

# A Multi-Jurisdictional Flood Mitigation Plan for Municipalities in the Non-tidal, New Jersey Section of the Delaware River Basin



August 2008 Draft



Lambertville, NJ April 2005



Frenchtown, NJ June 2006



Trenton, NJ April 2005



Stockton, NJ April 2005

**For questions or to make comments on this document, contact:**

Laura Tessieri, P.E., CFM  
Delaware River Basin Commission  
PO Box 7360, 25 State Police Drive  
West Trenton, NJ 08628-0360  
[Laura.Tessieri@drbc.state.nj.us](mailto:Laura.Tessieri@drbc.state.nj.us)  
(609)883-9500 x304

Photos Credits (L to R): David Sayers, DRBC; Robert Limbeck, DRBC; (2) John Jenks, USGS.

## **Acknowledgements:**

This report would not have been possible without the cooperation and support we received from Mercer, Hunterdon, Warren and Sussex Counties. In particular, special mention and thanks are given to:

### **Mercer County:**

- Robert Hartman, County Emergency Management Deputy Coordinator
- Marisa Wiczorek, AICP/PP, Senior Planner

### **Hunterdon County:**

- Ken Bogen, Principal Planner
- William J. Powell, County Emergency Management Coordinator

### **Warren County:**

- Frank E. Wheatley, County Emergency Management Coordinator
- William E. Hunt, Domestic Preparedness Planner

### **Sussex County:**

- Chief E.S. "Skip" Danielson, Director Emergency Services
- Mark W. Vogel, Deputy Coordinator
- Alice Brees, Planner
- David Kunz, GIS Manager

*(This page was intentionally left blank)*

# TABLE OF CONTENTS

## Executive Summary

### Section 1: Introduction

Purpose and Scope of Plan.....	13
Goals and Objectives .....	15
Authority .....	15
Participating Jurisdictions.....	17
Profile of the Delaware River Basin .....	19
Profile of the Study Area .....	23

### Section 2: Planning Process

Plan Development Process.....	35
Involved Stakeholders in Mitigation Planning .....	39
Regional Planning Team.....	39
Municipal Participation.....	40
Public Participation – Citizen and Stakeholder Involvement .....	42
Review and Incorporation of Existing Information .....	43

### Section 3: Flood Hazard Identification and Profiling

Nature of the Flood Hazard.....	49
Types of Flooding.....	53
History of Past Flood Events .....	55
Location and Extent of Flood Hazard.....	66
Analysis of Repetitive Loss Properties .....	66

### Section 4: Risk Assessment

Assessing Vulnerability .....	73
Estimating Potential Losses .....	73
Analyzing Land Use and Development Trends .....	83

### Section 5: Mitigation Strategy

Delaware River Basin Mitigation Strategy.....	87
Strategy .....	87
Guiding Principles .....	88
Organization of Interstate Flood Mitigation Task Force Report .....	88
Recommendations.....	89
Implementation .....	93
New Jersey Mitigation Strategy.....	99
Findings .....	100
Recommendations of NJ Delaware Flood Mitigation Task Force.....	100
Implementation .....	102
County/Local Mitigation Strategy .....	105
Municipal Specific Flood Mitigation Goals and Action Plans .....	105
Mitigation Categories.....	105
Prioritization Process .....	107
Mitigation Action Tables .....	107

**Section 6: Flood Profile and Mitigation Action Plan by Jurisdiction**

Mercer County .....	119
Ewing Township .....	125
Hamilton Township .....	128
Hopewell Township .....	134
Lawrence Township .....	137
Pennington Borough .....	140
Trenton City .....	141
Hunterdon County .....	151
Delaware Township .....	156
East Amwell Township .....	159
Franklin Township .....	161
Frenchtown Borough .....	164
Hampton Borough .....	169
Kingwood Township .....	171
Lambertville City .....	174
Lebanon Township .....	179
Milford Borough .....	181
Raritan Township .....	183
Stockton Borough .....	185
West Amwell Township .....	190
Warren County .....	193
Belvidere Township .....	200
Blairstown Township .....	204
Franklin Township .....	208
Frelinghuysen Township .....	209
Town of Hackettstown .....	212
Hardwick Township .....	214
Harmony Township .....	215
Independence Township .....	218
Knowlton Township .....	220
Lopatcong Township .....	222
Mansfield Township .....	225
Oxford Township .....	227
Town of Phillipsburg .....	230
Pohatcong Township .....	234
White Township .....	238
Sussex County .....	243
Andover Borough .....	249
Branchville Borough .....	251
Byram Township .....	253
Frankford Township .....	255
Fredon Township .....	257
Montague Township .....	260
Town of Newton .....	263

Sandyston Township.....	267
Sparta Township .....	269
Stillwater Township .....	272
<b>Section 7: Plan Adoption and Plan Maintenance Procedures</b>	
Municipal Review .....	276
Municipal Adoption Process.....	276
Incorporation into Existing Planning Mechanisms.....	277
Monitoring, Evaluating and Updating the Plan .....	277
Continued Public Involvement .....	279
<b>Appendix A.</b> Local Mitigation Plan Crosswalk	
<b>Appendix B.</b> Municipal Statements of Intent	
<b>Appendix C.</b> Forms Prepared for Municipalities:	
• Municipal Requirements for Satisfactory Participation	
• Outreach Flyers	
• Sample Mitigation Goals	
• Formation of a Local Mitigation Planning Committee	
• Municipal Questionnaire	
• Municipal Worksheet	
• Sample Public Notice Language	
• Residential/Business Questionnaire	
• Categories of Mitigation Actions	
• STAPLEE Prioritization Matrix	
<b>Appendix D.</b> County Floodplain Maps	
<b>Appendix E.</b> Sample Plan Resolution	
<b>Appendix F.</b> Resolutions of Plan Adoption	

*(This page was intentionally left blank)*

## EXECUTIVE SUMMARY

Between mid-September 2004 and late July 2006, three major floods caused severe and repeated damage to thousands of structures, and disrupted the lives of many in the Delaware River Basin. The flooding was the worst experienced since the record flood of 1955.

This Plan is the result of a multi-agency and local partnership that formed following those three Delaware River main stem flood events. The purpose of the partnership was to capitalize on resources at the federal, state and county level and assist local municipalities in completing a regional flood hazard mitigation plan. The overall goal of this Flood Mitigation Plan is to make the Delaware River Basin more disaster resilient by reducing long-term risks to loss of life and property damage from flooding. The aim is to empower local communities to mitigate and support a sustainable community plan so that, when confronted by a natural disaster, they will sustain fewer losses and recover more quickly.

The geographic scope of this Flood Mitigation Plan includes forty-three (43) New Jersey municipalities located in Mercer, Hunterdon, Warren and Sussex counties that are either entirely or partially located within the Delaware River Basin and have elected to participate in the planning process. This study area was chosen as such because although the planning requirement had been in place since 2000, as of late 2006 - no municipalities in this area had an approved All Hazards Mitigation Plan and only a few municipalities in the study area had effective Flood Mitigation Plans.

This Plan is unique in that while it will meet the flood mitigation plan requirements of each municipality and also employ a watershed management approach to ensure that final mitigation actions address both local jurisdictional needs and regional multi-jurisdictional needs. Through this Plan, local flood issues will be elevated to the county, state and regional level. This Plan is essentially an action plan that contains over one hundred and sixty (160) mitigation actions developed by individual municipalities and counties.

Key objectives of this Flood Mitigation Plan are to:

- Increase the coordination and cooperation among intergovernmental entities in carrying out flood mitigation;
- Demonstrate a firm local commitment to flood mitigation;
- Leverage a wide array of funding opportunities to implement actions;
- Comply with federal legislative requirements for local mitigation plans; and
- Reduce future flood loss.

One of the purposes of the Flood Mitigation Plan is to enable participating municipalities to get one step closer to becoming eligible to compete for FEMA funding aimed at flood mitigation. There are two types of natural hazard mitigation plans recognized by the Federal Emergency Management Agency (FEMA): a Flood Mitigation Plan and an All Hazards Mitigation Plan. As the name suggests, a Flood Mitigation Plan is specific to flooding. For participating

municipalities, this Flood Mitigation Plan is an important and significant step towards completion of the required All Hazards Mitigation Plan. It also is a stand-alone document that details regional, county-wide and municipal mitigation actions that when implemented could reduce future flood loss.

The phrase “100-Year Flood” is a cause of confusion among the public, government officials, and insurers. Many continue to believe it is a description of a flood that occurs only once every 100 years. In fact, "100-Year Flood" is an abbreviated way of describing a flood of such magnitude that has a 1-percent (or 1 in 100) statistical probability of being equaled or exceeded in any given year. This terminology describing flood events is often found to be misleading because it is based on statistical probabilities, not periodicity. By definition, more than one 100-year flood event or base flood can occur within the span of a single year or one might not be witnessed on time scales of greater than 100 years. **Based on probability theory, a building in the Special Flood Hazard Area has a 26 % (or 1 in 4) chance of experiencing a 100-year flood over the entire life of a 30-year mortgage.**

Regarding the physical nature of the flood zone, over 67,670 acres of the total county area in Mercer, Hunterdon Warren and Sussex Counties fall within the 100-year flood zone. In other words, roughly 7% of that land area is vulnerable to a 100-year flood event. These flood zone size estimates were completed using the Q3 digital flood zone maps (Section 3).

Repeat flood insurance claims indicate areas where floodplain occupancy continues in spite of repeated inundation. As of 01/31/08, FEMA identified 562 repetitive loss and 60 severe repetitive loss properties in Mercer, Hunterdon, Warren and Sussex counties. The definition of a repetitive loss property is 2 or more flood losses, where the definition of a severe repetitive loss property is 4 or more flood losses or when the payments exceed the building value. **As an example of the severity of flooding in recent years, the number of repetitive loss properties in the entire Delaware River Basin prior to September 2004 was 317. Between September 2004 and February 2007, an additional 2,266 properties were added to this list (Section 3).**

Residential flood risk was calculated by a simple methodology that uses the FEMA default present-value coefficients from the benefit-cost analysis software modules. The results of this analysis reveal that Harmony Township, Warren County has the highest projected flood risk over 100 years at \$10.3 million. Following Harmony Township is the City of Trenton, Mercer County with a projected 100-year flood risk of \$6.9M; Kingwood Township, Hunterdon County with a projected 100-year flood risk of \$4.9M; Lambertville, Hunterdon County with a projected 100-year flood risk of \$4.3M; and Knowlton, Warren County with a projected 100-year flood risk of \$4.0M (Section 4).

HAZUS-MH® (FEMA’s loss estimation software) was used in the risk assessment and examine the vulnerability from flooding using the amount of direct economic losses related to buildings. This assessment considers monetary losses from the buildings including structural damage, contents damage, and inventory loss. The results of the HAZUS-MH model for Mercer, Hunterdon, Sussex and Warren show that \$180 million is vulnerable to loss from a 100-year flood. Individually, Mercer - \$77M, Hunterdon - \$39M, Warren - \$23M and Sussex - \$41M (Section 4).

Each municipality’s vulnerability to flooding was ranked based on the repetitive risk analysis, the vulnerability assessment and the data presented by each municipality in this report. The results are presented below and described further in Section 4 of this report.

### Summary of Flood Vulnerability by Jurisdiction

<b>MERCER</b>	
EWING TWP	Medium
HAMILTON TWP	Medium
HOPEWELL TWP	Medium
LAWRENCE TWP	Medium
PENNINGTON BOROUGH	Low
TRENTON CITY	High
<b>HUNTERDON</b>	
DELAWARE TWP	Medium
EAST AMWELL TWP	Low
FRANKLIN TWP	Low
FRENCHTOWN BOROUGH	High
HAMPTON BOROUGH	Low
KINGWOOD TWP	High
LAMBERTVILLE CITY	High
LEBANON TWP	Low
MILFORD BOROUGH	Low
RARITAN TWP	Medium
STOCKTON BOROUGH	High
WEST AMWELL TWP	Low

<b>WARREN</b>	
BELVIDERE TWP	High
BLAIRSTOWN TWP	High
FRANKLIN TWP	Low
FRELINGHUYSEN TWP	Low
HACKETTSTOWN TOWN	Low
HARDWICK TWP	Low
HARMONY TWP	High
INDEPENDENCE TWP	Low
KNOWLTON TWP	High
LOPATCONG TWP	Medium
MANSFIELD TWP	Low
OXFORD TWP	Low
PHILLIPSBURG TOWN	High
POHATCONG TWP	High
WHITE TWP	Medium
<b>SUSSEX</b>	
ANDOVER BOROUGH	Low
BRANCHVILLE	Low
BYRAM TWP	Low
FRANKFORD TWP	Low
FREDON TWP	Low
MONTAGUE TWP	Medium
NEWTON TOWN	Low
SANDYSTON TWP	Low
SPARTA TWP	Low
STILLWATER TWP	Low

This Plan contains forty-three (43) municipal flood profiles and action plans. Over one hundred and sixty (160) mitigation actions developed by individual municipalities and counties are presented in this Plan that when implemented could reduce future flood loss. As an overview, a subset of the desired mitigation actions contained in the report are presented below. More detail on these, as well as, the full list of desired municipal and county and regional mitigation actions can be found in Sections 5 & 6 of this Plan.

Acquisitions:

Mercer: Hamilton, Trenton  
Hunterdon: Kingwood, Stockton  
Warren: Harmony, Knowlton

Elevations:

Mercer: Hopewell Trenton  
Hunterdon: Kingwood, Lambertville, Raritan  
Warren: Belvidere, Frelinghuysen, Independence, Oxford, Pohatcong

Elevate Utilities:

Mercer: Hamilton, Trenton  
Hunterdon: Frenchtown  
Warren: Blairstown, Knowlton

Stream Desnagging/Restoration:

Mercer: Lawrence  
Hunterdon: Franklin, Hampton  
Warren: Belvidere, Blairstown, Franklin, Hackettstown, Independence, Mansfield, White  
Sussex: Montague, Newton, Sparta, Stillwater

Backflow Prevention Devices:

Mercer: Ewing  
Hunterdon: Frenchtown Lambertville Stockton  
Warren: Belvidere, Blairstown, Phillipsburg, Pohatcong

Flood Warning:

Mercer: Hamilton  
Hunterdon: East Amwell  
Warren: Allamuchy, Hardwick, White  
Sussex: Montague

Dam Studies:

Warren: Allamuchy  
Sussex: Fredon, Newton, Sparta

Structural:

Mercer: Trenton - Flood proof Trenton Water Filtration Plant; Hopewell - Raise Canal Bank  
Hunterdon: Stockton - Relocate Fire Department, Flood proof Borough Hall; Lambertville - Swan Creek Flood Gate and Lift Station  
Warren: Belvidere - Decommission Pequest Dam; Blairstown - Levee along Paulinskill; Phillipsburg - Modifications to Lift Station and WWTP; Pohatcong - Musconetcong Dam  
Sussex: Byram - Dam Improvements