## Volume I

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SECTION 1</strong> INTRODUCTION</td>
<td>1-1</td>
</tr>
<tr>
<td>1.1 Background</td>
<td>1-1</td>
</tr>
<tr>
<td>1.1.2 DMA 2000 Origins – The Robert T. Stafford Disaster Relief and Emergency Assistance Act</td>
<td>1-1</td>
</tr>
<tr>
<td>1.2 Purpose</td>
<td>1-1</td>
</tr>
<tr>
<td>1.3 Scope</td>
<td>1-2</td>
</tr>
<tr>
<td>1.3.1 Organizations Involved in the Mitigation Planning Effort</td>
<td>1-2</td>
</tr>
<tr>
<td>1.4 Authority and References</td>
<td>1-4</td>
</tr>
<tr>
<td>1.5 Summary of Changes in Plan Update</td>
<td>1-5</td>
</tr>
<tr>
<td>1.5.1 Organization</td>
<td>1-5</td>
</tr>
<tr>
<td>1.5.2 Risk Assessment</td>
<td>1-5</td>
</tr>
<tr>
<td>1.5.3 Capability Assessment</td>
<td>1-5</td>
</tr>
<tr>
<td>1.5.4 Mitigation Strategies</td>
<td>1-6</td>
</tr>
<tr>
<td>1.5.5 Plan Integration into Other Planning Mechanisms</td>
<td>1-6</td>
</tr>
<tr>
<td>1.6 Organization of Mitigation Plan</td>
<td>1-6</td>
</tr>
<tr>
<td><strong>SECTION 2</strong> REGIONAL PROFILE</td>
<td>2-1</td>
</tr>
<tr>
<td>2.1 Location</td>
<td>2-1</td>
</tr>
<tr>
<td>2.2 History</td>
<td>2-2</td>
</tr>
<tr>
<td>2.3 Government and Political Subdivisions</td>
<td>2-2</td>
</tr>
<tr>
<td>2.4 Physical Setting</td>
<td>2-3</td>
</tr>
<tr>
<td>2.4.1 Hydrography and Hydrology</td>
<td>2-3</td>
</tr>
<tr>
<td>2.4.2 Topography</td>
<td>2-7</td>
</tr>
<tr>
<td>2.4.3 Geology</td>
<td>2-8</td>
</tr>
<tr>
<td>2.4.4 Climate</td>
<td>2-8</td>
</tr>
<tr>
<td>2.4.5 Land Use and Land Cover</td>
<td>2-9</td>
</tr>
<tr>
<td>2.5 Population and Demographics</td>
<td>2-11</td>
</tr>
<tr>
<td>2.6 General Building Stock</td>
<td>2-15</td>
</tr>
<tr>
<td>2.7 Critical Facilities</td>
<td>2-22</td>
</tr>
<tr>
<td>2.7.1 Essential Facilities</td>
<td>2-23</td>
</tr>
<tr>
<td>2.7.1.1 Emergency Facilities</td>
<td>2-23</td>
</tr>
<tr>
<td>2.7.1.2 Hospitals and Medical Centers</td>
<td>2-30</td>
</tr>
<tr>
<td>2.7.1.3 Shelters</td>
<td>2-34</td>
</tr>
<tr>
<td>2.7.1.4 Schools</td>
<td>2-36</td>
</tr>
<tr>
<td>2.7.1.5 Senior Care and Senior Living Facilities</td>
<td>2-47</td>
</tr>
<tr>
<td>2.7.2 Transportation Systems</td>
<td>2-49</td>
</tr>
<tr>
<td>2.7.2.1 Highway, Roadways and Associated Systems</td>
<td>2-50</td>
</tr>
<tr>
<td>2.7.2.2 Airports and Heliports</td>
<td>2-51</td>
</tr>
<tr>
<td>2.7.2.3 Railway</td>
<td>2-53</td>
</tr>
<tr>
<td>2.7.2.4 Public Transportation</td>
<td>2-53</td>
</tr>
<tr>
<td>2.7.3 Lifeline Utility Systems</td>
<td>2-53</td>
</tr>
<tr>
<td>2.7.3.1 Potable Water Supply</td>
<td>2-54</td>
</tr>
<tr>
<td>2.7.3.2 Wastewater Facilities</td>
<td>2-59</td>
</tr>
<tr>
<td>2.7.3.3 Energy Resources</td>
<td>2-60</td>
</tr>
<tr>
<td>2.7.3.4 Communication Resources</td>
<td>2-61</td>
</tr>
<tr>
<td>2.7.4 High-Potential Loss Facilities</td>
<td>2-62</td>
</tr>
</tbody>
</table>
CONTENTS

2.7.4.1 Dams ................................................................................... 2-62
2.7.4.2 Levees .................................................................................. 2-63
2.7.4.3 HAZMAT Facilities ............................................................. 2-63
2.8 Other Facilities (User Defined) ...................................................... 2-64
2.9 Economic Profile ........................................................................ 2-83

SECTION 3 PLANNING PROCESS ................................................................................. 3-1
3.1 Introduction .................................................................................. 3-1
3.2 Organization of Planning Process .................................................. 3-2
3.3 Plan Update Activity ...................................................................... 3-5
3.4 Stakeholder Outreach and Involvement .......................................... 3-9
  3.4.1 Federal, State and Regional Agencies ........................................ 3-10
  3.4.2 Lehigh and Northampton County Government Agencies .......... 3-11
  3.4.3 Surrounding Counties ............................................................... 3-12
  3.4.4 Fire Services ........................................................................... 3-12
  3.4.5 Police and Law Enforcement Services ...................................... 3-12
  3.4.6 School Districts and Higher Education ..................................... 3-13
  3.4.7 Hospitals, Health Care and Emergency Medical Services .......... 3-13
  3.4.8 Transportation ........................................................................ 3-14
  3.4.9 Utilities .................................................................................. 3-14
  3.4.10 Business and Commerce ....................................................... 3-14
3.5 Public Outreach and Participation ................................................... 3-14
3.6 Integration/Coordination with Existing Plans and Programs ............ 3-17
  3.6.1 Emergency Management Plans and Programs ......................... 3-17
  3.6.2 Comprehensive Planning and Land Use Regulation ................... 3-18
  3.6.3 Act 167 Stormwater Management Plans .................................. 3-18
  3.6.4 National Flood Insurance and the Community Rating System ...... 3-19
  3.6.5 Capital Improvement Planning ............................................... 3-20
  3.6.6 Housing and Urban Development (HUD) and Community Development 3-20
  3.6.7 Community Development Block Grant (CDBG) Funding ............. 3-20

SECTION 4 HAZARD PROFILES
4.1 Methodology and Tools .................................................................. 4.1-1
4.2 Hazard Identification ...................................................................... 4.2-1
4.3 Hazard Profiles
  4.3.1 Drought .................................................................................. 4.3.1-1
  4.3.2 Earthquake ............................................................................. 4.3.2-1
  4.3.3 Extreme Temperature .............................................................. 4.3.3-1
  4.3.4 Flood ..................................................................................... 4.3.4-1
  4.3.5 Hailstorm ............................................................................... 4.3.5-1
  4.3.6 Landslide ................................................................................ 4.3.6-1
  4.3.7 Lightning Strike ...................................................................... 4.3.7-1
  4.3.8 Radon Exposure ...................................................................... 4.3.8-1
  4.3.9 Subsidence/Sinkhole ................................................................. 4.3.9-1
  4.3.10 Wildfire ............................................................................... 4.3.10-1
  4.3.11 Windstorm, Tornado ............................................................... 4.3.11-1
  4.3.12 Winter Storm ......................................................................... 4.3.12-1
  4.3.13 Structural Collapse .................................................................. 4.3.13-1
  4.3.14 Dam Failure ........................................................................... 4.3.14-1
  4.3.15 Environmental Hazard ........................................................... 4.3.15-1
CONTENTS

4.3.16 Fire (Urban/Structural Fire) ........................................................... 4.3.16-1
4.3.17 Levee Failure................................................................................. 4.3.17-1
4.3.18 Mass Gathering ............................................................................. 4.3.18-1
4.3.19 Nuclear Incident ............................................................................ 4.3.19-1
4.3.20 Terrorism ...................................................................................... 4.3.20-1
4.3.21 Transportation Accident ................................................................. 4.3.21-1
4.3.22 Utility Interruption ........................................................................ 4.3.22-1
4.4 Hazard Ranking .............................................................................................. 4.4-1

SECTION 5 CAPABILITY ASSESSMENT .............................................................. 5-1
5.1 Emergency Management ............................................................................. 5-2
5.1.1 County Capabilities ............................................................................ 5-2
5.1.2 Local Capabilities ............................................................................... 5-8
5.2 Participation in the National Flood Insurance Program .................................. 5-11
5.3 Community Rating System (CRS) .......................................................... 5-12
5.4 Planning and Regulatory Capability ......................................................... 5-12
5.4.1 Comprehensive Plan, The Lehigh Valley...2030 .................................. 5-13
5.4.2 Stormwater Management Planning ................................................... 5-15
5.4.3 Water Supply Planning ...................................................................... 5-15
5.4.4 Natural Resource Planning ................................................................. 5-16
5.4.5 Open Space Planning ........................................................................ 5-19
5.4.5 Informational Resources .................................................................. 5-19
5.5 Administrative and Technical Capability .................................................... 5-19
5.6 Fiscal Capability ...................................................................................... 5-20
5.6.1 Capital Improvement Planning ......................................................... 5-21
5.6.2 Federal Hazard Mitigation Funding Opportunities ................................ 5-21
5.6.3 Federal Disaster Assistance Programs ............................................... 5-21
5.6.4 Other Potential Funding Sources ....................................................... 5-22
5.7 Political Capability................................................................................... 5-23
5.8 Self-Assessment ..................................................................................... 5-23
5.9 Capability Assessment Recommendations ............................................. 5-25

SECTION 6 MITIGATION STRATEGY ............................................................... 6-1
6.1 Review and Update of Hazard Mitigation Goals ....................................... 6-1
6.2 Update of Municipal Mitigation Strategies .............................................. 6-3
6.3 Update of County-Level Mitigation Strategies ......................................... 6-5
6.4 Mitigation Strategy Prioritization and Implementation ............................. 6-6

SECTION 7 PLAN MAINTENANCE PROCEDURES ....................................... 7-1
7.1 Monitoring, Evaluating and Updating the Plan ....................................... 7-1
7.1.1 Monitoring and Evaluating ................................................................. 7-2
7.1.2 Annual Plan Review .......................................................................... 7-2
7.1.3 Plan Maintenance and Updating ......................................................... 7-4
7.2 Implementation of Mitigation Plan through Existing Programs .................. 7-5
7.2.1 Emergency Management Plans and Programs .................................... 7-5
7.2.2 Comprehensive Planning and Land Use Regulation .......................... 7-6
7.2.3 Act 167 Stormwater Management Plans .......................................... 7-6
7.2.4 National Flood Insurance (NFIP) and the Community Rating System ... 7-6
7.2.5 FEMA Unified Hazard Mitigation Assistance (Unified HMA) Grant ... 7-7
# Section 8: Plan Adoption

8.1 Overview ........................................................................................................... 8-1

## 8.1.1 Plan Adoption by Local Governing Bodies ............................................. 8-1

# Section 9: Jurisdictional Annexes

9.1 Lehigh and Northampton Counties ................................................................. 9.1-1

9.2 Alburtis Borough ............................................................................................. 9.2-1

9.3 Allentown City ............................................................................................... 9.3-1

9.4 Catasauqua Borough .................................................................................... 9.4-1

9.5 Coopersburg Borough ................................................................................. 9.5-1

9.6 Coplay Borough ........................................................................................... 9.6-1

9.7 Emmaus Borough ......................................................................................... 9.7-1

9.8 Fountain Hill Borough .................................................................................. 9.8-1

9.9 Hanover Township (LC) .............................................................................. 9.9-1

9.10 Heidelberg Township ................................................................................ 9.10-1

9.11 Lower Macungie Township ...................................................................... 9.11-1

9.12 Lower Milford Township .......................................................................... 9.12-1

9.13 Lowhill Township ....................................................................................... 9.13-1

9.14 Lynn Township .......................................................................................... 9.14-1

9.15 Macungie Borough ..................................................................................... 9.15-1

9.16 North Whitehall Township ....................................................................... 9.16-1

9.17 Salisbury Township .................................................................................... 9.17-1

9.18 Slatington Borough ................................................................................... 9.18-1

9.19 South Whitehall Township ...................................................................... 9.19-1

9.20 Upper Macungie Township ..................................................................... 9.20-1

9.21 Upper Milford Township ......................................................................... 9.21-1

9.22 Upper Saucon Township .......................................................................... 9.22-1

9.23 Washington Township ............................................................................. 9.23-1

9.24 Weisengberg Township ........................................................................... 9.24-1

9.25 Whitehall Township ................................................................................ 9.25-1

9.26 Allen Township ........................................................................................ 9.26-1

9.27 Bangor Borough ....................................................................................... 9.27-1

9.28 Bath Borough ............................................................................................ 9.28-1

9.29 Bethlehem City ........................................................................................ 9.29-1

9.30 Bethlehem Township ................................................................................. 9.30-1

9.31 Bushkill Township ..................................................................................... 9.31-1

9.32 Chapman Borough ..................................................................................... 9.32-1

9.33 Easton City ............................................................................................... 9.33-1

9.34 East Allen Township ............................................................................... 9.34-1

9.35 East Bangor Borough .............................................................................. 9.35-1

9.36 Forks Township ........................................................................................ 9.36-1

9.37 Freemansburg Borough ........................................................................... 9.37-1

9.38 Glendon Borough ...................................................................................... 9.38-1

9.39 Hanover Township (NC) .......................................................................... 9.39-1

9.40 Hellertown Borough ................................................................................. 9.40-1
9.41 Lehigh Township.............................................................. 9.41-1
9.42 Lower Mount Bethel Township................................................. 9.42-1
9.43 Lower Nazareth Township........................................................ 9.43-1
9.44 Lower Saucon Township.......................................................... 9.44-1
9.45 Moore Township........................................................................... 9.45-1
9.46 Nazareth Borough ........................................................................ 9.46-1
9.47 North Catasauqua Borough ......................................................... 9.47-1
9.48 Northampton Borough ................................................................. 9.48-1
9.49 Palmer Township........................................................................... 9.49-1
9.50 Pen Argyl Borough........................................................................... 9.50-1
9.51 Plainfield Township........................................................................ 9.51-1
9.52 Portland Borough ............................................................................ 9.52-1
9.53 Roseto Borough ............................................................................. 9.53-1
9.54 Stockertown Borough .................................................................... 9.54-1
9.55 Tatamy Borough ............................................................................ 9.55-1
9.56 Upper Mount Bethel Township ...................................................... 9.56-1
9.57 Upper Nazareth Township ............................................................ 9.57-1
9.58 Walnutport Borough ................................................................. 9.58-1
9.59 Washington Township ................................................................ 9.59-1
9.60 West Easton Borough ................................................................. 9.60-1
9.61 Williams Township ....................................................................... 9.61-1
9.63 Wind Gap Borough ........................................................................ 9.63-1

ACRONYMS................................................................................. AC-1

GLOSSARY................................................................................... G-1

Appendices

Appendix A  References
Appendix B  Local Plan Review Crosswalk
Appendix C  Meeting Documentation
Appendix D  Municipal Forms and Worksheets
Appendix E  Public and Stakeholder Outreach Documentation
Appendix F  Sample Adoption Resolution
Appendix G  Earthquake Vulnerability Assessment Results
TABLES

Table | Description | Page
---|---|---
1-1 | Jurisdictions Participating in the 2012 Update | 1-2
1-2 | FEMA Local Mitigation Plan Crosswalk | 1-4
2-1 | Stormwater Management Plans for Lehigh Valley | 2-5
2-2 | Existing Land Use - 2010 | 2-10
2-3 | Lehigh Valley Population and Demographic Statistics Summary (2005-2009 ACS) | 2-11
2-4 | Lehigh County Population and Demographic Statistics | 2-11
2-5 | Northampton County Population and Demographic Statistics | 2-12
2-6 | Lehigh County Building Stock Replacement Value by Occupancy Class | 2-15
2-7 | Northampton County Building Stock Replacement Value by Occupancy Class | 2-16
2-8 | Household History and Forecasts by Municipality, 1990-2030 | 2-19
2-9 | Major Subdivisions (500 Units or More), as of April 2011 | 2-20
2-10 | Proposed Shopping Centers (25,000 square feet or more), 2008-April 2011 | 2-21
2-11 | Emergency Operation Centers (EOC) in the Lehigh Valley | 2-22
2-12 | Police Stations in Northampton County | 2-22
2-13 | Fire/EMS in the Lehigh Valley | 2-24
2-14 | Medical Facilities in the Lehigh Valley | 2-29
2-15 | Shelter Facilities in the Lehigh Valley | 2-33
2-16 | Schools in the Lehigh Valley | 2-37
2-17 | Senior Facilities in the Lehigh Valley | 2-47
2-18 | Transportation Facilities/Offices in Northampton County | 2-51
2-19 | Airports in the Lehigh Valley | 2-52
2-20 | Potable Water Facilities in Northampton County | 2-55
2-21 | Water Storage Tanks in Northampton County | 2-58
2-22 | Public Sewerage Treatment Plants | 2-60
2-23 | Electric and Natural Gas Facilities in the Lehigh Valley | 2-61
2-24 | Broadcasting Facilities/Equipment in the Lehigh Valley | 2-62
2-25 | User Defined Facilities in the Lehigh Valley | 2-65
2-26 | Largest Employers (non-governmental) | 2-84
3-1 | Jurisdictions Participating in the 2012 Update | 3-1
3-2 | Lehigh Valley Hazard Mitigation Plan Update Steering Committee Membership | 3-3
3-3 | Summary of Project Activity and Milestones | 3-5
4.3.1-1 | Precipitation Deficit Drought Indicators for Pennsylvania | 4.3.1-5
4.3.1-2 | Monthly and Annual Precipitation Normal (total in inches) from 1971 to 2000 for Select Municipalities in the Lehigh Valley | 4.3.1-5
4.3.1-3 | Palmer Drought Severity Index (PDSI) Classifications | 4.3.1-6
4.3.1-4 | Past Occurrences of Drought Events from 1960 to 2011 | 4.3.1-8
4.3.1-5 | Crop Loss Insurance Claims Due to Drought | 4.3.1-13
4.3.1-6 | Impacts on the Economy | 4.3.1-17
4.3.1-7 | Estimated County Losses Relating to Agricultural Production | 4.3.1-18
4.3.2-1 | Richter Scale Magnitudes | 4.3.2-3
4.3.2-2 | Modified Mercalli Intensity Scale with Associated Impacts | 4.3.2-4
4.3.2-3 | Earthquake Events between 1871 and 2012 in the Lehigh Valley | 4.3.2-10
4.3.2-4 | Summary of Estimated Sheltering Needs for the Lehigh Valley | 4.3.2-14
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3.2-5</td>
<td>Estimated Sheltering Needs by Municipality for the Lehigh Valley</td>
<td>4.3.2-14</td>
</tr>
<tr>
<td>4.3.2-6</td>
<td>Estimated Number of Injuries and Casualties from the 500-Year MRP Earthquake Event</td>
<td>4.3.2-16</td>
</tr>
<tr>
<td>4.3.2-7</td>
<td>Estimated Number of Injuries and Casualties from the 2,500-Year MRP Earthquake Event</td>
<td>4.3.2-16</td>
</tr>
<tr>
<td>4.3.2-8</td>
<td>Summary of Estimated Annualized Earthquake General Building Stock Losses for the Lehigh Valley</td>
<td>4.3.2-17</td>
</tr>
<tr>
<td>4.3.2-9</td>
<td>Example of Structural Damage State Definitions for a Light Wood-Framed Building</td>
<td>4.3.2-20</td>
</tr>
<tr>
<td>4.3.2-10</td>
<td>Estimated Number of Buildings Damaged by General Occupancy for 100-year, 500-year and 2,500-year MRP Earthquake Events</td>
<td>4.3.2-21</td>
</tr>
<tr>
<td>4.3.2-11</td>
<td>Estimated Number of Buildings Damaged by Building Type for 100-year, 500-year and 2,500-year MRP Earthquake Events</td>
<td>4.3.2-21</td>
</tr>
<tr>
<td>4.3.2-12</td>
<td>Estimated Potential General Building Stock Loss (Structure and Contents) for the 500-Year MRP Earthquake Event</td>
<td>4.3.2-22</td>
</tr>
<tr>
<td>4.3.2-13</td>
<td>Estimated Potential General Building Stock Loss (Structure and Contents) for the 2,500-Year MRP Earthquake Event</td>
<td>4.3.2-24</td>
</tr>
<tr>
<td>4.3.2-14</td>
<td>Estimated Damage and Loss of Functionality for Critical Facilities in the Lehigh Valley for the 500-Year MRP Earthquake Event</td>
<td>4.3.2-28</td>
</tr>
<tr>
<td>4.3.2-15</td>
<td>Estimated Damage and Loss of Functionality for Critical Facilities in the Lehigh Valley for the 2,500-Year MRP Earthquake Event</td>
<td>4.3.2-71</td>
</tr>
<tr>
<td>4.3.2-16</td>
<td>Estimated Utility Impacts in the Lehigh Valley from the 500-year MRP Earthquake Event</td>
<td>4.3.2-110</td>
</tr>
<tr>
<td>4.3.2-17</td>
<td>Estimated Utility Impacts in the Lehigh Valley from the 2,500-year MRP Earthquake Event</td>
<td>4.3.2-119</td>
</tr>
<tr>
<td>4.3.2-18</td>
<td>Estimated Debris Generated by the 500- and 2,500-year MRP Earthquake Events</td>
<td>4.3.2-129</td>
</tr>
<tr>
<td>4.3.3-1</td>
<td>Four Categories of Heat Stress</td>
<td>4.3.3-5</td>
</tr>
<tr>
<td>4.3.3-2</td>
<td>Extreme Temperature Events</td>
<td>4.3.3-8</td>
</tr>
<tr>
<td>4.3.4-1</td>
<td>Stormwater Management Plans for Lehigh Valley</td>
<td>4.3.4-6</td>
</tr>
<tr>
<td>4.3.4-2</td>
<td>Area Located in the 1% and 0.2% FEMA DFIRM Flood Boundaries</td>
<td>4.3.4-10</td>
</tr>
<tr>
<td>4.3.4-3</td>
<td>Flooding Events between 1950 and 2012 in the Lehigh Valley</td>
<td>4.3.4-16</td>
</tr>
<tr>
<td>4.3.4-4</td>
<td>Ice Jam Events in the Lehigh Valley between 1780 and 2012</td>
<td>4.3.4-22</td>
</tr>
<tr>
<td>4.3.4-5</td>
<td>Estimated Lehigh Valley Population Vulnerable to the 1% Flood Hazard</td>
<td>4.3.4-25</td>
</tr>
<tr>
<td>4.3.4-6</td>
<td>Estimated Lehigh Valley Population Displaced or Seeking Short-Term Shelter from the 1% Chance Flood Event</td>
<td>4.3.4-28</td>
</tr>
<tr>
<td>4.3.4-7</td>
<td>Estimated Number of Parcels Located in the 1% and 0.2% FEMA DFIRM Flood Boundaries</td>
<td>4.3.4-31</td>
</tr>
<tr>
<td>4.3.4-8</td>
<td>Estimated Building Exposure and Potential Losses to the 1% and 0.2% Flood Events</td>
<td>4.3.4-34</td>
</tr>
<tr>
<td>4.3.4-9</td>
<td>NFIP Policies, Claims and Repetitive Loss Statistics</td>
<td>4.3.4-38</td>
</tr>
<tr>
<td>4.3.4-10</td>
<td>Critical Facilities Located in the DFIRM 1% and 0.2% Flood Boundaries and Estimated Potential Damage from the 1% Flood Event</td>
<td>4.3.4-42</td>
</tr>
<tr>
<td>4.3.4-11</td>
<td>Estimated Debris Generated from the 1% Flood Event</td>
<td>4.3.4-48</td>
</tr>
<tr>
<td>4.3.5-1</td>
<td>History of Hailstorms in the Lehigh Valley</td>
<td>4.3.5-3</td>
</tr>
<tr>
<td>4.3.5-2</td>
<td>Estimated Jurisdictional Losses Relating to Agricultural Production (USDA Census of Agriculture 2007)</td>
<td>4.3.5-7</td>
</tr>
</tbody>
</table>
4.3.6-1 Area Located in the Approximate High Susceptibility/Moderate Incidence Landslide Hazard Area ................................................................. 4.3.6-4
4.3.6-2 Population Located in the High Susceptibility/Moderate Incidence Landslide Hazard Area ...................................................................................... 4.3.6-6
4.3.6-3 General Building Stock Located in the High Susceptibility/Moderate Incidence Landslide Hazard Area .......................................................................................................... 4.3.6-8
4.3.6-4 Essential Critical Facilities in the High Susceptibility/Moderate Incidence Landslide Hazard Area ........................................................................................ 4.3.6-10

4.3.7-1 Lehigh Valley Recorded Lightning Events.................................................................................................................................................. 4.3.7-2

4.3.8-1 Radon Risk for Smokers and Non-Smokers .............................................................................................................................................. 4.3.8-4

4.3.9-1 Reported Sinkholes in the Lehigh Valley, 2007-2011 ........................................................................................................................................ 4.3.9-12
4.3.9-2 Area Located in the Approximate Subsidence/Sinkhole Hazard Area .............................................................................................. 4.3.9-14
4.3.9-3 Population Located in the Approximate Subsidence/Sinkhole Hazard Area (U.S. Census 2010) .......................................................................................... 4.3.9-17
4.3.9-4 Estimated General Building Stock Located in the Approximate Subsidence/Sinkhole Hazard Area ........................................................................... 4.3.9-19
4.3.9-5 Facilities Located in the Identified Hazard Area (Limestone) ................................................................................................. 4.3.9-21

4.3.10-1 Land Use Summary for the Lehigh Valley .................................................................................................................................................. 4.3.10-1
4.3.10-2 Fire Danger Rating and Color Code .................................................................................................................................................. 4.3.10-7
4.3.10-3 Reported Wildfires in the Lehigh Valley .............................................................................................................................................. 4.3.10-12
4.3.10-4 Estimated Population Located within the WUI in the Lehigh Valley .............................................................................................. 4.3.10-16
4.3.10-5 Building Stock Replacement Value Located within the WUI in the Lehigh Valley .......................................................................................... 4.3.10-18
4.3.10-6 Facilities in WUI in the Lehigh Valley .............................................................................................................................................. 4.3.10-20

4.3.11-1 Wind Zones in the U.S. .................................................................................................................................................. 4.3.11-4
4.3.11-2 Fujita Damage Scale .................................................................................................................................................. 4.3.11-9
4.3.11-3 Enhanced Fujita Damage Scale .................................................................................................................................................. 4.3.11-10
4.3.11-4 EF Scale Damage Indicators .................................................................................................................................................. 4.3.11-11
4.3.11-5 Tornado and Windstorm Events between 1975 and 2010 in the Lehigh Valley .............................................................................................. 4.3.11-14
4.3.11-6 Description of Damage Categories .................................................................................................................................................. 4.3.11-20
4.3.11-7 Estimated Building Replacement Value (Structure Only) Damaged by the 100-Year and 500-Year MRP Hurricane-Related Winds for All Occupancy Classes ........................................................................................................ 4.3.11-22
4.3.11-8 Summary of Estimated Annualized Wind General Building Stock Losses for the Lehigh Valley .................................................................................................................................................. 4.3.11-26
4.3.11-9 Estimated Impacts to Critical Facilities by the 500-Year MRP Hurricane Event (Wind Only) .................................................................................................................................................. 4.3.11-29
4.3.11-10 Debris Production for 100- and 500-Year MRP Hurricane-Related Winds .................................................................................................................................................. 4.3.11-71

4.3.12-1 NESIS Ranking Categories 1 – 5 .................................................................................................................................................. 4.3.12-3
4.3.12-2 Winter Storm Events between 1950 and 2012 in the Lehigh Valley .................................................................................................................................................. 4.3.12-5
4.3.12-3 General Building Stock Exposure (Structure Only) and Estimated Losses from Winter Storm Events in the Lehigh Valley .................................................................................................................................................. 4.3.12-12

4.3.13-1 Likelihood of Future Occurrences of Environmental / Explosion Hazards .................................................................................................................................................. 4.3.13-2
4.3.14-1 Dams in Lehigh Valley

4.3.15-1 Reported Release of Hazardous Materials 2001-2011

4.3.15-2 Reported Explosion Incidents 2001-2011

4.3.15-3 Likelihood of Future Occurrences of Environmental / Explosion Hazards

4.3.16-1 Reported Structural Fires 2001-2011

4.3.16-2 Likelihood of Future Occurrences

4.3.18-1 Mass Gathering Pre-Planned Events

4.3.18-2 Non-planned Mass Gatherings

4.3.18-3 Likelihood of Future Occurrences of Mass Gathering

4.3.20-1 Terrorist Events Since 2001

4.3.21-1 Lehigh Valley Transportation Network

4.3.21-2 High-Priority Traffic Safety Locations

4.3.21-3 Bridges in the Lehigh Valley

4.3.21-4 Injuries and Fatalities from Automobile Crashes

4.3.21-5 Injuries and Fatalities of Pedestrians

4.3.21-6 Summary of Major Accidents

4.3.21-7 Accidents of Significance through 2011

4.3.22-1 Utility Interruptions from 2001-2011

4.4-1 Summary of Risk Factor (RF) Approach

4.4-2 Risk Ranking for Lehigh and Northampton Counties

5-1 Development Ordinances and Regulations Adopted by Municipalities

5-2 Capability Self-Assessment Matrix

7-1 Lehigh Valley Hazard Mitigation Plan Update Steering Committee Membership
## FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1</td>
<td>Regional Setting</td>
<td>2-1</td>
</tr>
<tr>
<td>2-2</td>
<td>Classification of Municipalities</td>
<td>2-3</td>
</tr>
<tr>
<td>2-3</td>
<td>Stormwater Management Plans</td>
<td>2-4</td>
</tr>
<tr>
<td>2-4</td>
<td>Surface Terrain</td>
<td>2-7</td>
</tr>
<tr>
<td>2-5</td>
<td>Steep Slope and Carbonate Geology</td>
<td>2-8</td>
</tr>
<tr>
<td>2-6</td>
<td>Existing Land Use</td>
<td>2-9</td>
</tr>
<tr>
<td>2-7</td>
<td>Population Growth Projections</td>
<td>2-14</td>
</tr>
<tr>
<td>2-8</td>
<td>Municipal Zoning</td>
<td>2-18</td>
</tr>
<tr>
<td>2-9</td>
<td>General Land Use Plan</td>
<td>2-18</td>
</tr>
<tr>
<td>2-10</td>
<td>Emergency Facilities in the Lehigh Valley</td>
<td>2-32</td>
</tr>
<tr>
<td>2-11</td>
<td>Lehigh Valley School Districts</td>
<td>2-36</td>
</tr>
<tr>
<td>2-12</td>
<td>Schools, Shelters and Senior Facilities in the Lehigh Valley</td>
<td>2-49</td>
</tr>
<tr>
<td>2-13</td>
<td>Transportation Facilities</td>
<td>2-50</td>
</tr>
<tr>
<td>2-14</td>
<td>Airports in the Lehigh Valley</td>
<td>2-52</td>
</tr>
<tr>
<td>2-15</td>
<td>Community Water Supply Service</td>
<td>2-54</td>
</tr>
<tr>
<td>2-16</td>
<td>Public Sanitary Sewer Service</td>
<td>2-59</td>
</tr>
<tr>
<td>2-17</td>
<td>Dams in the Lehigh Valley</td>
<td>2-63</td>
</tr>
<tr>
<td>2-18</td>
<td>Employment Trends</td>
<td>2-83</td>
</tr>
<tr>
<td>4.3.1-1</td>
<td>Climate Divisions in the U.S.</td>
<td>4.3.1-2</td>
</tr>
<tr>
<td>4.3.1-2</td>
<td>Climate Divisions of Pennsylvania</td>
<td>4.3.1-3</td>
</tr>
<tr>
<td>4.3.1-3</td>
<td>Palmer Drought Severity Index for Pennsylvania (1895 to 1995)</td>
<td>4.3.1-14</td>
</tr>
<tr>
<td>4.3.1-4</td>
<td>Existing Community Water Service Areas with Central Water Systems</td>
<td>4.3.1-16</td>
</tr>
<tr>
<td>4.3.2-1</td>
<td>Pennsylvania Earthquake Hazard Zones</td>
<td>4.3.2-2</td>
</tr>
<tr>
<td>4.3.2-2</td>
<td>Peak Ground Acceleration Modified Mercalli Scale in the Lehigh Valley for a 100-Year MRP Earthquake Event</td>
<td>4.3.2-5</td>
</tr>
<tr>
<td>4.3.2-3</td>
<td>Peak Ground Acceleration Modified Mercalli Scale in the Lehigh Valley for a 500-Year MRP Earthquake Event</td>
<td>4.3.2-6</td>
</tr>
<tr>
<td>4.3.2-4</td>
<td>Peak Ground Acceleration Modified Mercalli Scale in the Lehigh Valley for a 2,500-Year MRP Earthquake Event</td>
<td>4.3.2-7</td>
</tr>
<tr>
<td>4.3.3-1</td>
<td>Average Maximum Temperature throughout Pennsylvania (1971 and 2000)</td>
<td>4.3.3-3</td>
</tr>
<tr>
<td>4.3.3-2</td>
<td>Average Minimum Temperature throughout Pennsylvania (1971 to 2000)</td>
<td>4.3.3-4</td>
</tr>
<tr>
<td>4.3.3-3</td>
<td>Extreme Heat and Heat Index</td>
<td>4.3.3-6</td>
</tr>
<tr>
<td>4.3.3-4</td>
<td>Extreme Cold and Wind Chill</td>
<td>4.3.3-6</td>
</tr>
<tr>
<td>4.3.4-1</td>
<td>Stormwater Management Plans</td>
<td>4.3.4-5</td>
</tr>
<tr>
<td>4.3.4-2</td>
<td>Floodplain Illustration</td>
<td>4.3.4-9</td>
</tr>
<tr>
<td>4.3.4-3</td>
<td>NFIP Floodplains in the Lehigh Valley</td>
<td>4.3.4-10</td>
</tr>
<tr>
<td>4.3.4-4</td>
<td>Historic Ice Jams in the Lehigh Valley</td>
<td>4.3.4-22</td>
</tr>
<tr>
<td>4.3.4-5</td>
<td>NFIP Policies, Claims, Repetitive Loss and Severe Repetitive Loss Properties in the Lehigh Valley</td>
<td>4.3.4-41</td>
</tr>
<tr>
<td>4.3.5-1</td>
<td>Hail Events Per Square Mile in Pennsylvania</td>
<td>4.3.5-6</td>
</tr>
</tbody>
</table>
4.3.6-1 U.S Geological Survey. Landslide Incidence and Susceptibility ................. 4.3.6-2
4.3.7-1 Weather Fatalities in the U. S. ................................................................. 4.3.7-6
4.3.8-1 Sketch of Radon Entry Points into a House ........................................... 4.3.8-2
4.3.8-2 Radon Hazard Zones in Pennsylvania .................................................. 4.3.8-2
4.3.8-3 Percentage of Pennsylvania homes having radon levels greater than 4 pCi/L..... 4.3.8-5
4.3.9-1 Lehigh Valley Geology ......................................................................... 4.3.9-4
4.3.9-2 Areas of Pennsylvania Subject to Natural Subsidence Due to the Presence of Limestone Bedrock ................................................................. 4.3.9-5
4.3.9-3 Lehigh Valley Limestone Geology ............................................................ 4.3.9-6
4.3.9-4 Karst Features in the Lehigh Valley ........................................................... 4.3.9-7
4.3.9-5 Collapse of Creek Bank and Yard along Bushkill Creek ....................... 4.3.9-10
4.3.9-6 Norfolk Southern Railroad Bridge Wingwall Sinking into a Water-filled Sinkhole along Bushkill Creek ............................................................... 4.3.9-10
4.3.9-7 Sinkhole at Corporate Plaza Building in the City of Allentown, Lehigh County, PA in February, 1994 ................................................................. 4.3.9-11
4.3.10-1 Land Cover in the Lehigh Valley ............................................................ 4.3.10-2
4.3.10-2 Location of Wildfire Events responded to by BOF from 2002-2008 ........... 4.3.10-3
4.3.10-3 WUI for the U.S. in 2000 ................................................................. 4.3.10-5
4.3.10-4 WUI for the Lehigh Valley ................................................................. 4.3.10-6
4.3.10-5 Observed Fire Danger Map (February 22, 2012) ................................... 4.3.10-8
4.3.10-6 Wildfire Priority Landscapes in the Lehigh Valley .................................. 4.3.10-10
4.3.11-1 Wind Zones in the U.S. ...................................................................... 4.3.11-4
4.3.11-2 Annual Average Number of Tornadoes in the U.S., 1981 to 2010 ............ 4.3.11-6
4.3.11-3 Tornado Risk in the U.S. ..................................................................... 4.3.11-7
4.3.11-4 Total Annual Threat of Tornado Events in the U.S., 1980-1999 ............... 4.3.11-8
4.3.11-5 U.S. Tornado Summaries by County ................................................... 4.3.11-12
4.3.11-6 Wind Speeds and Storm Track for the 100-Year Mean Return Period Event in the Lehigh Valley ................................................................. 4.3.11-18
4.3.11-7 Wind Speeds and Storm Track for the 500-Year Mean Return Period Event in the Lehigh Valley ................................................................. 4.3.11-19
4.3.13-1 Dams in the Lehigh Valley ................................................................. 4.3.13-7
4.3.17-1 Allentown Levee .............................................................................. 4.3.17-2
4.3.17-2 Salisbury Levee .............................................................................. 4.3.17-3
4.3.17-3 Allentown-Jordan Creek Floodwall ...................................................... 4.3.17-4
4.3.17-4 Bethlehem Levee System .................................................................... 4.3.17-5
4.3.19-1 Jurisdictions within 50 Mile Ingestion Zone ........................................... 4.3.19-4
4.3.19-2 SSES EPZ and Ingestion Zone .............................................................. 4.3.19-5
4.3.21-1 High Priority Traffic Safety Locations ................................................... 4.3.21-3
4.3.21-2 Freight Rail Lines in the Lehigh Valley ................................................... 4.3.21-5
4.3.21-3 Airports in the Lehigh Valley ............................................................... 4.3.21-7
<table>
<thead>
<tr>
<th>Page</th>
<th>Section Title</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1</td>
<td>Natural Resources Plan</td>
<td>5-18</td>
</tr>
</tbody>
</table>