storm water runoff controls which significantly improves the capability and flexibility of land developers and communities to control runoff consistent with the Little Conestoga Creek Management Plan.

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

To take this concept a step further, there is also the possibility that the storm water could be managed "off-site;" that is, in a location of the property(s) in question. There could be publicly owned detention, retention, lake, pond or other physical facilities to serve multiple developments. The design and release rate would need to be consistent with the Plan.

4. <u>"No Harm Option"</u>

For any proposed development, the developer has the option of using a less restrictive runoff control if the developer can prove that "no harm" would be caused by discharging at a higher runoff rate than that specified by the Plan. Proof of "no harm" would have to be shown from the development site through the remainder of the downstream drainage network until there is no additional flow increase. Proof of "no harm" must be shown using the capacity criteria specified in Section 303.C of the Model Ordinance if downstream capacity analysis is a part of the "no harm" justification.

Attempts to prove "no harm" based upon downstream peak flow versus capacity analysis shall be governed by the following provisions:

a. The peak flow values to be used for downstream areas for the design return period storms (2-, 5-, 10-, 25-, 50-, and 100-year) shall be the values from the calibrated TR-20 Model for the Little Conestoga Creek Watershed. These flow values would be supplied to the developer by the County upon request.

b. Any available capacity in the downstream conveyance system as documented by a developer may be used by the developer only in proportion to his development site acreage relative to the total upstream undeveloped acreage from the identified capacity (i.e. if his site is 10% of the upstream undevelopment acreage, he may use up to 10% of the documented downstream available capacity).

c. Developer-proposed runoff controls which would generate increased peak flow rates at documented storm drainage problem areas would, by definition, be precluded from successful attempts to prove "no harm," except in conjunction with proposed capacity improvements for the problem areas consistent with Section 303.C. of the Model Ordinance.

Appendix A

TABLE III-3 100 Year Storm of 24-hour Duration			
Subarea Number	Present Conditions (CFS)	Future with 100% Release Rate	Future With 50% Release Rate
1	293.0	293.0	147.0
2	172.0	174.0	86.0
3	209.0	209.0	209.0
4	1,194.0	1,228.0	*1,333.0
5	1,043.0	1,043.0	1,043.0
6	384.0	384.0	384.0
7	1,542.0	1,576.0	*1,667.0
8	539.0	539.0	539.0
9	2,727.0	2,746.0	2,829.0
10	359.0	359.0	359.0
11	425.0	425.0	425.0
12	367.0	367.0	367.0
13	3,709.0	*3,923.0	3,848.0
14	3,754.0	3,871.0	3,880.0
15	413.0	413.0	413.0
16	494.0	494.0	494.0
17	921.0	921.0	921.0
18	348.0	348.0	348.0
19	1,572.0	1,633.0	1,404.0
20	1,634.0	*1,730.0	1,491.0
21	1,775.0	*2,014.0	1,653.0
22	314.0	314.0	157.0
23	414.0	429.0	310.0
24	543.0	*594.0	373.0
25	928.0	936.0	464.0
26	1,145.0	*1,315.0	889.0
27	1,306.0	*1,486.0	999.0
28	68.0	68.0	68.0

Subarea Number	Present Conditions (CFS)	Future with 100% Release Rate	Future With 50% Release Rate
29	358.0	358.0	358.0
30	629.0	629.0	629.0
31	1,385.0	*1,550.0	1,027.0
32	787.0	787.0	394.0
33	313.0	313.0	157.0
34	158.0	158.0	79.0
35	2,814.0	*3,264.0	2,249.0
36	4,336.0	*4,915.0	3,850.0
37	3,764.0	3,878.0	3,886.0
38	337.0	337.0	337.0
39	587.0	592.0	431.0
40	299.0	299.0	150.0
41	1,062.0	1,091.0	807.0
42	7,994.0	*8,649.0	7,867.0
43	8,377.0	*9,070.0	8,304.0
44	574.0	574.0	574.0
45	400.0	400.0	400.0
46	787.0	787.0	787.0
47	1,681.0	1,681.0	1,681.0
48	806.0	806.0	806.0
49	8,566.0	*9,269.0	8,452.0
50	689.0	689.0	689.0
51	This	watershed number was not used.	
52	654.0	654.0	654.0
53	781.0	781.0	781.0
54	473.0	473.0	473.0
55	1,915.0	1,970.0	1,635.0
56	1,988.0	*2,156.0	1,642.0
57	2,386.0	*2,527.0	2,046.0
58	296.0	296.0	148.0
59	3,298.0	3,413.0	2,976.0
60	3,375.0	3,526.0	3,099.0

Subarea Number	Present Conditions (CFS)	Future with 100% Release Rate	Future With 50% Release Rate
61	3,554.0	3,712.0	3,500.0
62	4,787.0	4,930.0	4,692.0
63	1,009.0	1,048.0	709.0
64	1,908.0	1,944.0	1,686.0
65	13,255.0	*14,113.0	13,053.0
66	501.0	501.0	251.0
67	527.0	527.0	527.0
68	13,495.0	*14,412.0	13,437.0
69	13,989.0	*14,934.0	13,938.0
70	2,157.0	2,157.0	1,520.0
71	2,396.0	*2,671.0	1,741.0
72	2,572.0	*2,816.0	1,957.0
73	14,678.0	*15,772.0	15,033.0
74	755.0	755.0	755.0
75	1,598.0	*2,144.0	1,465.0
76	14,096.0	*15,159.0	14,468.0
77	378.0	378.0	189.0
78	590.0	*620.0	310.0
79	14,165.0	*15,258.0	14,547.0
80	14,130.0	*15,240.0	14,658.0
81	14,156.0	*15,267.0	14,681.0
82	14,057.0	*15,170.0	14,595.0
83	434.0	434.0	217.0
84	14,070.0	*15,194.0	14,617.0
85	286.0	286.0	143.0
86	525.0	546.0	410.0
87	813.0	813.0	407.0
88	988.0	988.0	988.0
89	1,347.0	1,359.0	1,298.0
90	1,979.0	*2,294.0	1,835.0
91	2,273.0	*2,534.0	2,066.0
92	511.0	511.0	256.0

Subarea Number	Present Conditions (CFS)	Future with 100% Release Rate	Future With 50% Release Rate
93	293.0	293.0	147.0
94	2,857.0	*3,254.0	2,577.0
95	691.0	691.0	691.0
96	879.0	879.0	879.0
97	433.0	433.0	217.0
98	3,563.0	*3,845.0	3,158.0
99	3,832.0	*4,092.0	3,481.0
100	634.0	634.0	634.0
101	837.0	837.0	837.0
102	4,389.0	4,553.0	4,027.0
103	545.0	545.0	545.0
104	1,014.0	1,014.0	1,014.0
105	4,936.0	5,047.0	4,529.0
106	4,930.0	5,067.0	4,652.0
107	4,772.0	4,970.0	4,643.0
108	736.0	736.0	736.0
109	723.0	723.0	362.0
110	878.0	938.0	468.0
111	1,645.0	*1,730.0	1,112.0
112	1,660.0	*1,876.0	1,142.0
113	137.0	139.0	69.0
114	1,748.0	*1,990.0	1,246.0
115	15,692.0	*17,143.0	16,457.0
116	15,920.0	*17,403.0	16,694.0
117	2,958.0	*3,441.0	2,524.0
118	810.0	810.0	405.0
119	817.0	817.0	817.0
120	375.0	375.0	375.0
121	2,186.0	2,186.0	2,186.0
122	542.0	542.0	542.0
123	1,348.0	1,348.0	1,348.0
124	1,318.0	1,318.0	1,318.0

Subarea Number	Present Conditions (CFS)	Future with 100% Release Rate	Future With 50% Release Rate
125	408.0	408.0	408.0
126	14,532.0	*15,608.0	14,889.0
127	1,583.0	1,620.0	1,296.0
128	422.0	422.0	422.0
129	1,294.0	1,294.0	1,294.0
130	744.0	744.0	744.0
131	685.0	685.0	685.0
132	750.0	750.0	375.0
133	15,924.0	*17,408.0	16,699.0

* Future flow in excess of present flow.

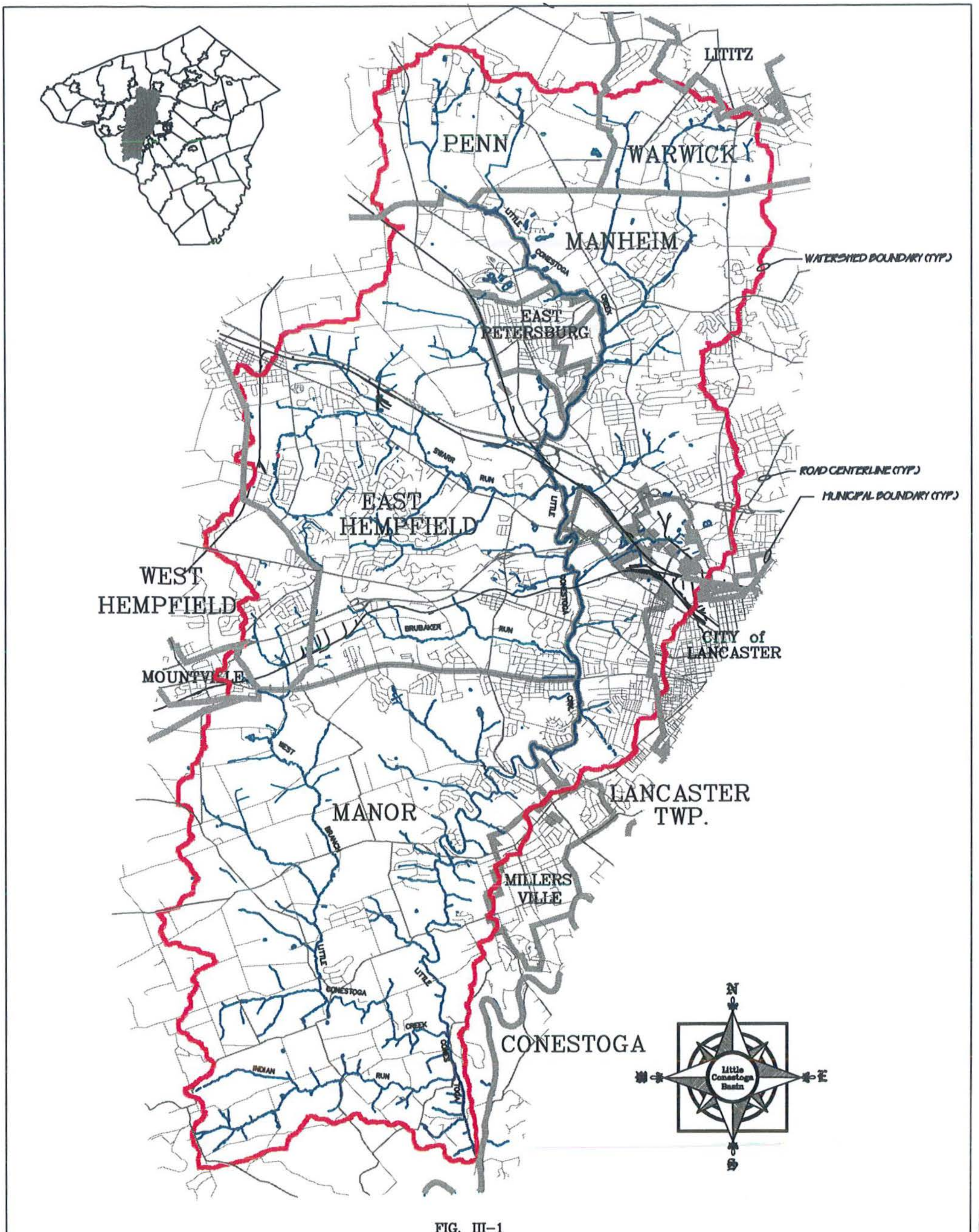
LITITZ
PENN
WARWICK
MANHEIM
WATERSHED BOUNDARY (TYP.)
LITTLE
CONESTOGA
CREEK
EAST
PETERSBURG
SWARR
RUN
ROAD CENTERLINE (TYP.)
MUNICIPAL BOUNDARY (TYP.)
EAST
HEMPFIELD
WEST
HEMPFIELD
BRUBAKER
RUN
CITY of
LANCASTER
MOUNTVILLE
WEST
BRANCH
MANOR
LANCASTER
TWP.
MILLERS
VILLE
LITTLE
CONESTOGA
CREEK
INDIAN
RUN
CONESTOGA
N
E
S
W
Little
Conestoga
Basin

FIG. III-1