

Amherst County  
City of Lynchburg  
Town of Bedford

Appomattox County  
Town of Altavista  
Town of Brookneal

Bedford County  
Town of Appomattox

Campbell County  
Town of Amherst



# Central Virginia Planning District Commission **Hazard Mitigation Plan** **2020 Update**



**October, 2020**







## **Central Virginia Planning District Hazard Mitigation Plan 2020**

This report was funded by Federal Emergency Management Agency through the Virginia Department of Emergency Management.

### **Participating Jurisdictions:**

- Amherst County
- Appomattox County
- Bedford County
- Campbell County
- City of Lynchburg
- Town of Altavista
- Town of Appomattox
- Town of Amherst
- Town of Bedford
- Town of Brookneal

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# Table of Contents

## Table of Contents

Table of Contents .....	i
List of Figures .....	x
List of Tables .....	xvi
Executive Summary .....	xx
Jurisdictions.....	xxi
Participation.....	xxi
Hazard Identification and Risk Assessment (HIRA).....	xxii
Capabilities.....	xxiv
Mitigation.....	xxv
Information & Outreach Goal.....	xxv
Prevention Capacity Goal.....	xxv
Property Protection Goal .....	xxv
Structural Projects Goal .....	xxv
Natural System Resiliency Goal .....	xxv
Implementation and Maintenance.....	xxvi
1.0 Introduction.....	1
1.1 Hazard Mitigation Planning .....	1
1.2 Plan Purpose .....	1
1.3 Participating Communities .....	1
1.4 Plan Organization.....	2
2.0 Community Profile.....	2-1
2.1 2020 Update - Summary of Changes.....	2-1
2.2 Central Virginia Planning District Commission .....	2-1
2.3 Jurisdictions .....	2-2
2.3.1 Amherst County .....	2-2
2.3.2 Appomattox County .....	2-3
2.3.3 Bedford County .....	2-3
2.3.4 Campbell County .....	2-4
2.3.5 City of Lynchburg.....	2-4
2.3.6 Town of Altavista.....	2-5



# Table of Contents

2.3.7	Town of Amherst .....	2-5
2.3.8	Town of Appomattox .....	2-6
2.3.9	Town of Bedford .....	2-6
2.3.10	Town of Brookneal .....	2-7
2.4	Land Use and Land Cover .....	2-7
2.4.1	Amherst County .....	2-7
2.4.2	Appomattox County .....	2-8
2.4.3	Bedford County .....	2-8
2.4.4	Campbell County .....	2-8
2.4.5	Lynchburg City .....	2-8
2.5	Natural Features .....	2-8
2.5.1	Physiography .....	2-8
2.5.2	Geology .....	2-9
2.5.3	Topography .....	2-9
2.5.4	Hydrology .....	2-9
2.6	Population and Demographics .....	2-17
2.6.1	Employment and Industry .....	2-17
2.6.2	Industries in Lynchburg Metropolitan Statistical Area .....	2-18
2.6.3	Housing .....	2-22
2.6.4	Development Trends .....	2-23
2.7	References .....	2-31
3.0	Planning Process .....	3-1
3.1	2020 Update - Summary of Changes .....	3-1
3.2	Introduction .....	3-1
3.3	FEMA Hazard Mitigation Plan Process .....	3-2
3.4	Planning Team .....	3-2
3.5	Primary Technical Advisory Committee (TAC) Meetings .....	3-2
3.6	Coordination with other Agencies, Entities, and Plans .....	3-5
3.7	Public Involvement .....	3-5
3.8	Hazard Identification and Risk Analysis (HIRA) .....	3-7
3.9	Capabilities Assessment .....	3-8
3.10	Mitigation Strategies .....	3-8
3.11	Adoption and Evaluation .....	3-9





# Table of Contents

4.0	Hazard Identification and Risk Assessment (HIRA) .....	4-1
4.1	2020 Update - Summary of Changes .....	4-1
4.2	Introduction .....	4-2
4.2.1	Critical Facilities and Infrastructure .....	4-2
4.2.2	Limitations of Data .....	4-3
4.2.3	Types of Hazards .....	4-4
4.2.4	Hazards Interrelationship .....	4-5
4.2.5	Hazard Ranking Methodology .....	4-6
4.2.6	Declared Disasters .....	4-7
4.2.7	Hazus .....	4-10
4.2.8	Surveys .....	4-12
4.3	Flooding .....	4-16
4.3.1	Hazard Profile .....	4-16
4.3.2	Impact and Vulnerability .....	4-22
4.3.3	Risk Assessment .....	4-27
4.3.4	Jurisdictional Analysis .....	4-33
4.3.5	Probability of Future Occurrences .....	4-102
4.3.6	References .....	4-102
4.4	Dam Failure .....	4-103
4.4.1	Hazard Profile .....	4-103
4.4.2	Impact and Vulnerability .....	4-114
4.4.3	Risk Assessment and Jurisdictional Analysis for High Hazard Dams .....	4-114
4.4.4	Probability of Future Occurrences .....	4-184
4.4.5	References .....	4-185
4.5	Hurricane .....	4-186
4.5.1	Hazard Profile .....	4-186
4.5.2	Impact and Vulnerability .....	4-189
4.5.3	Risk Assessment and Jurisdictional Analysis .....	4-189
4.5.4	Probability of Future of Occurrences .....	4-200
4.5.5	References .....	4-200
4.6	Tornado .....	4-201
4.6.1	Hazard Profile .....	4-201
4.6.2	Impact and Vulnerability .....	4-206



# Table of Contents

4.6.3	Risk Assessment and Jurisdictional Analysis .....	4-207
4.6.4	Probability of Future Occurrences .....	4-209
4.6.5	References .....	4-215
4.7	Severe Thunderstorm.....	4-216
4.7.1	Hazard Profile.....	4-216
4.7.2	Impact and Vulnerability.....	4-220
4.7.3	Risk Assessment and Jurisdictional Analysis .....	4-222
4.7.4	Probability of Future of Occurrences .....	4-225
4.7.5	References .....	4-225
4.8	Severe Winter Storm.....	4-227
4.8.1	Hazard Profile.....	4-227
4.8.2	Impact and Vulnerability.....	4-230
4.8.3	Risk Assessment and Jurisdictional Analysis .....	4-233
4.8.4	Probability of Future Occurrences .....	4-237
4.8.5	References .....	4-239
4.9	Hailstorm .....	4-240
4.9.1	Hazard Profile.....	4-240
4.9.2	Impact and Vulnerability.....	4-249
4.9.3	Risk Assessment and Jurisdictional Analysis .....	4-249
4.9.4	Probability of Future Occurrences .....	4-250
4.9.5	References .....	4-250
4.10	Extreme Temperatures: Cold / Wind Chill.....	4-251
4.10.1	Hazard Profile.....	4-251
4.10.2	Impact and Vulnerability.....	4-252
4.10.3	Risk Assessment .....	4-254
4.10.4	Probability of Future Occurrences .....	4-254
4.10.5	References .....	4-254
4.11	Extreme Temperatures: Excessive Heat.....	4-255
4.11.1	Hazard Profile.....	4-255
4.11.2	Impact and Vulnerability.....	4-256
4.11.3	Risk Assessment .....	4-258
4.11.4	Probability of Future Occurrences .....	4-258
4.11.5	References .....	4-259



# Table of Contents

4.12	Drought.....	4-261
4.12.1	Hazard Profile.....	4-261
4.12.2	Impact and Vulnerability.....	4-267
4.12.3	Risk Assessment and Jurisdictional Analysis .....	4-268
4.12.4	Probability of Future Occurrences .....	4-270
4.12.5	References .....	4-271
4.13	Wildfire.....	4-272
4.13.1	Hazard Profile.....	4-272
4.13.2	Impact and Vulnerability.....	4-276
4.13.3	Risk Assessment and Jurisdictional Analysis .....	4-276
4.13.4	Probability of Future Occurrences .....	4-283
4.13.5	References .....	4-284
4.14	Fog.....	4-285
4.14.1	Hazard Profile.....	4-285
4.14.2	Impact and Vulnerability.....	4-285
4.14.3	Risk Assessment .....	4-286
4.14.4	Probability of Future Occurrences .....	4-287
4.14.5	References .....	4-287
4.15	Earthquake.....	4-289
4.15.1	Hazard Profile.....	4-289
4.15.2	Impact & Vulnerability.....	4-294
4.15.3	Risk Assessment and Jurisdictional Analysis .....	4-294
4.15.4	Probability of Future Occurrence .....	4-300
4.15.5	References .....	4-302
4.16	Landslides .....	4-303
4.16.1	Hazard Profile.....	4-303
4.16.2	Impact and Vulnerability.....	4-304
4.16.3	Risk Assessment and Jurisdictional Analysis .....	4-305
4.16.4	Probability of Future of Occurrences .....	4-313
4.16.5	References .....	4-314
4.17	Land Subsidence, Sinkhole, and Karst.....	4-315
4.17.1	Hazard Profile.....	4-315
4.17.2	Impact and Vulnerability.....	4-318





# Table of Contents

4.17.3	Risk Assessment and Jurisdictional Analysis .....	4-321
4.17.4	Probability of Future of Occurrences .....	4-321
4.17.5	Reference.....	4-325
4.18	Hazardous Material Incidents.....	4-326
4.18.1	Hazard Profile.....	4-326
4.18.2	Impact & Vulnerability.....	4-336
4.18.3	Risk Assessment and Jurisdictional Analysis .....	4-337
4.18.4	Probability of Future Occurrences .....	4-349
4.18.5	References .....	4-349
4.19	Urban Fire / Conflagration.....	4-350
4.19.1	Hazard Profile.....	4-350
4.19.2	Impact and Vulnerability.....	4-352
4.19.3	Risk Assessment and Jurisdictional Analysis .....	4-352
4.19.4	Probability of Future Occurrences .....	4-360
4.19.5	References .....	4-360
4.20	Contagious / Communicable Diseases .....	4-362
4.20.1	Hazard Profile.....	4-362
4.20.2	Impact and Vulnerability.....	4-365
4.20.3	Risk Assessment .....	4-368
4.20.4	Probability of Future Occurrences .....	4-371
4.20.5	References .....	4-371
4.21	Terrorism / Homeland Security Incident .....	4-372
4.21.1	Hazard Profile.....	4-372
4.21.2	Impact and Vulnerability.....	4-374
4.21.3	Risk Assessment and Jurisdictional Analysis .....	4-375
4.21.4	Probability of Future Occurrences .....	4-378
4.21.5	References .....	4-378
4.22	Solar Events .....	4-380
4.22.1	Hazard Profile.....	4-380
4.22.2	Impact and Vulnerability.....	4-389
4.22.3	Risk Assessment .....	4-390
4.22.4	Probability of Future Occurrences .....	4-391
4.22.5	References .....	4-392



# Table of Contents

4.23	Conclusion .....	4-393
5.0	Capabilities .....	5-1
5.1	Federal, State, and Regional Capabilities .....	5-1
5.1.1	FEMA National Flood Insurance Program (NFIP) .....	5-1
5.1.2	FEMA Community Rating System (CRS) .....	5-1
5.1.3	FEMA Grant Programs .....	5-2
5.1.4	FEMA Risk Mapping, Assessment, and Planning (Risk MAP) .....	5-2
5.1.5	USACE Flood Plain Management Services Program .....	5-2
5.1.6	USACE Continuing Authorities Program .....	5-2
5.1.7	USACE General Investigations Program .....	5-3
5.1.8	HUD Community Development Block Grant (CDBG) .....	5-3
5.1.9	EPA Drinking Water State Revolving Fund (DWSRF) and Water Supply Assistance Grant (WSAG) Fund Program .....	5-3
5.1.10	EPA Clean Water State Revolving Fund (CWSRF) Program .....	5-3
5.1.11	FHWA Emergency Transportation Operations (ETO) .....	5-4
5.1.12	FHWA Federal-aid Highway Emergency Relief Program .....	5-4
5.2	Capability Assessment .....	5-8
5.3	Planning Capabilities .....	5-8
5.3.1	Comprehensive Plans .....	5-8
5.3.2	Capital Improvement Plans .....	5-9
5.3.3	Zoning Ordinances .....	5-9
5.3.4	Building Codes, Permitting, and Inspections .....	5-9
5.3.5	Historic Preservation Plans .....	5-9
5.3.6	Subdivision Ordinances .....	5-9
5.3.7	Stormwater Management Plans .....	5-9
5.3.8	Emergency Operations Plans .....	5-9
5.3.9	Continuity of Operations/Continuity of Government Plans .....	5-10
5.3.10	Disaster Recovery Plans .....	5-10
5.3.11	Floodplain Management .....	5-10
5.3.12	Floodplain Management Plan .....	5-10
5.4	Legal Capabilities .....	5-10
5.4.1	Dillon Rule .....	5-10
5.4.2	Regulation .....	5-11



# Table of Contents

5.4.3	Land Use .....	5-11
5.4.4	Planning .....	5-11
5.4.5	Zoning .....	5-11
5.4.6	Subdivision Regulation .....	5-12
5.4.7	Floodplain Regulation .....	5-12
5.4.8	Building Codes and Building Inspection .....	5-12
5.4.9	Acquisition .....	5-12
5.4.10	Taxation .....	5-13
5.4.11	Spending .....	5-13
5.5	Administrative Capabilities .....	5-13
5.6	Fiscal Capabilities .....	5-15
5.7	Technical Capabilities .....	5-16
5.7.1	The Community Rating System (CRS) .....	5-16
5.7.2	NWS StormReady Program .....	5-16
5.7.3	Firewise Communities/USA Recognition Program .....	5-16
5.7.4	Community Emergency Response Team (CERT) .....	5-17
5.8	Local Capabilities – Amherst County and Town of Amherst .....	5-17
5.9	Local Capabilities – Appomattox County and Town of Appomattox .....	5-20
5.10	Local Capabilities – Bedford County and Town of Bedford .....	5-23
5.11	Local Capabilities – Campbell County, Town of Altavista, and Brookneal .....	5-27
5.12	Local Capabilities – Lynchburg City .....	5-32
6.0	Mitigation .....	6-1
6.1	2020 Update - Summary of Changes .....	6-1
6.2	Introduction .....	6-1
6.3	Mitigation Strategy Types .....	6-1
6.3.1	Information and Outreach (I) .....	6-2
6.3.2	Prevention Capacity (C) .....	6-2
6.3.3	Property Protection (P) .....	6-3
6.3.4	Structure (S) .....	6-3
6.3.5	Natural System Resiliency (R) .....	6-3
6.4	Regional Mitigation Goals, Objectives, and Actions .....	6-4
6.4.1	Information & Outreach (I) Goal .....	6-4
6.4.2	Prevention Capacity (C) Goal. ....	6-5





# Table of Contents

6.4.3	Property Protection Goal .....	6-7
6.4.4	Structural Projects (S) Goal .....	6-9
6.4.5	Natural System Resiliency (R) Goal .....	6-9
6.5	Mitigation Analysis Techniques .....	6-11
6.6	Jurisdiction-Specific Mitigation Actions .....	6-12
7.0	Implementation and Maintenance .....	7-1
7.1	Plan Adoption .....	7-1
7.2	Plan Integration and Implementation .....	7-1
7.3	Evaluating and Updating .....	7-2
7.4	Public Involvement.....	7-2
Appendix A: Adoption Resolutions.....		A-1
Appendix B: FEMA Crosswalk.....		B-1
Appendix C: Acronyms.....		C-1
Appendix D: Meeting Documentation.....		D-1
Appendix E: Public Involvement Documentation.....		E-1
Appendix F: Plan Comments .....		F-1
Appendix G: Critical Facilities.....		G-1
Appendix H: Hazard Events.....		H-1
Appendix I: Mitigation Funding Sources.....		I-1
Appendix J: Mitigation Progress.....		J-1



# Table of Contents

## List of Figures

Figure 2-1 Jurisdictions in CVPDC Area.....	2-10
Figure 2-2 Current Land Cover of CVPDC Area .....	2-11
Figure 2-3 Physiographic Provinces of CVPDC Area .....	2-12
Figure 2-4 Geologic Units in CVPDC Area .....	2-13
Figure 2-5 Topography of the CVPDC Area.....	2-14
Figure 2-6 Slopes of the CVPDC Area .....	2-15
Figure 2-7 Major Watersheds for CVPDC Area .....	2-16
Figure 2-8 Land cover categories in CVPDC Area, 2001 and 2011 .....	2-25
Figure 2-9 Future Growth Areas in CVPDC Area .....	2-26
Figure 2-10 TAZ characteristics: Population Change in Central Virginia MPO, 2016-2045 .....	2-29
Figure 2-11 TAZ characteristics: Employment Change in Central Virginia MPO, 2016-2045 .....	2-30
Figure 3-1 FEMA Guidance on Developing Local Hazard Mitigation Plans.....	3-2
Figure 3-2 Hazard Mitigation Planning Process .....	3-6
Figure 4-1 Interrelationship of Hazards for CVPDC area .....	4-5
Figure 4-2 A Summary of Disaster Declarations in CVPDC Area .....	4-10
Figure 4-3 Locality Hazard Ranking Survey for CVPDC: Probability of Occurrence .....	4-14
Figure 4-4 Locality Hazard Ranking Survey for CVPDC: Consequence of Impact.....	4-15
Figure 4-5 FEMA Special Flood Hazard Area Map for CVPDC Area .....	4-20
Figure 4-6 Hazards interrelationship .....	4-23
Figure 4-7 Repetitive Loss Areas in the CVPDC Area .....	4-26
Figure 4-8 Building Losses in 1-percent Annual Chance Flooding Scenario for CVPDC area .....	4-31
Figure 4-9 Community dashboard of Amherst County (Unincorporated Areas) .....	4-35
Figure 4-10 Community dashboard of Town of Amherst .....	4-35
Figure 4-11 Vulnerable structures in floodplain of Amherst County (overview map) .....	4-42
Figure 4-12 Vulnerable structures in floodplain of Amherst County (detailed map).....	4-43
Figure 4-13 Vulnerable roads and bridges in floodplain of Amherst County .....	4-44
Figure 4-14 Vulnerable structures, roads and road bridges in floodplain of Town of Amherst .....	4-45
Figure 4-15 Community growth areas and floodplain within Amherst County.....	4-46
Figure 4-16 Community dashboard of Appomattox County (Unincorporated Areas) .....	4-47
Figure 4-17 Community dashboard of Town of Appomattox .....	4-48
Figure 4-18 Vulnerable structures in floodplain of Appomattox County .....	4-52
Figure 4-19 Roads and road bridges in floodplain of Appomattox County .....	4-53
Figure 4-20 Vulnerable structures, roads and road bridges in floodplain of Town of Appomattox .....	4-54
Figure 4-21 Community Growth Areas and Flood Areas within Appomattox County .....	4-55
Figure 4-22 Community dashboard of Bedford County (Unincorporated Areas) .....	4-56
Figure 4-23 Community dashboard of Town of Bedford .....	4-57
Figure 4-24 Vulnerable structures in floodplain of Bedford County .....	4-65
Figure 4-25 Critical facilities and infrastructure in floodplain of Bedford County .....	4-66
Figure 4-26 Road and road bridges in floodplain of Bedford County.....	4-67
Figure 4-27 Vulnerable structures, roads and road bridges in floodplain of Town of Bedford (Panel A).....	4-68



# Table of Contents

Figure 4-28 Vulnerable structures, roads and road bridges in floodplain of Bedford County (Panel B, C) .4-69	
Figure 4-29 Vulnerable structures, roads and road bridges in floodplain of Bedford County and Town of Bedford (Panel D, E, F).....	4-70
Figure 4-30 Vulnerable structures, roads and road bridges in floodplain of Town of Bedford .....	4-71
Figure 4-31 Community growth areas and floodplain within Bedford County (Panel 1, 2) .....	4-72
Figure 4-32 Community growth areas and floodplain within Bedford County (Panel 3 to 6) .....	4-73
Figure 4-33 Community dashboard of Campbell County (Unincorporated Areas) .....	4-75
Figure 4-34 Community dashboard of Altavista .....	4-75
Figure 4-35 Community dashboard of Brookneal .....	4-76
Figure 4-36 Vulnerable structures in floodplain of Campbell County .....	4-82
Figure 4-37 Critical facilities and infrastructure in floodplain of Campbell County .....	4-83
Figure 4-38 Roads and bridges in floodplain of Campbell County .....	4-84
Figure 4-39 Vulnerable structures in floodplain of Town of Altavista.....	4-85
Figure 4-40 Vulnerable structures in floodplain of Town of Brookneal .....	4-86
Figure 4-41 Community growth areas and floodplain within Campbell County (map 1).....	4-87
Figure 4-42 Community growth areas and floodplain within Campbell County (map 2).....	4-88
Figure 4-43 Community dashboard of City of Lynchburg .....	4-90
Figure 4-44 Vulnerable structures in floodplain of City of Lynchburg.....	4-95
Figure 4-45 Roads and bridges in floodplain of City of Lynchburg.....	4-96
Figure 4-46 Vulnerable structures, roads and road bridges in floodplain of City of Lynchburg (Panel A, B) .....	4-97
Figure 4-47 Vulnerable structures, roads and road bridges in floodplain of City of Lynchburg (Panel C) .....	4-98
Figure 4-48 Vulnerable structures, roads and road bridges in floodplain of City of Lynchburg (Panel D) .....	4-99
Figure 4-49 Vulnerable structures, roads and road bridges in floodplain of City of Lynchburg (Panel F)...4-100	
Figure 4-50 Community growth areas and floodplain within City of Lynchburg .....	4-101
Figure 4-51 Virginia Department of Conservation and Recreation Dam Safety Regions and Contacts Map .....	4-104
Figure 4-52 Dams in CVPDC .....	4-108
Figure 4-53 Hazards interrelationship .....	4-111
Figure 4-54 Dam failure primary incident mechanism .....	4-112
Figure 4-55 Dam failure incident driver.....	4-112
Figure 4-56 Location of high and unknown hazard dams in Amherst County and Town of Amherst. .4-116	
Figure 4-57 Inundation zone map of Thrasher Dam .....	4-118
Figure 4-58 Inundation zone map of Stonehouse Dam.....	4-120
Figure 4-59 Inundation zone map of Graham Creek Reservoir Dam. ....	4-122
Figure 4-60 Inundation zone map of Pedlar River Dam. ....	4-124
Figure 4-61 Inundation zone map of Reusens Dam. ....	4-126
Figure 4-62 Location of High and Unknown hazard dams in Appomattox County.....	4-129
Figure 4-63 Location of High and Unknown hazard dams in Bedford County.....	4-132
Figure 4-64 Inundation zone map of Beaverdam Creek Dam.....	4-136





# Table of Contents

Figure 4-65 Inundation zone map of Bedford Lake Dam.....	4-138
Figure 4-66 Inundation zone map of Eagle Eyrie Lake Dam .....	4-139
Figure 4-67 Inundation zone map of Elk Garden Lake Dam .....	4-141
Figure 4-68 Inundation zone map of Falling Creek Reservoir Dam .....	4-143
Figure 4-69 Inundation zone map of Ivy Lake Dam .....	4-145
Figure 4-70 Inundation zone map of Smith Mountain Dam .....	4-148
Figure 4-71 Inundation zone map of Spring Hill Lake Dam.....	4-153
Figure 4-72 Inundation zone map of Stoney Creek Reservoir Dam .....	4-154
Figure 4-73 Inundation zone map of Stroobants Dam .....	4-156
Figure 4-74 Inundation zone map of Woods Landing Dam .....	4-158
Figure 4-75 Location of High and Unknown hazard dams in Campbell County.....	4-161
Figure 4-76 Inundation zone map of New Camp Hydaway Dam .....	4-162
Figure 4-77 Inundation zone map of Otter River Raw Water Terminal Reservoir Dam.....	4-164
Figure 4-78 Inundation zone map of Timberlake Dam.....	4-166
Figure 4-79 Location of High and Unknown hazard dams in Lynchburg City. ....	4-168
Figure 4-80 Demographics in dam break inundation zone of high hazard dams within City of Lynchburg: Total old population (age > 65) .....	4-171
Figure 4-81 Demographics in dam break inundation zone of high hazard dams within City of Lynchburg: Total young population (age < 18) .....	4-172
Figure 4-82 Demographics in dam break inundation zone of high hazard dams within City of Lynchburg: Total Black population .....	4-173
Figure 4-83 Demographics in dam break inundation zone of high hazard dams within City of Lynchburg: Total Native American population .....	4-174
Figure 4-84 Community growth areas and dam break inundation zone of high hazard dams within City of Lynchburg .....	4-175
Figure 4-85 Inundation zone map of Lake Summit Dam .....	4-177
Figure 4-86 Inundation zone map of Lakeland Dam .....	4-178
Figure 4-87 Dam Break Inundation Zone of College Lake Dam .....	4-181
Figure 4-88 Vulnerable Roads and Road Bridges in Dam Break Inundation Zone of College Lake Dam .....	4-182
Figure 4-89 Building Losses from College Lake Dam Break Inundation (Hazardus-Level 2 Analysis).....	4-184
Figure 4-90 CVPDC Area Tropical Cyclone Tracks from 1851-2018 .....	4-188
Figure 4-91 Hazards interrelationship .....	4-189
Figure 4-92 Ground surface roughness map for CVPDC Area.....	4-191
Figure 4-93 Ground surface roughness map for Amherst County in CVPDC Area .....	4-192
Figure 4-94 Ground surface roughness map for Appomattox County in CVPDC Area .....	4-193
Figure 4-95 Ground surface roughness map for Bedford County in CVPDC Area.....	4-194
Figure 4-96 Ground surface roughness map for Campbell County in CVPDC Area.....	4-195
Figure 4-97 Ground surface roughness map for City of Lynchburg in CVPDC Area .....	4-196
Figure 4-98 Annualized Total Hurricane Loss Estimate in CVPDC Area .....	4-199
Figure 4-99 Average annual number of tornadoes .....	4-202
Figure 4-100 Annual Tornado Hazard Frequency.....	4-202
Figure 4-101 Damage from tornado in Appomattox County, 2016 .....	4-204
Figure 4-102 Tornado touchdowns in CVPDC Area, 1950 - 2018.....	4-205



# Table of Contents

Figure 4-103 Hazards interrelationship .....	4-206
Figure 4-104 Geographic concentrations of wood structures and mobile home by census block in Amherst County .....	4-210
Figure 4-105 Geographic concentrations of wood structures and mobile home by census block in Appomattox County .....	4-211
Figure 4-106 Geographic concentrations of wood structures and mobile home by census block in Bedford County .....	4-212
Figure 4-107 Geographic concentrations of wood structures and mobile home by census block in Campbell County .....	4-213
Figure 4-108 Geographic concentrations of wood structures and mobile home by census block in City of Lynchburg .....	4-214
Figure 4-109 Derecho climatology and seasonal variability in the United States.....	4-217
Figure 4-110 Wind Damages in City of Lynchburg .....	4-218
Figure 4-111 Damaging Winds Associated with Severe Thunderstorms in CVPDC Area, 1958 - 2018 .	4-219
Figure 4-112 Hazards interrelationship .....	4-221
Figure 4-113 Occurrences density of cloud-to-ground lightning flashes in the United States.....	4-224
Figure 4-114 North Eastern Snowfall Impact Scale (NESIS) .....	4-229
Figure 4-115 The Highest Impact Snow Storms that Affected the Northeast Urban Corridor, March 12-14, 1993 .....	4-230
Figure 4-116 Hazards interrelationship .....	4-231
Figure 4-117 Hazardous Winter Weather Potential Based on LEQ Precipitation in CVPDC Area .....	4-232
Figure 4-118 Snowfall Relative Risk in CVPDC Area .....	4-234
Figure 4-119 Ice Relative Risk in CVPDC Area .....	4-235
Figure 4-120 Steep Slope Locations (>15%) in Lynchburg City .....	4-236
Figure 4-121 Average Number of Days with Snowfall > 1 inch in CVPDC Area.....	4-238
Figure 4-122 Average Number of Days with Snowfall > 1 inch in Virginia.....	4-239
Figure 4-123 Large Hail Event in the United States in 2019. ....	4-242
Figure 4-124 Hail Events in CVPDC Area, 1959 - 2018.....	4-243
Figure 4-125 Hail Events in Amherst County in CVPDC Area, 1959 - 2018 .....	4-244
Figure 4-126 Hail Events in Appomattox County in CVPDC Area, 1959 - 2018.....	4-245
Figure 4-127 Hail Events in Bedford County in CVPDC Area, 1959 - 2018.....	4-246
Figure 4-128 Hail Events in Campbell County in CVPDC Area, 1959 - 2018.....	4-247
Figure 4-129 Hail Events in City of Lynchburg in CVPDC Area, 1959 - 2018 .....	4-248
Figure 4-130 Hazards interrelationship .....	4-249
Figure 4-131 National Weather Service Wind Chill Chart.....	4-253
Figure 4-132 Hazards interrelationship .....	4-253
Figure 4-133 National Weather Service Heat Index .....	4-257
Figure 4-134 Hazards interrelationship .....	4-257
Figure 4-135 Cooling center shelters and demographic patterns in City of Lynchburg .....	4-259
Figure 4-136 Percent Area in Drought for Virginia, 2000 - 2019.....	4-262
Figure 4-137 Drought Condition in Virginia from U.S. Drought Monitor (on September 17, 2019) .....	4-263
Figure 4-138 Virginia's Drought Evaluation Regions .....	4-264
Figure 4-139 Virginia Drought Severity and Coverage Index, 2000 - 2019 .....	4-265
Figure 4-140 Droughts Occurrence in CVPDC, 1994 – 2019 .....	4-266



# Table of Contents

Figure 4-141 Agriculture damage estimates from drought period in CVPDC, 1994-2019.....	4-266
Figure 4-142 Hazards interrelationship .....	4-267
Figure 4-143 Drought Vulnerability in CVPDC Area.....	4-270
Figure 4-144 Wildfire incidence in CVPDC Area, 2002 - 2016.....	4-274
Figure 4-145 Causes of Reported Wildfire Incidence in CVPDC Area, 2010-2016 .....	4-275
Figure 4-146 Hazards interrelationship .....	4-276
Figure 4-147 Wildfire Hazard Potential in CVPDC Area .....	4-277
Figure 4-148 Woodland Home Communities in CVPDC Area .....	4-279
Figure 4-149 Woodland Home Community and Critical Facility at High Wildfire Risk in CVPDC Area ..	4-283
Figure 4-150 Hazards interrelationship .....	4-286
Figure 4-151 Airports in CVPDC Area .....	4-287
Figure 4-152 USGS 2018 Long-term National Seismic Hazard Map .....	4-291
Figure 4-153 Earthquake epicenters in Virginia, 1774 - 2017 .....	4-293
Figure 4-154 Hazards interrelationship .....	4-294
Figure 4-155 Total Building-related Earthquake Losses .....	4-299
Figure 4-156 Total Direct Economic Loss in Probabilistic, Annualized, User-defined Earthquake Scenarios for CVPDC Area .....	4-301
Figure 4-157 Hazards interrelationship .....	4-304
Figure 4-158 Landslide Incidence and Susceptibility in Virginia.....	4-307
Figure 4-159 Landslides susceptibility estimates in CVPDC Area .....	4-308
Figure 4-160 Karst distribution in Virginia .....	4-316
Figure 4-161 Distribution of Soluble carbonate rock units in CVPDC Area .....	4-317
Figure 4-162 Hazards interrelationship .....	4-318
Figure 4-163 Identified Karst-related Sinkholes in Virginia .....	4-319
Figure 4-164 Critical Facility and Infrastructure in Karst Terrain in CVPDC Area .....	4-324
Figure 4-165 Location of EPA Toxic Release Inventory (TRI) Facilities in CVPDC .....	4-327
Figure 4-166 Location of EPA Toxic Release Inventory (TRI) Facilities in City of Lynchburg .....	4-328
Figure 4-167 Gas transmission and hazardous liquid pipelines in CVPDC Area .....	4-333
Figure 4-168 Hazards interrelationship .....	4-336
Figure 4-169 Mobile HazMat analysis corridors and buffers in CVPDC Area (overlay with population density) .....	4-338
Figure 4-170 Mobile HazMat analysis corridors and buffers in CVPDC Area (overlay with critical facility) .....	4-339
Figure 4-171 Fixed hazmat analysis locations and buffers in CVPDC Area (overlay with population density) .....	4-342
Figure 4-172 Fixed hazmat analysis locations and buffers in City of Lynchburg.....	4-343
Figure 4-173 Hazards interrelationship .....	4-352
Figure 4-174 Distribution of old buildings (constructed before 1973) in CVPDC Area.....	4-354
Figure 4-175 Location of fire stations in urban area / urban cluster in CVPDC Area .....	4-359
Figure 4-176 Integrated framework to implement strategies for improving fire safety in buildings. .	4-360
Figure 4-177 Top communicable diseases in Virginia by Locality, 2018 (exclude Chronic Hepatitis) ..	4-362
Figure 4-178 Hazards interrelationship .....	4-365
Figure 4-179 Demographic and Socioeconomic Profiles of the Vulnerable Groups to Communicable Diseases in the CVPDC Area (Panel A) .....	4-369



# Table of Contents

Figure 4-180 Demographic and Socioeconomic Profiles of the Vulnerable Groups to Communicable Diseases in the CVPDC Area (Panel B) .....	4-370
Figure 4-181 Hazards interrelationship .....	4-374
Figure 4-182 Population density in CVPDC Area .....	4-376
Figure 4-183 Detention facilities and large population venues in CVPDC .....	4-378
Figure 4-184 Estimated 3-hour Planetary Kp-index (Kp) on Oct 12, 2019 .....	4-382
Figure 4-185 Hazards interrelationship .....	4-389
Figure 4-186 Expected blackout regions after simulated CME with an impact level of 1921 .....	4-391



# Table of Contents

## List of Tables

Table 1-1 Main Sections of CVPDC Hazard Mitigation Plan 2020 .....	2
Table 2-1 Population Change (2000-2010) in CVPDC Area .....	2-17
Table 2-2 Income and Employment Characteristics for CVPDC Area .....	2-17
Table 2-3 Spread of Workers across Industry in Lynchburg Metropolitan Statistical Area .....	2-18
Table 2-4 Top Employers in CVPDC Area .....	2-19
Table 2-5 Top 10 Employers in CVPDC Area by Jurisdiction .....	2-20
Table 2-6 Housing Statistics for CVPDC Area .....	2-23
Table 2-7 National Land Cover Change 2001 to 2011 in CVPDC Area .....	2-23
Table 2-8 Projected Population Change in Central Virginia MPO, 2016 - 2045 .....	2-27
Table 2-9 Projected Number of Households Change in Central Virginia MPO, 2016 - 2045 .....	2-27
Table 2-10 Projected Employment Change in Central Virginia MPO, 2016 - 2045 .....	2-27
Table 2-11 Projected Number of Automobiles Change in Central Virginia MPO, 2016 - 2045 .....	2-27
Table 3-1 Project Management Team Members .....	3-3
Table 3-2 Technical Advisory Committee Members for CVPDC Hazard Mitigation Plan 2020 Update ....	3-4
Table 4-1 Comparison of Hazards between 2013 and 2020 Plan Updates .....	4-4
Table 4-2 Hazard Ranking Criteria .....	4-7
Table 4-3 Major Disasters Occurred in CVPDC Area.....	4-8
Table 4-4 General building stock in CVPDC area.....	4-11
Table 4-5 Building Stock Exposure by General Occupancy .....	4-11
Table 4-6 Building Stock Exposure by Building Type .....	4-12
Table 4-7 Transportation System Dollar Exposure - Hazus.....	4-12
Table 4-8 Utility System Dollar Exposure.....	4-12
Table 4-9 Classification of Flood Zones .....	4-20
Table 4-10 Flood Events in the CVPDC area (Source: NCEI database, 1996–2019) .....	4-21
Table 4-11 Flash Flood Events in the CVPDC area (Source: NCEI database, 1996–2019) .....	4-22
Table 4-12 Communities participating in the NFIP (01/01/1978 - 09/30/2018).....	4-23
Table 4-13 NFIP Repetitive Loss and Severe Loss Properties (As of September 30, 2019; Source: Virginia Department of Conservation and Recreation/FEMA) .....	4-25
Table 4-14 1-percent and 0.2-percent annual chance flood area by jurisdiction .....	4-27
Table 4-15 Number of structures, critical facilities and road bridges in floodplain by jurisdiction .....	4-28
Table 4-16 Direct Economic Losses for User Defined facilities (1-percent annual chance flooding) .....	4-30
Table 4-17 Direct Economic Losses by Building Occupancy - Total Loss (1-percent annual chance of flooding).....	4-30
Table 4-18 Direct Economic Losses for User Defined facilities (0.2-percent annual chance of flooding) .....	4-32
Table 4-19 Direct Economic Losses by Building Occupancy - Total Loss (0.2-percent annual chance of flooding).....	4-32
Table 4-20 Percentage difference between 1-percent and 0.2-percent annual chance of flooding in direct economic losses for user defined facilities. ....	4-33
Table 4-21 Percentage difference between 1-percent and 0.2-percent annual chance of flooding in direct economic losses by building occupancy - total loss .....	4-33



# Table of Contents

Table 4-22 Ethnic group in and adjacent to floodplains of Amherst County and Town of Amherst .....	4-36
Table 4-23 Income level and age group in floodplains of Amherst County and Town of Amherst .....	4-36
Table 4-24 Critical facility and infrastructure in floodplain of Amherst County and Town of Amherst..	4-37
Table 4-25 Top 50 flood-prone roads in Amherst County (unincorporated area) .....	4-39
Table 4-26 Flood-prone roads in Town of Amherst .....	4-40
Table 4-27 Road bridges at high risk (scour critical) in floodplain in Amherst County .....	4-40
Table 4-28 Road bridges in floodplain in Town of Amherst.....	4-41
Table 4-29 Ethnic group in floodplains of Appomattox County.....	4-49
Table 4-30 Income level and age group in floodplains of Appomattox County.....	4-49
Table 4-31 Critical facility and infrastructure in floodplain of Appomattox County and Town of Appomattox .....	4-49
Table 4-32 Top 50 flood-prone roads in Appomattox County (unincorporated area).....	4-50
Table 4-33 Flood-prone roads in Town of Appomattox .....	4-51
Table 4-34 Road bridges at high risk (scour critical) in floodplain in Appomattox County .....	4-51
Table 4-35 Ethnic group in floodplains of Bedford County.....	4-58
Table 4-36 Income level and age group in floodplains of Bedford County.....	4-58
Table 4-37 Critical facility and infrastructure in floodplain of Bedford County and the Town of Bedford .....	4-59
Table 4-38 Critical facility and infrastructure located outside of (but adjacent to) floodplain of Bedford County and Town of Bedford .....	4-61
Table 4-39 Top 50 flood-prone roads in Bedford County (unincorporated area).....	4-61
Table 4-40 Flood-prone roads in Town of Bedford .....	4-63
Table 4-41 Road bridges at high risk (scour critical) in floodplain in Bedford County .....	4-63
Table 4-42 Road bridges in floodplain in Town of Bedford .....	4-64
Table 4-43 Ethnic group in floodplains of Campbell County.....	4-77
Table 4-44 Income level and age group in floodplains of Campbell County .....	4-77
Table 4-45 Critical facility and infrastructure in floodplain of Campbell, Altavista, and Brookneal .....	4-78
Table 4-46 Top 50 flood-prone roads in Campbell County (unincorporated area).....	4-79
Table 4-47 Flood-prone roads within Town of Altavista .....	4-80
Table 4-48 Flood-prone roads within Town of Brookneal.....	4-81
Table 4-49 Road bridges at high risk (scour critical) in floodplain in Campbell County .....	4-81
Table 4-50 Road bridges in floodplain in Town of Altavista .....	4-81
Table 4-51 Road bridges in floodplain in Town of Brookneal .....	4-81
Table 4-52 Ethnic group in floodplains of City of Lynchburg .....	4-91
Table 4-53 Income level and age group in floodplains of City of Lynchburg .....	4-91
Table 4-54 Critical facility and infrastructure in floodplain of City of Lynchburg .....	4-92
Table 4-55 Critical facility and infrastructure located outside of (but adjacent to) floodplain of City of Lynchburg .....	4-92
Table 4-56 Top 50 flood-prone roads in City of Lynchburg .....	4-93
Table 4-57 Road bridges at high risk (scour critical) in floodplain in City of Lynchburg.....	4-94
Table 4-58 Number of dams per jurisdiction in DSIS within CVPDC area.....	4-104
Table 4-59 Number of dams under each regulation in DSIS within CVPDC area .....	4-105
Table 4-60 Virginia Hazard Potential Classification of Dams .....	4-106
Table 4-61 Number of Dams in each Hazard potential category in CVPDC area .....	4-107





# Table of Contents

Table 4-62 Typical Dam Failure Modes.....	4-113
Table 4-63 Number of Dams in each Hazard Potential Category within Amherst County. ....	4-115
Table 4-64 Critical facility and infrastructure in dam failure inundation zone within Amherst County.....	4-115
Table 4-65 Vulnerable road bridges in dam breach zone of Thrasher Dam .....	4-118
Table 4-66 Vulnerable facilities and infrastructures in dam breach zone of Thrasher Dam .....	4-119
Table 4-67 Vulnerable road bridges and tunnels in dam breach zone of Stonehouse Dam .....	4-120
Table 4-68 Vulnerable road bridges and tunnels in dam breach zone of Graham Creek Reservoir Dam .....	4-122
Table 4-69 Vulnerable facilities and infrastructures in dam breach zone of Graham Creek Reservoir Dam .....	4-122
Table 4-70 Vulnerable road bridges and tunnels in dam breach zone of Pedlar River Dam .....	4-125
Table 4-71 Vulnerable facilities and infrastructures in dam breach zone of Pedlar River Dam .....	4-125
Table 4-72 Vulnerable road bridges and tunnels in dam breach zone of Reusens Dam .....	4-127
Table 4-73 Vulnerable facilities and infrastructures in dam breach zone of Reusens Dam .....	4-128
Table 4-74 Number of Dams in each Hazard Potential Category within Appomattox County.....	4-129
Table 4-75 Number of Dams in each Hazard Potential Category within Bedford County.....	4-130
Table 4-76 Critical facility and infrastructure in dam break inundation area within Bedford County ..	4-130
Table 4-77 Vulnerable road bridges in dam breach zone of Beaverdam Creek Dam .....	4-137
Table 4-78 Vulnerable road bridges in dam breach zone of Bedford Lake Dam .....	4-138
Table 4-79 Vulnerable facilities and infrastructures in dam breach zone of Bedford Lake Dam.....	4-139
Table 4-80 Vulnerable road bridges in dam breach scenario of Eagle Eyrie Lake Dam .....	4-140
Table 4-81 Vulnerable road bridges and tunnels in dam breach scenario of Elk Garden Lake Dam ....	4-141
Table 4-82 Vulnerable road bridges and tunnels in dam breach scenario of Falling Creek Reservoir Dam .....	4-144
Table 4-83 Vulnerable facilities and infrastructures in dam breach zone of Falling Creek Reservoir Dam .....	4-144
Table 4-84 Vulnerable roadways downstream of Ivy Lake Dam (Source: Ivy Lake Dam EAP).....	4-145
Table 4-85 Vulnerable road bridges and tunnels in dam breach scenario of Ivy Lake Dam.....	4-146
Table 4-86 Vulnerable facilities and infrastructures in dam breach zone of Ivy Lake Dam.....	4-147
Table 4-87 Vulnerable road bridges in dam breach scenario of Smith Mountain Dam .....	4-148
Table 4-88 Vulnerable facilities and infrastructures in dam breach zone of Smith Mountain Dam .....	4-151
Table 4-89 Vulnerable road bridges in dam breach scenario of Spring Hill Lake Dam.....	4-153
Table 4-90 Vulnerable roadways downstream of Stoney Creek Reservoir Dam .....	4-154
Table 4-91 Vulnerable road bridges in dam breach scenario of Stoney Creek Reservoir Dam .....	4-155
Table 4-92 Vulnerable facilities and infrastructures in dam breach zone of Stoney Creek Reservoir Dam .....	4-155
Table 4-93 Vulnerable road bridges in dam breach scenario of Stroobants Dam .....	4-157
Table 4-94 Vulnerable facilities and infrastructures in dam breach zone of Stroobants Dam .....	4-157
Table 4-95 Number of Dams in each Hazard Potential Category within Campbell County.....	4-159
Table 4-96 Critical facility and infrastructure in dam break inundation area within Campbell County ..	4-159
Table 4-97 Vulnerable road bridges in dam breach scenario of New Camp Hydaway Dam .....	4-163
Table 4-98 Vulnerable facilities and infrastructures in dam breach zone of Otter River Raw Water Terminal Reservoir Dam .....	4-164
Table 4-99 Vulnerable road bridges in dam breach zone of Timberlake Dam .....	4-167





# Table of Contents

Table 4-100 Number of Dams in each Hazard Potential Category within Lynchburg City. ....	4-168
Table 4-101 Comparison of demographics in DBIZ and in City of Lynchburg (Source: US Census 2010) .....	4-169
Table 4-102 Critical facility and Infrastructure in dam break inundation zone within City of Lynchburg .....	4-169
Table 4-103 Vulnerable road bridges and tunnels in dam breach scenario of Lake Summit Dam .....	4-177
Table 4-104 Vulnerable road bridges and tunnels in dam breach scenario of Lakeland Dam .....	4-179
Table 4-105 Vulnerable road bridges in dam breach scenario of College Lake Dam .....	4-180
Table 4-106 Vulnerable facilities and infrastructures in dam breach zone of College Lake Dam .....	4-180
Table 4-107 Direct Economic Losses for Impacted Facilities (College Lake Dam Breach Scenario) .....	4-183
Table 4-108 Direct Economic Losses by Building Occupancy (College Lake Dam Breach Scenario) .....	4-183
Table 4-109 Saffir-Simpson Hurricane Damage Scale (Source: National Weather Service) .....	4-187
Table 4-110 Hurricane Damage Classification (Source: National Hurricane Center) .....	4-187
Table 4-111 Critical facilities in low ground surface roughness areas (roughness length < 0.3m) in CVPDC Area .....	4-190
Table 4-112 Hurricane Return Period and its Chance of Occurrence.....	4-197
Table 4-113 Hazus direct economic loss categories and descriptions .....	4-197
Table 4-114 Number of Buildings Damaged from a Hurricane .....	4-197
Table 4-115 Estimate of Potential Building Damage - Wind Only.....	4-198
Table 4-116 Direct Economic Losses for Buildings in 1000-year Event .....	4-198
Table 4-117 Fujita and Enhanced Fujita Scale.....	4-203
Table 4-118 Tornado touchdowns in CVPDC Area by jurisdiction, 1950 - 2019 .....	4-207
Table 4-119 Open-air venues in CVPDC Area.....	4-208
Table 4-120 RV parks and campground in CVPDC Area .....	4-208
Table 4-121 Beaufort Wind Scale .....	4-216
Table 4-122 Occurrence of Thunderstorm Wind Events by Jurisdiction in CVPDC area, 1958 - 2019 ..	4-222
Table 4-123 Occurrence of Thunderstorm Wind Events by Month in CVPDC Area, 1959 - 2019.....	4-223
Table 4-124 Occurrence of Damaging Lightning Events by Jurisdiction in CVPDC Area, 1996 - 2019 ..	4-224
Table 4-125 Occurrence of Damaging Lightning Events by Month in CVPDC Area, 1996 - 2019 .....	4-224
Table 4-126 Snowfall extremes in the CVPDC area .....	4-228
Table 4-127 NESIS Categories and Corresponding Value. ....	4-228
Table 4-128 Ten highest-impact snowstorms that affected the Northeast urban corridor, ranked by severity .....	4-229
Table 4-129 Population in Snowfall Relative Risk in CVPDC Area .....	4-234
Table 4-130 Population in Ice Relative Risk in CVPDC Area .....	4-235
Table 4-131 Winter Weather Events Occurring during January 2000 and June 2018.....	4-236
Table 4-132 Lynchburg City Steep Slope Locations (>15%) .....	4-236
Table 4-133 Hail Intensity and Magnitude.....	4-240
Table 4-134 Hail Fatalities, Injuries and Damage in U.S., 2014-2018.....	4-250
Table 4-135 Total Storms Events above 1 inch, 2000 - 2019 .....	4-250
Table 4-136 Health Hazards Associated with Heat Index Values.....	4-258
Table 4-137 Drought Severity Classification .....	4-262
Table 4-138 Drought Hazard History .....	4-265
Table 4-139 Population served by public supply and self-supplied water for 2015 in the CVPDC area	4-269



# Table of Contents

Table 4-140 Keetch-Byram Drought Index (KBDI) and correlated potential fire behavior .....	4-273
Table 4-141 Wildfire Incidence and Burned Area in the CVPDC Area, 2002 - 2016.....	4-274
Table 4-142 Number of Wildfires Incidence and Their Causes in the CVPDC Area, 2010-2016 .....	4-275
Table 4-143 Areas in Different Wildfire Risk Category in CVPDC Area.....	4-278
Table 4-144 Woodland home community with high wildfire risk in CVPDC Area .....	4-279
Table 4-145 Critical facility and infrastructure located at high wildfire hazard potential areas in CVPDC Area .....	4-281
Table 4-146 Modified Mercalli Intensity (MMI) Scale and corresponding Richter Scale .....	4-292
Table 4-147 Significant earthquakes in Virginia (magnitude greater than 4.5) (Source: VA DMME) ...	4-292
Table 4-148 Mid-rise and high-rise buildings in CVPDC Area .....	4-296
Table 4-149 Estimated Direct Economic Loss for Buildings in a 500-Year Event .....	4-297
Table 4-150 Estimated Direct Economic Loss for Buildings in a 2500-Year Event .....	4-297
Table 4-151 Estimated Direct Economic Loss for Buildings in Annualized Scenario .....	4-298
Table 4-152 Estimated Direct Economic Loss for Buildings in User-defined Scenario .....	4-299
Table 4-153 USGS Landslide Risk Category.....	4-305
Table 4-154 Critical facilities in high and very high susceptibility areas of landslides .....	4-309
Table 4-155 Critical Facility and Infrastructure in Karst Terrain in CVPDC Area .....	4-321
Table 4-156 Hazardous materials classification by the U. S. Department of Transportation.....	4-329
Table 4-157 EPA Toxic Release Inventory (TRI) Facilities in CVPDC Area .....	4-329
Table 4-158 Gas transmission and hazardous liquid pipelines incidents in CVPDC Area .....	4-334
Table 4-159 Hazmat incidents in CVPDC Area, 2009 -2019 .....	4-335
Table 4-160 Potential Impact area (buffer size) by HazMat Material Class .....	4-337
Table 4-161 Potential affected population in impact area of mobile hazmat analysis.....	4-340
Table 4-162 Number of critical facilities within potential immediate impact area (0.5-mile transportation buffer) of hazmat release in mobile hazmat analysis.....	4-340
Table 4-163 Potential affected population in impact areas of fixed hazmat analysis.....	4-344
Table 4-164 Critical facilities within potential immediate impact area (0.5-mile round buffer) of fixed hazmat analysis .....	4-344
Table 4-165 Urban Fire Incidents in CVPDC Area, 2008 - 2018.....	4-351
Table 4-166 Statistics of old buildings (constructed before 1973) by jurisdiction in CVPDC Area .....	4-353
Table 4-167 Critical facilities constructed before 1973 in Urban areas of CVPDC Area.....	4-354
Table 4-168 Top Reportable Communicable Diseases by Incidence Rate in CVPDC in 2018 .....	4-363
Table 4-169 WHO pandemic phase descriptions and main actions by phase .....	4-367
Table 4-170 Large population venues in CVPDC .....	4-377
Table 4-171. Detention facilities in CVPDC .....	4-377
Table 4-172 NOAA Space Weather Scale for Geomagnetic Storms .....	4-384
Table 4-173 NOAA Space Weather Scale for Solar Radiation Storms .....	4-385
Table 4-174 NOAA Space Weather Scale for Radio Blackouts.....	4-387
Table 4-175 Average Annual Loss for the CVPDC Region by Hazard .....	4-393
Table 4-176 Average Annual Casualty and Injuries for the CVPDC Region by Hazard .....	4-394
Table 4-177 Final Hazard Ranking of Hazards for the CVPDC Region .....	4-395
Table 5-1 Amherst County Capabilities .....	5-17
Table 5-2 Town of Amherst Capabilities.....	5-19
Table 5-3 Appomattox County Capabilities .....	5-21



# Table of Contents

Table 5-4 Town of Appomattox Capabilities.....	5-22
Table 5-5 Bedford County Capabilities .....	5-24
Table 5-6 Town of Bedford Capabilities.....	5-26
Table 5-7 Campbell County Capabilities .....	5-28
Table 5-8 Town of Altavista Capabilities.....	5-29
Table 5-9 Town of Brookneal Capabilities .....	5-30
Table 5-10 Lynchburg City Capabilities.....	5-32
Table 6-1 CVPDC Mitigation Actions .....	6-13
Table 6-2 Amherst County Mitigation Actions.....	6-16
Table 6-3 Town of Amherst Mitigation Actions .....	6-21
Table 6-4 Appomattox County Mitigation Actions.....	6-24
Table 6-5 Town of Appomattox Mitigation Actions .....	6-28
Table 6-6 Bedford County Mitigation Actions.....	6-31
Table 6-7 Town of Bedford Mitigation Actions .....	6-37
Table 6-8 Campbell County Mitigation Actions .....	6-40
Table 6-9 Town of Altavista Mitigation Actions .....	6-46
Table 6-10 Brookneal Mitigation Actions .....	6-49
Table 6-11 Lynchburg City Mitigation Actions .....	6-52





# EXECUTIVE SUMMARY





# Executive Summary

## Executive Summary

The Central Virginia Planning District Hazard Mitigation Plan 2020 is a revision to the Region 2000 Hazard Mitigation Plan, completed and adopted by FEMA in 2013. The original Hazard Mitigation Plan (HMP) was developed for the Central Virginia Planning District Commission (CVPDC), then the Region 2000 Local Government Council, was written in 2006. While this HMP represents an update to the 2013 plan, it has been developed and designed such that it looks, feels, and reads differently than the previous version. As such, this regional hazard mitigation document has been developed as though it is the first regional plan and does not directly build upon or maintain past mitigation strategies. This is due to several factors including: availability of new hazard information and data that drives new considerations of risk, the region has matured and new capabilities are now available, this plan was developed with expanded stakeholder participation, and uses a new format to allow readers to more easily understand the content. In addition, the previous Hazard Mitigation Plan included several action items that have been completed, creating an opportunity for developing new mitigation strategies. Finally, the CVPDC HMP 2020 incorporates a corresponding interactive website that allows for real-time review of hazard data, a detailed plan and mitigation strategy oversight program, and a format for continued public engagement and participation.

Mitigation is defined as *“the action of lessening in severity or intensity”*. Hazard mitigation focuses on lessening the severity and intensity of identified hazards as well as protecting life and property. An HMP identifies specific measures to be taken by a

community to reduce their vulnerability from future hazard events and shorten the recovery time. The HMP is created through a planning process with input from citizens, business owners, public safety officials, and other stakeholders.

In 2006 and 2012, the Center for Geospatial Information Technology (CGIT) at Virginia Tech was contracted by Virginia Region 2000 Local Government Council to carry out the original and first update of Hazard Mitigation Plan. This 2020 update was also contracted with the CGIT, with contribution by Sobis, Inc. Funding for the project was provided through a grant from the Virginia Department of Emergency Management (VDEM) and Federal Emergency Management Agency (FEMA) with the appropriate match made by each locality in CVPDC.

This HMP update includes an updated list of identified natural, technological, and man-made hazards that are a threat to the CVPDC area; an update to the evaluation and analysis of the risks to each jurisdiction in CVPDC; a strategy for long and short-term mitigation of identified natural hazards; and a process for ongoing review and maintenance of the HMP. With these updated items, the plan follows the requirements for local mitigation planning as required under Section 322 of the Robert T. Stafford Act (42U.S.C. 5165) and 44 CFR Part 201 as the necessary components of a local hazard mitigation plan and the new regulations for the program per 2019.<sup>1</sup>

The Project Management Team, defined in Table 1, reviewed each section of the plan to ensure that each section adequately served their communities.

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<sup>1</sup> Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, and Related Authorities as

of June 2019. <https://www.fema.gov/media-library/assets/documents/15271>



# Executive Summary

The adoption of the CVPDC HMP 2020 by the participating jurisdictions assures continuing entitlement for FEMA and other federally-funded grant assistance through the Hazard Mitigation Grant Program (HMGP), the Building Resilient Infrastructure and Communities (BRIC) Program, the Flood Mitigation Assistance (FMA) Program, and Rehabilitation of High Hazard Potential Dam Grant Program.

## Jurisdictions

The CVPDC HMP covers the following jurisdictions:

<b>COUNTIES</b>	<b>TOWNS</b>
Amherst County	Town of Altavista
Appomattox County	Town of Appomattox
Bedford County	Town of Amherst
Campbell County	Town of Bedford
<b>CITIES</b>	Town of Brookneal
City of Lynchburg	

The CVPDC HMP and the 2020 update fulfills the requirements of Sections 201.6(a)(3) and 201.6(c)(5) of the Disaster Mitigation Act of 2000 as administered by the VDEM and FEMA, for multi-jurisdictional planning participation and adoption.

This plan is awaiting evaluation and approval from FEMA before it can be evaluated and adopted by the eleven participating local governments. Resolutions will be added to this HMP as Appendix A: Adoption Resolutions upon approval by FEMA.

## Participation

All jurisdictions listed in the above section of the CVPDC HMP participated in the creation of the original plan and the two updates to the plan. The project management team was made up of local officials from each jurisdiction, State agencies, universities and colleges, and non-profits.

Participation in the update included a series of project management team meetings to review and update the plan. In addition, a public survey was administered, and two public meetings held to provide the public information and the opportunity to provide input into the mitigation plan.

Each of the jurisdictions in this plan was represented elected officials and/or staff from the locality with knowledge of planning, public works, and emergency response. The membership of the project management team is in accordance with the requirements of Section 44 CFR 201.6(b)(2) for a multi-jurisdictional plan and the members are listed in the table below.



# Executive Summary

## *Project Management Team Members*

Representative	Title	Jurisdiction / Organization
Kelly Hitchcock	Planning and Development Coordinator	CVPDC
Sharon Williams	Community Development Director	Altavista, Town of
Thomas Fore	Director of Public Utilities	Altavista, Town of
Samuel Bryant	Director, Fire Chief - Marshal	Amherst County Public Safety
Robert "Bob" Hopkins	Director of Public Utilities	Amherst County Service Authority
Sara Carter	Town Manager	Amherst, Town of
Johnnie Roark	Director of Community Development	Appomattox County
Bobby Wingfield	Public Safety Director, Emergency Manager Coordinator	Appomattox County
Jeff Elder	Director of Operations	Appomattox, Town of
Gary Shanaberger	Town Manager	Appomattox, Town of
Jack Jones	Chief of Department, Dept. of Fire & Rescue	Bedford County
Jeff Johnson	Director of Emergency Communications	Bedford County
Mary Zirkle	Economic Development Coordinator	Bedford, Town of
Mike Crews	Public Works Director	Brookneal, Town of
Jonaaron Evans	Communications Technician	Campbell County
Tracy Fairchild	Director/Emergency Coordinator, CC Public Safety	Campbell County
Myra Simpson	Deputy-Director of Public Safety	Campbell County
Melissa Foster	Director, Dept. of Emergency Services	Lynchburg City
Erin Hawkins	Water Quality Manager, Water Resources Dept.	Lynchburg City
Jeff Martin	Assistant Director, Water Resources Dept.	Lynchburg City
Piper VanDePerre	Emergency Programs Specialist, Dept. of Emergency Services	Lynchburg City
Curt Whitlock	Managing Director Accreditation, Safety & Security	Centra Health
Brittany Powell	Local Health Emergency Coordinator	VDH - Central Virginia Health District
Christopher Bruce	All-Hazards Emergency Planner	VDEM Region 3
Jonathan Simmons	All-Hazards Emergency Planner	VDEM Region 6
Lauren Pillow	Hazardous Waste Inspector	VA DEQ
Gregory Bennett	Director Health & Environmental Safety	Liberty University
Ralph Lawson	Disaster Program Manager	Red Cross - Virginia Region
Bob Driskill	Director, Office of Campus Safety	University of Lynchburg

## **Hazard Identification and Risk Assessment (HIRA)**

The purpose of the HIRA is to:

1. Identify and profile the hazards that could affect the jurisdictions in the CVPDC area,

2. Determine which community assets are the most vulnerable to damage from these hazards, and
3. Estimate social, economic, and environmental losses from these hazards and prioritize the potential risks to the community.

All jurisdictions in the CVPDC area are vulnerable to natural, technological, and man-made hazards



# Executive Summary

that threaten the safety of residents, and have the potential to damage or destroy both public and private property, cause environmental degradation, or disrupt the local economy and overall quality of life. While many disasters are possible for any given area in the United States, the most likely hazards to potentially affect the communities in the CVPDC area generally include the hazards in the 2020 plan update. A ranking analysis was used to help identify which hazards should be considered a priority in the

region. The results of this analysis can be found below.

Drought, flooding, and urban fire hazards were ranked highest hazard risk, although it should be noted that the urban fire hazard may not be a priority for non-urban jurisdictions. The extreme temperatures, hailstorm, hurricane, severe thunderstorm, severe winter storm, tornado, wildfire, dam failure, and hazmat incident all ranked as moderate. Earthquake, fog, land subsidence/karst, and landslide hazards are ranked as low.

## *Final Hazard Ranking of Hazards for the CVPDC Region*

Hazards	Probability	Impact	Spatial Extent	Warning Time	Duration	Value	Rank
Drought	3	3	4	1	4	3.1	High
Earthquake	1	1	4	4	1	1.9	Low
Extreme Cold	3	2	4	1	3	2.7	Mod.
Extreme Heat	4	2	4	1	3	3	Mod.
Flooding	4	4	2	4	2	3.4	High
Fog	4	1	1	2	1	2	Low
Hailstorm	4	2	4	3	1	3	Mod.
Hurricane	2	3	4	1	1	2.5	Mod.
Land Subsidence/ Karst	1	1	1	4	1	1.3	Low
Landslide	2	2	1	4	1	1.9	Low
Severe Thunderstorm	4	2	4	2	1	2.9	Mod.
Sever Winter Storm	4	2	4	1	3	3	Mod.
Tornado	3	3	1	4	1	2.5	Mod.
Wildfire	4	2	1	4	3	2.7	Mod.
Dam Failure	2	3	1	4	2	2.3	Mod.
Hazmat Incident	3	2	1	4	2	2.3	Mod.
Urban Fire*	4	4	1	4	1	3.1	High

\*For CVPDC urban areas.





# Executive Summary

## Capabilities

The capability assessment serves as a guide to the communities on their existing capacity and limitations to implement policy and programmatic mitigation actions. Local capabilities analysis serves as the foundation for designing an effective hazard mitigation plan,

that builds on measures already in place, detects capacity gaps, and provides a foundation for effective mitigation strategy implementation.

Part of this section involves the jurisdictions conducting their own self-assessment. A general summary of the self-assessment is provided in the table below.

Jurisdiction	Planning Capabilities	Legal Capabilities	Technical Capabilities	Administrative Capabilities	Fiscal Capabilities
Amherst County	Few Planning Gaps	Legal Authority	Some Programs and Certifications	Adequate In-House and Contract Staffing and Expertise	\$50M Budget (2020)
Town of Amherst	Some Planning Gaps	Legal Authority	Few Programs and Certifications	Adequate In-House and Contract Staffing and Expertise	\$3.4M Budget (2020)
Appomattox County	Some Planning Gaps	Legal Authority	Some Programs and Certifications	Adequate In-House and Contract Staffing and Expertise	\$41.9M Budget (2020)
Town of Appomattox	Some Planning Gaps	Legal Authority	Few Programs and Certifications	Adequate In-House and Contract Staffing and Expertise	\$2.7M Budget (2020)
Bedford County	Few Planning Gaps	Legal Authority	Some Programs and Certifications	Adequate Staffing and Expertise	\$110M Budget (2020)
Town of Bedford	Some Planning Gaps	Legal Authority	Few Programs and Certifications	Adequate Staffing and Expertise	\$30.2M Budget (2020)
Campbell County	Some Planning Gaps	Legal Authority	Few Programs and Certifications	Adequate Staffing and Expertise	\$81M Budget (2020)
Town of Altavista	Some Planning Gaps	Legal Authority	Some Programs and Certifications	Adequate Staffing and Expertise	\$4.1M Budget (2020)
Brookneal	Some Planning Gaps	Legal Authority	Few Programs and Certifications	Adequate Staffing and Expertise	\$1.4M Budget (2020)
Lynchburg City	Few Planning Gaps	Legal Authority	Several Programs and Certifications	Robust Staffing and Expertise	\$179M Budget (2020)



# Executive Summary

## Mitigation

The Mitigation Strategy section presents goals, objectives, and specific actions that assist in minimizing the vulnerability and impact of natural and man-made hazards. The mitigation strategies are meant to be comprehensive with both regional and location-specific actions while at the same time being feasible based on the regional and jurisdictional capabilities.

CVPDC set up working group meetings with the Program Management Team to identify regional mitigation goals, objectives, and actions. A goal for each type of mitigation strategy and supporting objectives, based on regional needs and capabilities is presented. Recognizing that each jurisdiction has specific needs, jurisdiction-specific mitigation actions were developed and are presented in Jurisdiction-Specific Mitigation Actions Section of this Plan. The following regional goals were identified. Regional mitigation actions are identified in the table below.

**Information & Outreach Goal:** Increase hazard awareness and preparedness activity participation by area individuals, property owners, and businesses.

**Prevention Capacity Goal:** Through governmental operations, business and private sector partnerships, advance planning initiatives, voluntary and regulatory programs (e.g. code enforcement), and maintenance practices to lessen hazard impacts.

**Property Protection Goal:** Support property and infrastructure fortification programs and projects to lessen hazard impacts to lives, property, and infrastructure.

**Structural Projects Goal:** Execute measures that significantly lessen the impact of natural hazard impact to lives, communities, property, and infrastructure in the region.

**Natural System Resiliency Goal:** Preserve the function and resiliency of the region's natural resources and sensitive landscapes.

Goal	Mitigation Action Description	Hazard(s)
Information & Outreach	Develop hazard preparedness outreach/education best practices, resources, and program activity within the CVPDC website.	All Hazards
Information & Outreach	Expand outreach and education about the National Flood Insurance Program (NFIP), including inclusion within CVPDC website.	Flood
Information & Outreach	Develop public hazard communication campaign with emphasis on increasing number of residents joining area public information systems.	All Hazards
Information & Outreach	Establish regular hazard mitigation feature, where best practices for readiness, safe sheltering, public announcements, are incorporated within agency newsletter, social media feeds, and general scheduled agency outreach. Include property maintenance, business best practices - features for preparedness.	All Hazards
Capacity	Ensure the regional Hazard Mitigation Plan and mitigation planning are included as integral components of all regional planning initiatives including transportation, mobility, watershed, community development, emergency, and CEDS agency programs.	All Hazards



# Executive Summary

Goal	Mitigation Action Description	Hazard(s)
Capacity	Establish HMP Technical Advisory Committee, include locality, citizen, business, agency representation, that meets at least twice per year to review HMP mitigation strategy progress, evaluate changes, review regional projects.	All hazards
Capacity	Seek opportunities to host regional mitigation, program skills training for area locality, business and agency partner staff.	All Hazards
Capacity	Seek opportunity to expand regional Comprehensive Economic Development Strategy (CEDS) to incorporate community resiliency or develop regional resiliency plan in coordination with locality partners.	All Hazards
Capacity	Coordinate an emergency communication and verification protocol with VDOT to ensure emergency critical staff access.	All Hazards
Capacity	Evaluate and seek opportunity to execute (to include regional participation agreement and equipment purchase) regional Public Safety Answering Point (PSAP) generator(s) to facilitate rapid and efficient emergency communication and response capabilities between the region's emergency response departments.	All Hazards
Capacity	Encourage develop of local or regional Resiliency Plans	All Hazards
Capacity, Property Protection	Seek opportunities to evaluate and improve corridors, especially those with recurring stormwater impacts, essential for access to public transit or other multimodal access by vulnerable populations.	Flood
Property Protection, Structure	Seek opportunities to study condition of or improve drainage along rural roadways to reduce stormwater and flood impacts that impact roadway movement safety or impact emergency access/movement.	Flood
Property Protection, Natural System Resiliency	Support initiatives that expand use of green infrastructure in the region through education, workshops, training initiatives to expand expertise and local knowledge for green infrastructure use and implementation in area projects.	Flood, Dam
Property Protection, Structure, Natural System Resiliency	Seek opportunities to evaluate and execute streambank stabilization or other practices, to restore or protect the natural function of area streams to lessen flood impact to essential regional infrastructure (e.g. roadways, rail lines, communication towers).	Flood

## Implementation and Maintenance

The success and value of the CVPDC HMP as mitigation tool and resource relies on Plan integration, monitoring, evaluation and, when necessary, amendments.

Plan adoption is essential, however, fundamental to implementation success is the structural integration of the HMP within

foundational community and regional plans, regulatory systems, departmental procedures, and funding structure.

The primary tool for implementing land use goals is within each locality's zoning ordinance. The regional mitigation plan goals, objectives, and strategies should be evaluated and considered within review and zoning regulation updates, especially site improvements within flood zones.



# Executive Summary

Emergency managers should capitalize on local and regional disaster operations and recovery plans to execute elements of the Plan mitigation strategies, especially those directly applicable to emergency response operations and efficiency, including training, equipment, and facility improvement needs.

Many of the mitigation strategies, especially those property protection, structural, or natural system resiliency projects, will require considerable planning and large financial investment. Execution will require continuously seeking funding opportunities including federal and state grant programs, incorporation and dual benefits across departments and agencies to capitalize on funding efficiency, integration within capital improvement plans.

The CVPDC will be responsible for convening the CVPDC Mitigation Plan Advisory Committee (MPAC), similarly comprised of locality and agency stakeholder representatives. The CVPDC will facilitate twice-yearly MPAC meetings, where mitigation strategy implementation

including regional, locality-specific, and stakeholder summaries will be reported. The meetings will also be used to coordinate regional projects, with focus on information and outreach strategies, and incorporate a staff educational component such as information on state, federal or non-profit funding information, overview of success program execution by local partner, discussion of challenges, recordation of anticipated future changes or Plan integration, and outline agenda and actions for future meetings. Integral to the Plan maintenance program, will be the yearly submittal of a Virginia Hazard Mitigation Plan Annual Report Form to VDEM. The CVPDC Hazard Mitigation Annual Report, as well as regular program features throughout the year, will be made available for public comment and housed on the CVPDC Mitigation Plan website.

To ensure that the regional hazard plan does not exceed the FEMA five-year program eligibility an update process will be initiated, by beginning to seek FEMA funding and plan development preparation three years from the FEMA adoption.





# INTRODUCTION





# Introduction

## 1.0 Introduction

### 1.1 Hazard Mitigation Planning

Hazard mitigation is defined as any sustained action taken to reduce or eliminate long term risk to life, property, and the economy from a hazard event. Section 209 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-228, as amended), Title 44 of the Code of Federal Regulations (CFR), as amended by Section 201 of the Disaster Mitigation Act of 2000 (DMA2K), requires development of a pre-disaster mitigation plan as a requirement of receiving federal disaster assistance. States and local governments are required to adopt hazard mitigation plans to maintain eligibility for federal pre- and post-disaster hazard mitigation funding.

### 1.2 Plan Purpose

The CVPDC HMP 2020 has been developed to meet the requirements for all of the region's jurisdictions to meet the DMA2K which requires state and local governments to identify, assess risk and vulnerability, and describe actions to mitigate impacts of natural hazards.

The CVPDC HMP 2020 has been developed to serve the people within the CVPDC area by providing the impetus for making our homes, businesses, and communities as safe as possible against the impacts of natural, technological, and man-made hazards. This HMP contains the latest geographic and demographic information, along with a thorough assessment of the potential hazards faced. This plan addresses the overall capability of local governments, businesses, organizations, and property owners to reduce or eliminate the vulnerability to these hazards. Moreover, the plan outlines coordinated mitigation strategies,

including long-term goals, objectives, and a wide variety of mitigation actions.

The objective of this plan is to identify areas of concern from natural, technological, and man-made hazards in the CVPDC area and describe how these concerns will be addressed through the implementation of mitigation actions. It has been developed to assist CVPDC citizens, communities, local governments, and businesses in becoming less vulnerable to the impacts of hazards through the effective administration of hazard risk assessments, floodplain management, grant program applications, and a coordinated approach to mitigation policy through regional and local planning activities. In addition, pre-disaster actions and investment can significantly reduce the post-disaster financial costs to local governments, businesses, and residents. It is anticipated that this plan will be a useful tool for all community stakeholders by increasing public awareness about local hazards and risks while providing information about options and resources available to reduce those risks. Educating the public about potential hazards will help each jurisdiction protect itself against the effects of the hazards and will enable informed decision making on preparing for disasters.

### 1.3 Participating Communities

This plan update serves as the Federal pre-disaster planning instrument for all of the Central Virginia Planning District jurisdictions, the counties of Amherst, Appomattox, Bedford, and Campbell; the City of Lynchburg; and the Towns of Amherst, Altavista, Appomattox, Bedford, and Brookneal. Representatives from the region's four counties, one city, and five towns have dedicated mitigation actions. Pamplin City, as a function of its size and



# Introduction

governance capabilities, is represented by Appomattox County. The plan addresses twenty hazards, including natural, technological, and man-made in the area. When developing this plan, every effort was made to gather input from all aspects of the CVPDC communities to assure that the results of this analysis will be as complete as possible. The partnerships and participation of state and local government, private sector, and citizens ensures that many perspectives within the

CVPDC are represented, rather than that of a few government agencies.

## 1.4 Plan Organization

The CVPDC HMP 2020 is developed to meet the requirements of the DMA2K and is organized into six main sections described in Table 1-1.

*Table 1-1 Main Sections of CVPDC Hazard Mitigation Plan 2020*

Section	Description
Community Profile	The Community Profile provides information on the geography, natural features, employment, housing, development trends, and demographics of each jurisdiction in the PDC.
Planning Process	The Planning Process provides information on the makeup of the steering committee members, meetings for the committee members and public, and the steps taken to complete and adopt the mitigation plan.
Hazard Identification and Risk Assessment (HIRA)	The HIRA provides a detailed risk analysis for each hazard that may impact the PDC including hazard descriptions, maps, vulnerability assessments, and potential impacts. It also provides information on the essential facilities and utilities that were included in the analysis and an overall ranking of each hazard.
Capability Assessment	The Capability Assessment Section provides information on each community's self-assessment for their administrative, planning, fiscal, legal, and technical capabilities. This information will help a community determine the number and scope of mitigation actions they should undertake.
Mitigation Planning	Mitigation planning provides hazard mitigation community goals and objectives as well as individual actions each jurisdiction will be undertaking over the next five years. It identifies who will be involved in the mitigation action and when it will occur. A way to evaluate the mitigation actions is also included in this section.
Implementation and Maintenance	Presents the process by which the CVPDC and its member localities will maintain, including record implementation activities, and update the plan.
References	The References provides a listing of the different resources used in the development of this plan.
Appendices	The Appendices provide the meeting documentation, adoption resolutions, acronyms, FEMA requirement crosswalk, and public comments received.





# COMMUNITY PROFILE





# Community Profile

## 2.0 Community Profile

### 2.1 2020 Update - Summary of Changes

The CVPDC HMP 2020 made the following updates in the community profile section:

- **Demographic information updated.** All demographic and economic data was updated according to U.S. 2016 American Community Survey Data from 2012-16 when available.
- **Demographic information added.** Demographic parameters useful in assessing the economic development status and vulnerability of the region were added. Information about land cover and development trends has been added to this document to depict the development trends of the region.
- **Bedford reversion to Town status.** In 2013, Bedford abandoned its status as an independent city and became a town in Bedford County. The code of Virginia states, “cities with populations less than 50,000 may initiate a reversion.” The reversion of Bedford added approximately 6,222 residents (2010 Census) and nearly seven square miles to Bedford County. Additionally, it increased the town’s boundaries by 1.5 square miles. The reversion brought changes to the tax structure, utility provision, public safety, schools, representation, and election districts, among others.
- **Region 2000 name change.** The Region 2000 Planning District Commission was renamed to the Central Virginia Planning District Commission in 2019.

### 2.2 Central Virginia Planning District Commission

Virginia Planning District Commissions (PDCs) were originally formed in 1968 through the Code of Virginia, §15.2-4200 through §15.2-4222. The PDCs serve as a network providing the Commonwealth with complete statewide coverage and were developed to provide both technical and service programs to the governments they serve. The main purpose of the PDCs is to provide economic competitiveness on a regional scale, reduce redundancies in government, improve efficiency, enhance services, and improve implementation time for regional projects.

The Central Virginia Planning District Commission (CVPDC) is one of 21 PDCs of the Commonwealth. In January 2001, the CVPDC was transformed into the Region 2000 Local Government Council and had been referred to simply as Region 2000. In March 2019, the Region 2000 went “back to its roots” and re-established itself as the CVPDC during its 50th anniversary. The CVPDC works to provide services for member localities and identify and develop opportunities for coordination among the region's local governments. Additionally, the CVPDC encourages and assists local elected and appointed officials in addressing issues that extend beyond their individual localities while working to strengthen collaboration and effective communication among their neighboring jurisdictions.

The CVPDC is a defined geographic area surrounding the City of Lynchburg in Central Virginia. The Blue Ridge Mountains, the James River, the Staunton River, and Smith Mountain Lake are all important



# Community Profile

physiographic features of the region. CVPDC is a business-friendly region in the heart of Virginia, three hours south of the Washington DC metro area. Communities that make up the region include Amherst County, Bedford County, Appomattox County, Campbell County, Lynchburg City, and the towns of Altavista, Appomattox, Amherst, Brookneal and Pamplin City (Figure 2-1). The total land area of the communities encompasses approximately 2,000 square miles.

The region is rich in Civil War history with battlefields, historical parks, and museums found throughout. A portion of the Blue Ridge Parkway, the George Washington National Forest, and the historic Appomattox Court House National Historical Park are within the region.

Climate in the region is mild, with average January and July temperatures at 35°F and 71°F and annual rainfall and snowfall at 44" and 21" respectively.

The transportation network for the region is generally centered on the hub of Lynchburg. Two major highways crossing this region are U.S. Route 29 and U.S. Route 460. The highways have become corridors for most of the industrial, commercial, and residential development. There is one commercial airport in the region and four general aviation airports.

## 2.3 Jurisdictions

### 2.3.1 Amherst County

Amherst County is located near the geographic center of Virginia just north of the city of Lynchburg. The county was created in 1761 from Albemarle County and is named for Major General Jeffery Amherst, a hero of the battle of Ticonderoga. It is bounded on the northwest by Rockbridge County, to the south and southwest by Bedford County, Campbell County, and the City of Lynchburg and on the northeast by Nelson County. The James River borders the county on the south and east with the crest of the Blue



Ridge Mountains forming the western Boundary. According to the US Census, Amherst County had a 2010 population of 32,353. Half the population is located in the south central portion of the county near the City of Lynchburg and around Madison Heights. Sweet Briar College, a private women's liberal arts and science college, enrolls approximately 700 students. The college, founded in 1901, encompasses 3,250 acres located in the foothills of the Blue Ridge Mountains. Elevations ranging from 500 feet to 4,000 feet provide the County with spectacular rolling countryside.



# Community Profile

## 2.3.2 Appomattox County

Appomattox County is located at the geographic center of Virginia. The lack of efficient intrastate communication and the need for localized service initiated the formation of the county by an act passed on February 8, 1845. This act designated that Buckingham, Prince Edward, Charlotte, and Campbell counties each would give portions of their lands as of May 1, 1845. The county consists of 343 square miles of gently



rolling terrain indicative of Virginia's Piedmont Region. Appomattox County is perhaps best known in history as the site of the end of the Civil War at Appomattox Court House. The county is bordered to the north by Amherst County, Buckingham County, and Nelson County; to the south by Charlotte County; to the east by Prince Edward County; and to the west by Campbell County. The James River serves as the northwest border. The towns of Pamplin City and Appomattox are within the county, with the Town of Appomattox being the county seat. Elevations range from 460 feet to 1,151 feet above sea level. Drainage is provided by the James River, Appomattox River, Roanoke River Drainage Area, and Bent and Wreck Island Creeks.

## 2.3.3 Bedford County

Bedford County consists of 764 square miles located in west-central Virginia just east of the Roanoke metropolitan area. Bedford County was formed in 1754 and named for the Fourth Duke of Bedford, a British Government official. In 1839, the



Town of Liberty (now Town of Bedford) was established within the county limits. The scenic Blue Ridge Mountains make up the county's western border. The James River forms the northeast boundary. The 23,400-acre Smith Mountain Lake is situated to the south on the Roanoke River. Communities bordering Bedford include Rockbridge County to the northwest; Amherst County to the north and northeast; Campbell County to the east; Pittsylvania County to the south; and Franklin, Roanoke, and Botetourt Counties to the west. The area has a rolling to hilly terrain with elevations from 800 feet to 4,200 feet





# Community Profile

above sea level, including the famous Peaks of Otter, Sharp Top, and Flat Top, along the Blue Ridge Parkway on the county's western border.

## 2.3.4 Campbell County

Campbell County is located in the south-central Piedmont Region of Virginia, in the foothills of the Blue Ridge Mountains. From its beginnings in 1781 as a frontier settlement, to its emergence as a tobacco producer and then a center for industrial manufacturing, Campbell County has continually evolved and grown with national and world changes. The county is bordered on the north by the City of Lynchburg and James River, and in the South by the Roanoke (Staunton) River. Campbell County is 115 miles west of Richmond, the state capital; 200 miles southwest of Washington, DC; and 200 miles west of Norfolk.



## 2.3.5 City of Lynchburg

The City of Lynchburg is located near the geographic center of Virginia. In 1757, John Lynch established a ferry service on the James. The ferry service remained profitable for many years, and by the end of the American Revolution, the village at Lynch's Ferry had itself become an important center of trade. Lynch saw the possibilities of establishing a town on the hill overlooking the ferry site, and in late 1784 petitioned the General Assembly of Virginia for a town charter. In October, 1786, the charter was granted, founding the Town of Lynchburg.



Located on the James River, the city has a land area of 48 square miles and is bordered on the west by the Blue Ridge Mountains and Bedford County, to the south by Campbell County, and to the North by Amherst County. The city is a major highway and transportation hub that has contributed to its status as a broadly diversified manufacturing center. Lynchburg is 115 miles west of Richmond, the state capital; 52 miles east of Roanoke; 180 miles southwest of Washington, D.C.; and 200 miles west of the Port of Hampton Roads. Liberty University, a private coeducational Christian university, enrolls over 7,000 students residentially and tens of thousands of students in distance learning. The university, founded in 1971, encompasses 4,400 acres located in the foothills of the Blue Ridge Mountains and south of the James River. The city also includes the University of Lynchburg, Randolph College, and Virginia University of Lynchburg.



# Community Profile

## 2.3.6 Town of Altavista

Altavista is a relatively new town in southern Campbell County, incorporated in 1912. Residential and industrial growth occurred within the town boundaries until around 1960, after which the concentration of new development took place outside the boundaries.



## 2.3.7 Town of Amherst

The Town of Amherst was incorporated in 1910 and is situated on the topographic divide separating Tribulation Creek and Rutledge Creek. The Town of Amherst serves as the Amherst county seat.







# Community Profile

## 2.3.8 Town of Appomattox

Originally, the Town of Appomattox was named Nebraska and was renamed West Appomattox in 1895. Eventually, the West was dropped from the name. The town was named for the Appomattox River. It is the Appomattox county seat.



## 2.3.9 Town of Bedford

In 1782, the Town of Liberty was incorporated into Bedford County, and in 1890 changed its name to the Town of Bedford. In 1912, the town became known as Bedford City and reverted to the Town of Bedford in 2013. The town is situated on U.S. Route 460 in the center of Bedford County and serves as the county seat. The residents of this small City enjoy living in a small city with the convenience of being strategically located between the cities of Lynchburg and Roanoke, the largest cities in Central Virginia. The city's most popular attraction is the National D-day Memorial, in honor of the 19 "Bedford Boys" who died in the first minutes of the Normandy landings at Omaha Beach.





# Community Profile

## 2.3.10 Town of Brookneal

The Town of Brookneal, near Phelps Creek and Falling River, has been a center for commerce for the surrounding counties of Campbell, Charlotte, and Halifax since its founding in 1802. The unincorporated Town of Rustburg serves as the Campbell county seat.



## 2.4 Land Use and Land Cover

A majority of the land in CVPDC is in forest or agricultural use. The forested area (including forest, trees, and shrubland) covers about 70% of the region. A significant portion in the northwest of the region is part of the George Washington National Forest and Jefferson National Forest. The pasture and cropland account for about 18% of the area in the region (Figure 2-2).

The developed areas are low intensity residential. Most commercial and industrial development are concentrated in and around Lynchburg and Bedford, and along US Routes 460, 29, and 501. The greater Lynchburg area, known as the Lynchburg Metropolitan Statistical Area (MSA), has experienced population growth and additional residential and commercial development which has spread into the adjacent counties.

### 2.4.1 Amherst County

Woodlands cover approximately three-fourths of the land, and most of the northwestern portion of the county is part of the George Washington National Forest. The US highway 29 corridor in the eastern region of the county has become the focal point for most commercial, industrial, and residential development, especially near Lynchburg City.



# Community Profile

## **2.4.2 Appomattox County**

Commercial forest land comprises more than half of the county's land area and a large portion of the rest of the county is crop and pasture lands. This natural resource base has helped foster a significant forestry, wood products, and furniture industry. Most of the commercial, industrial, and residential development exists along US 460 in central and southeastern portions of the county between Lynchburg City and the Town of Appomattox.

## **2.4.3 Bedford County**

The majority of Bedford County land use is forest and pastures, with commercial, industrial, and residential development focused in the Town of Bedford and along Routes 460 and 221. Strategically located between the metropolitan areas of Lynchburg and Roanoke, the county is home to a diversified industrial base and displays an appealing quality of life. The good mix of industry, commerce, and agriculture ensures a strong, diversified economy and a positive business climate. Most of the residential growth occurs near Smith Mountain Lake and Lynchburg City.

## **2.4.4 Campbell County**

Most of the county land use is a combination of forest, pastures, and farmland. Commercial and residential development is found near Lynchburg, in the towns of Brookneal and Altavista, and along Routes 29 and 501. Four-lane primary highways and rail service provide access to markets in the eastern portion of the county. Industrial activity in the county has concentrated around the towns of Brookneal and Altavista and the northern portion of the county close to Lynchburg.

## **2.4.5 Lynchburg City**

Most of the city is low intensity residential, with commercial and industrial development focused in eastern portions of the city in the downtown region and along US Highways 460 and 501. The region's overall quality of life is tied directly to the health of the city's economy. The city keeps pace with changes in technology and telecommunications, attracting national and international businesses and fusing the local and regional market with the nation and the world.

## **2.5 Natural Features**

### **2.5.1 Physiography**

Physiographic provinces are defined by their relative elevation, relief, geomorphology, and lithology. The major physiographic provinces in CVPDC are the Piedmont Plateau (Campbell, Appomattox, Lynchburg, and parts of Bedford and Amherst), the Blue Ridge (Parts of Bedford and Amherst), and the Ridge and Valley (Small portion of Bedford County).

The Piedmont province is characterized by gently rolling topography, deeply weathered bedrock, and thick soils. The Blue Ridge province is generally classified as moderately-sloped (i.e. slopes ranging from 5-20%) and is characterized by irregular topography. The Valley and Ridge province exhibits parallel running ridges with accompanying valleys and is considered to be steep sloped. Figure 2-3 shows the physiography of the CVPDC area.





# Community Profile

## 2.5.2 Geology

Metamorphic rocks are most prevalent in the CVPDC and exist in over 80 percent of the region, such as gneiss, schist, and phyllite. The majority of igneous rocks like granite are mainly found in the Blue Ridge province portion. Sedimentary rocks are rare, accounting for less than 4 percent of the area. They include shale, sandstone, and few limestone and dolomites. They are concentrated in the western region falling within the Valley and Ridge province, and the south side of Campbell County (Figure 2-4). Most of the soils are a result of these rock formations weathering and tend to be fine-textured.

## 2.5.3 Topography

Much of the CVPDC region consists of beautiful rolling hills and low areas within stream valleys. In the western part of the region, there are several mountains running in a northeast-southwest trend. They consist of long, steep mountain flanks that border broad, strongly sloping mountaintops. The center of the region is well developed and very urbanized with gently rolling to rolling topography. Elevation in the region ranges from about 400 feet above sea level in the James River flood plain to above 4,000 feet above sea level on Mt. Pleasant in the west. Figure 2-5 presents the topography of the region while Figure 2-6 depicts the slopes.

## 2.5.4 Hydrology

The geography of the region varies from the ridge and valley system of the Blue Ridge Mountains in the western part of the region to more rolling hills in the eastern part of the region. CVPDC is divided by two physiographic provinces of Virginia: Southern Piedmont and the Blue Ridge. The Blue Ridge region lies east of I-81 including the western portions of Amherst and Bedford Counties.

The major watersheds for CVPDC jurisdictions include the James River Basin and the Roanoke River Basin. Figure 2-7 illustrates the location of the major watershed boundaries for the jurisdictions in CVPDC. The region is separated by two major watersheds, the James River Basin to the north and the Roanoke River Basin to the south.



# Community Profile

## Jurisdictions in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020

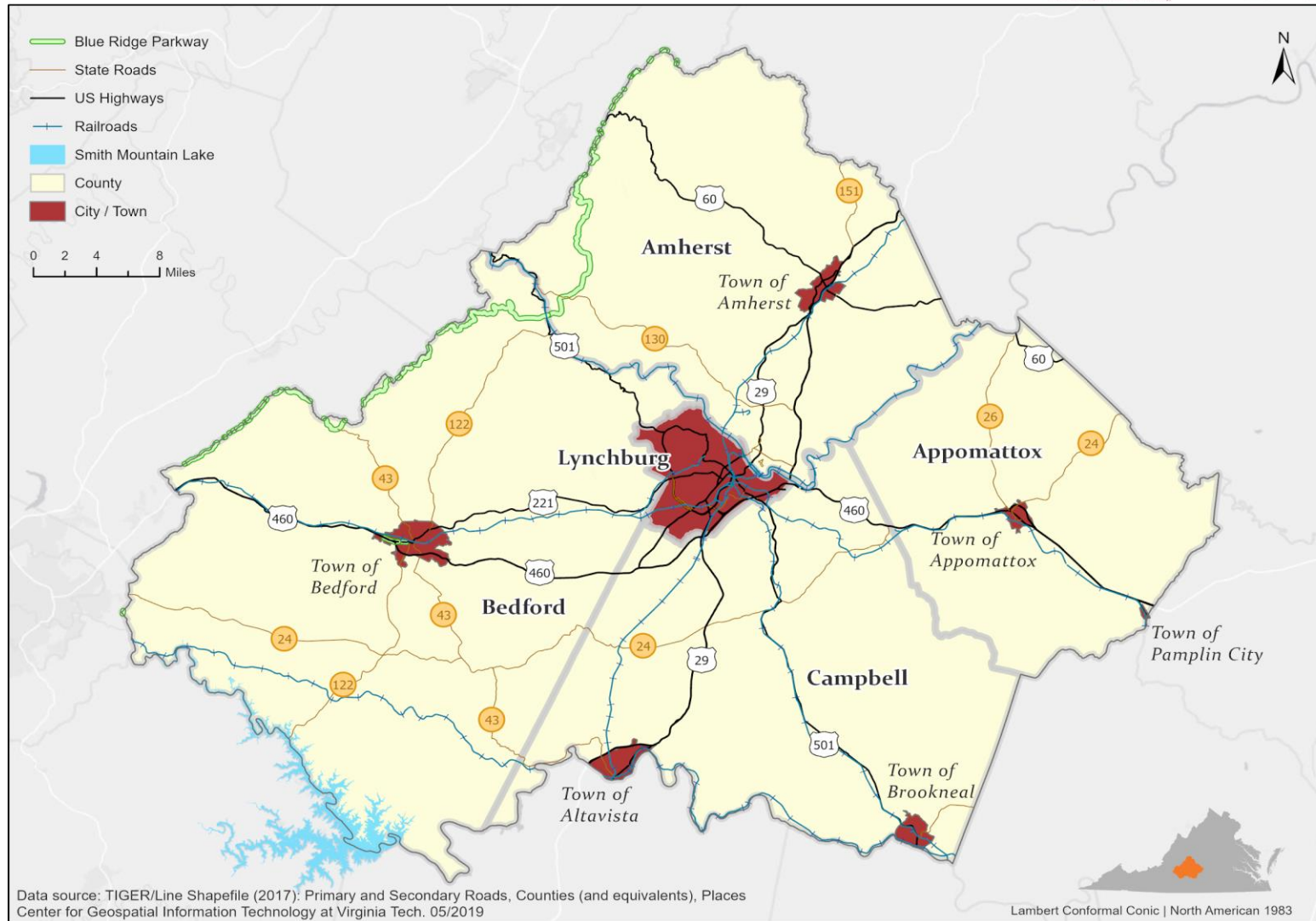


Figure 2-1 Jurisdictions in CVPDC Area



# Community Profile

## Land Cover of Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020

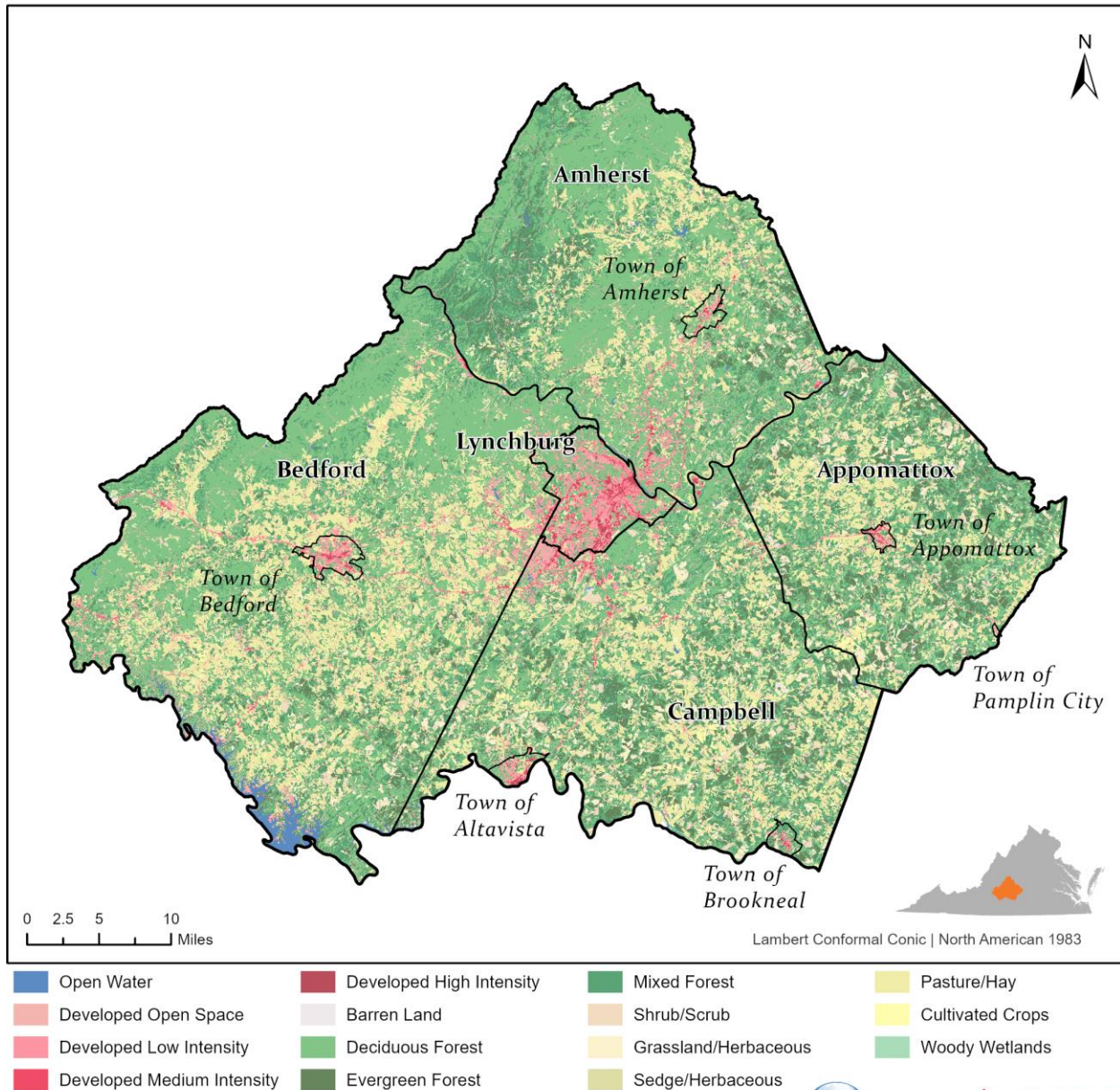


Figure 2-2 Current Land Cover of CVPDC Area

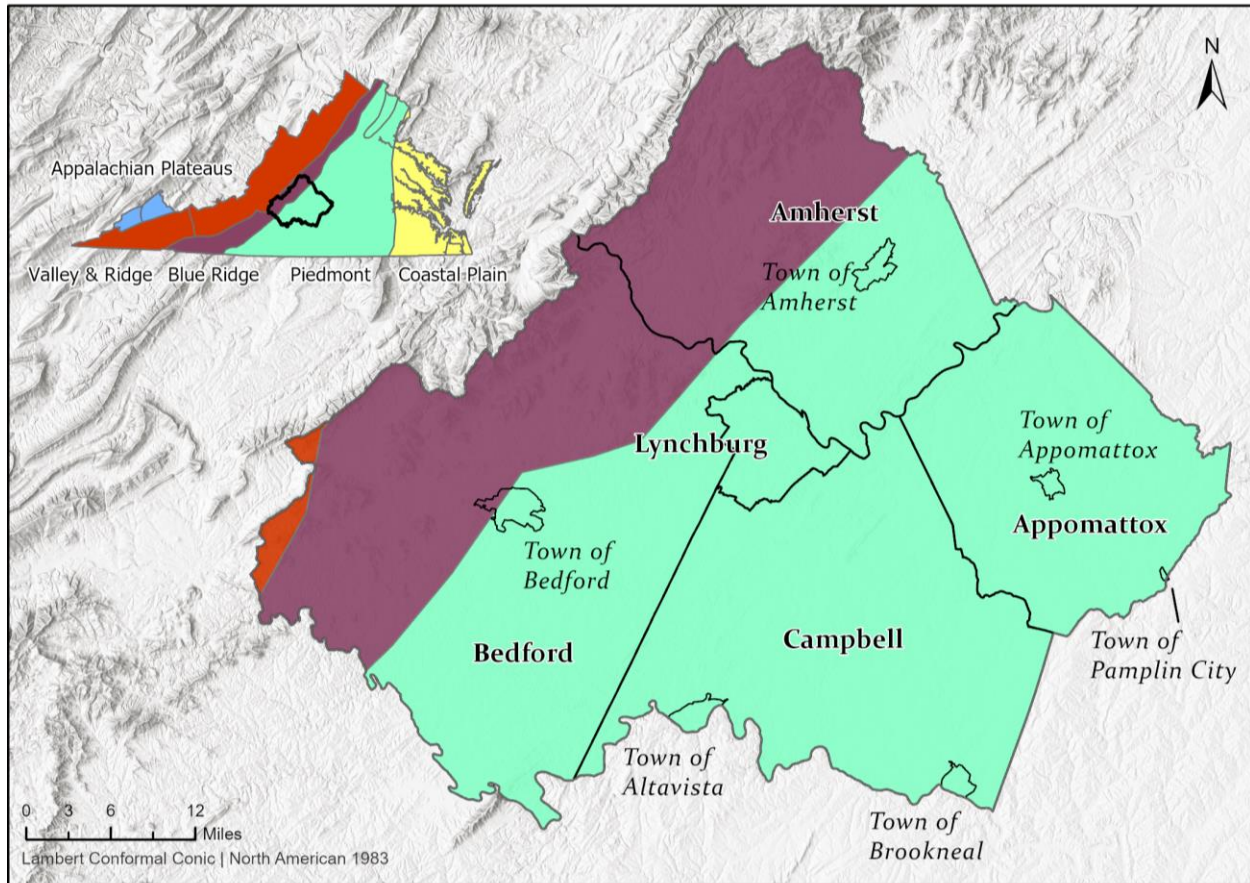




# Community Profile

## Physiographic Provinces of Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: USGS, U.S. Census Bureau, ESRI's Multi-Directional Hillshade  
Center for Geospatial Information Technology at Virginia Tech. 06/2019



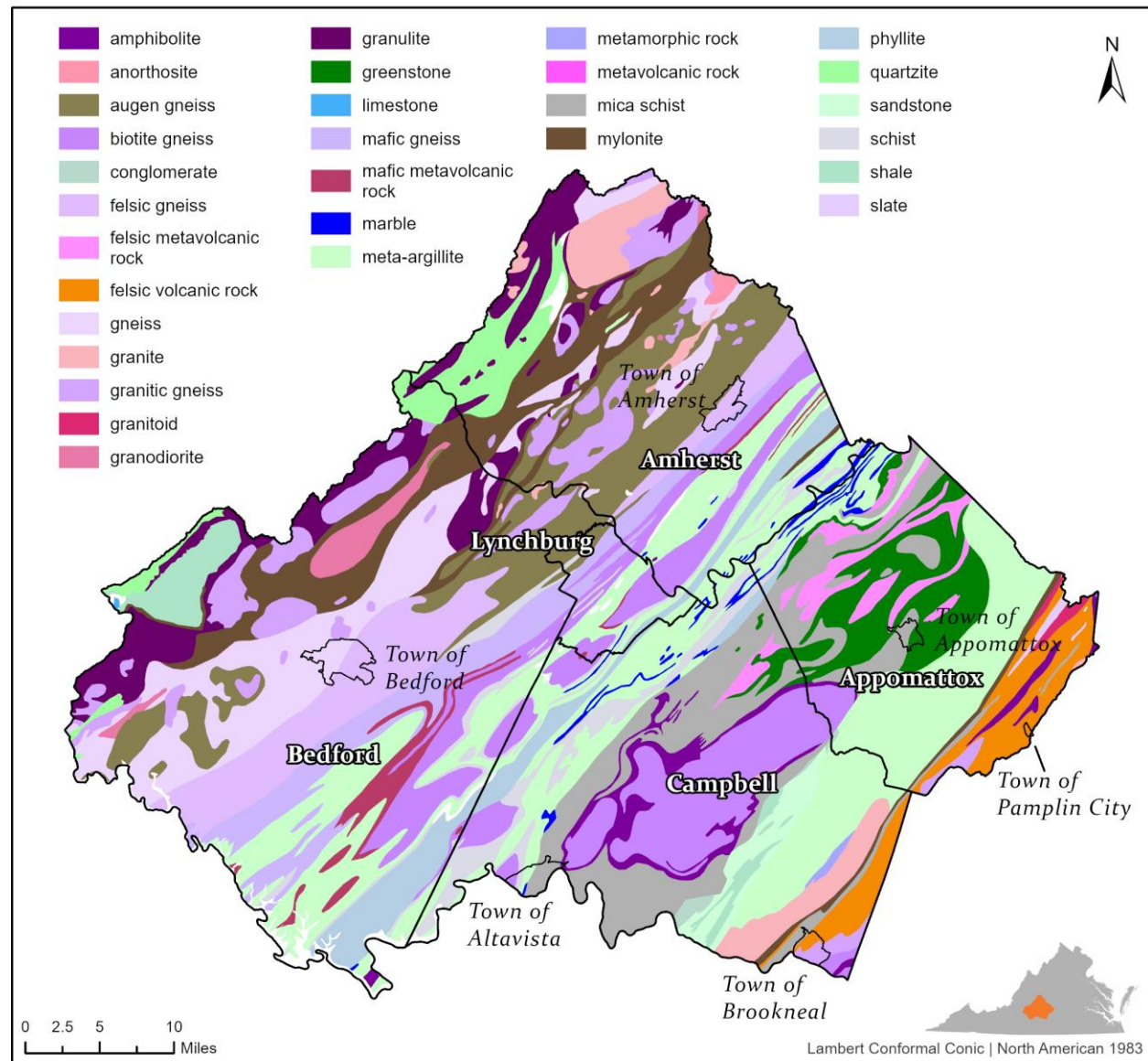
Figure 2-3 Physiographic Provinces of CVPDC Area



# Community Profile

## Geologic Units in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: USGS  
Center for Geospatial Information Technology at Virginia Tech. 06/2019



Figure 2-4 Geologic Units in CVPDC Area

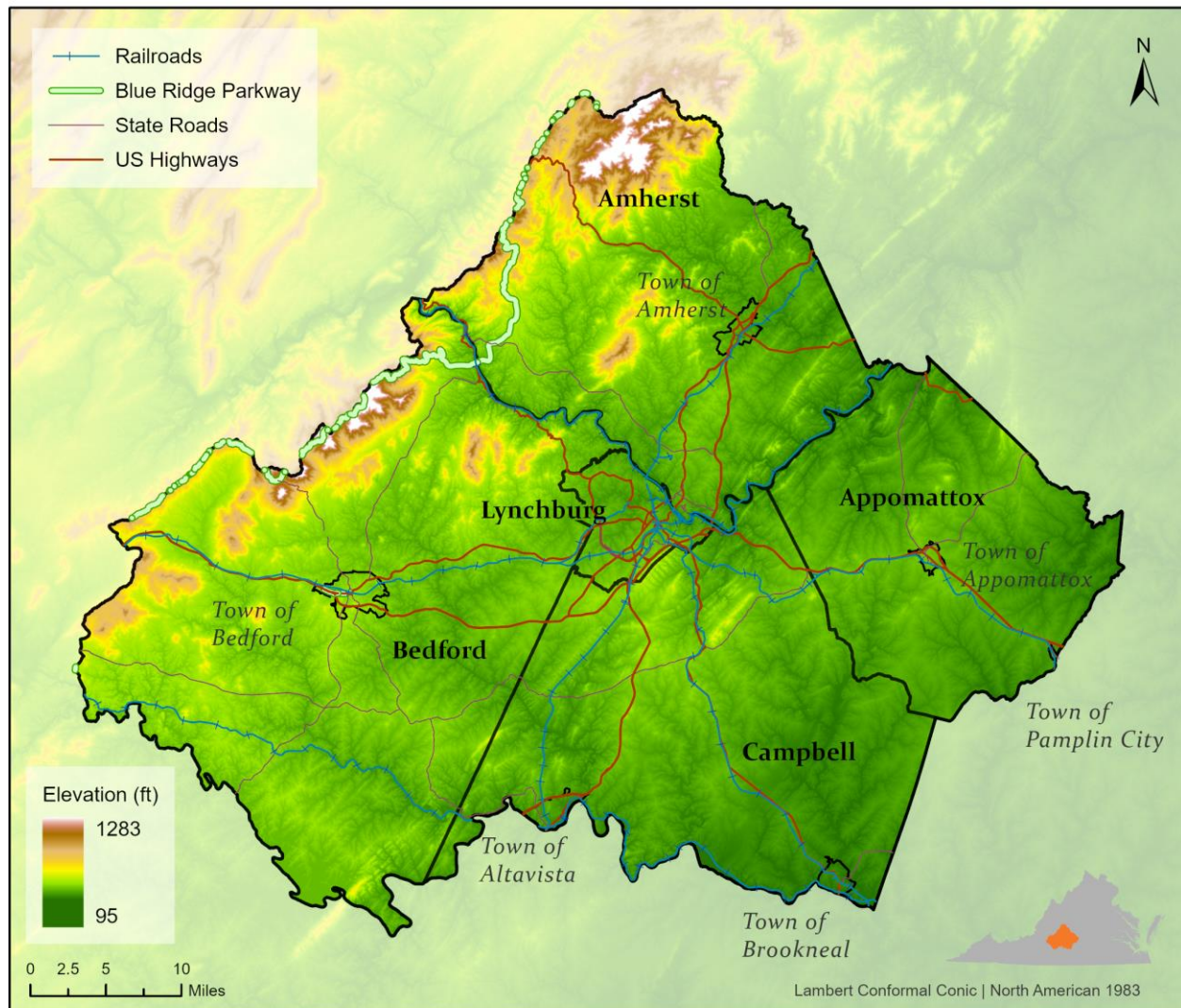




# Community Profile

## Topography of the Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: USGS Shuttle Radar Topography Mission  
Center for Geospatial Information Technology at Virginia Tech. 01/2020



Figure 2-5 Topography of the CVPDC Area

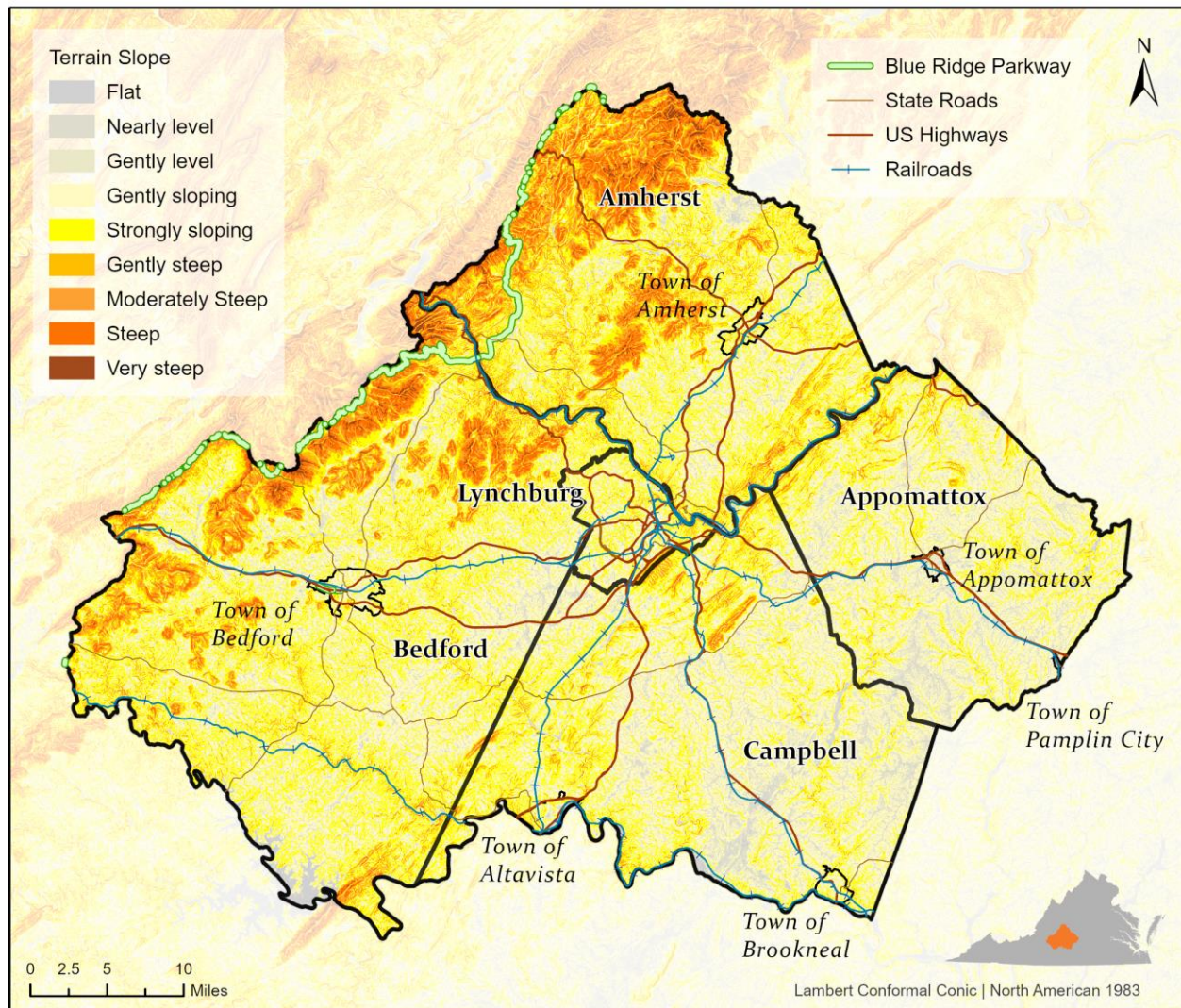




# Community Profile

## Terrain Slopes of the Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: ESRI Terrain Slope map  
Center for Geospatial Information Technology at Virginia Tech. 01/2020



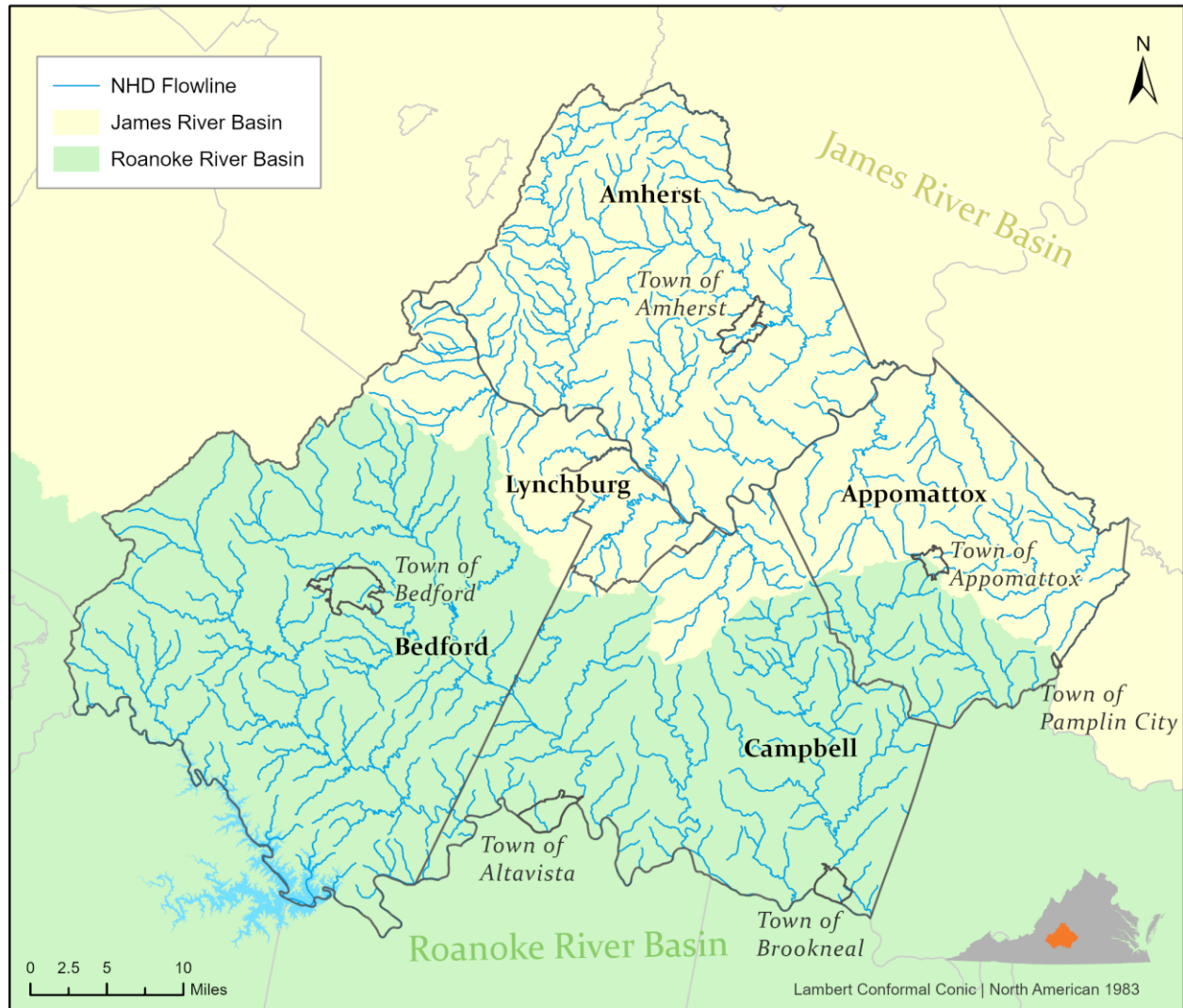
Figure 2-6 Slopes of the CVPDC Area



# Community Profile

## Major Watersheds for Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: USGS National Hydrography Dataset (NHD) & Watershed Boundary Dataset (WBD)  
Center for Geospatial Information Technology at Virginia Tech. 01/2020



(Source: USGS National Hydrography Dataset & Watershed Boundary Dataset)

Figure 2-7 Major Watersheds for CVPDC Area



# Community Profile

## 2.6 Population and Demographics

The CVPDC has experienced steady growth in population for the last several decades. Its total population in 2016 was 273,955 which represents a roughly 8% increase from the 2010 Census. The region is primarily rural, but the City of Lynchburg and the Salem-Roanoke metropolitan area to the west of the region have both experienced population growth and additional residential and commercial development which has spread into the adjacent counties.

Population growth is one of the most critical indicators to review in considering local development trends. Table 2-1 shows the breakdown of population growth rates by locality. Lynchburg City has the highest population in the region, while Bedford County experienced the highest growth rate (12.02 %). Amherst County and the Towns of Amherst, Altavista, and Brookneal experienced a slight decrease in population from 2010 through 2016. The population of Lynchburg MSA was 258,062 in 2016 - a 2.15% increase from 252,634 in the 2010 Census.

*Table 2-1 Population Change (2000-2010) in CVPDC Area*

Population	2010 Census	2016 Estimates	Growth rate (%)
Virginia	8,001,024	8,310,301	3.87
Amherst County	32,353	31,999	-1.09
Town of Amherst	2,231	2,199	-1.43
Appomattox County	14,973	15,314	2.28
Town of Appomattox	1,733	1,778	2.60
Town of Pamplin	219	221	0.91
Bedford County	68,676	76,933	12.02
Town of Bedford	6,222	6,543	5.16
Campbell County	54,842	55,061	0.40
Town of Altavista	3,450	3,422	-0.81
Town of Brookneal	1,112	1,103	-0.81
Lynchburg City	75,568	78,755	4.22

Source: Decennial Census and 2012-2016 ACS Census Population Data

### 2.6.1 Employment and Industry

When considering hazard mitigation, economic resiliency drives recovery. It is important to consider industry and business in the area so that steps can be taken to ensure disaster preparedness and lessen losses.

Certain economic characteristics present unique challenges for hazard mitigation. Clusters of unemployment and poverty could limit a household's ability to prepare for, cope with, and recover from hazards. Table 2-2 gives additional insight into the income and employment characteristics of the region's population. Most of the CVPDC localities have a lower unemployment rate than the Virginian average of 5.9%.

*Table 2-2 Income and Employment Characteristics for CVPDC Area*

Community	Median Household Income	Per Capita Income	Population Below Poverty Line (%)	Unemployment rate (%)
Virginia	\$ 66,149	\$ 34,967	11.4	5.9
Amherst County	\$ 47,002	\$ 23,372	14.1	5.5





# Community Profile

Community	Median Household Income	Per Capita Income	Population Below Poverty Line (%)	Unemployment rate (%)
Appomattox County	\$ 52,134	\$ 24,902	17.3	4.5
Bedford County	\$ 56,725	\$ 29,561	9.2	4.7
Campbell County	\$ 47,005	\$ 25,219	12.5	4.3
Lynchburg City	\$ 40,728	\$ 22,016	24.3	7.2

Source: U.S. Census Bureau 2012-2016 American Community Survey 5-Year Estimates

## 2.6.2 Industries in Lynchburg Metropolitan Statistical Area

Primary economic categories in the region include higher education, wireless technology, manufacturing automation, nuclear energy, plastics, pharmaceuticals, and health care. CVPDC belongs to one of the technology councils making up the Virginia Technology Alliance.

Table 2-3 shows the spread of workers across industry in the Lynchburg MSA. Most workers are employed in Education Services, Healthcare, and Social Assistance. Manufacturing and Retail Trade together account for 25.6% of all industry.

*Table 2-3 Spread of Workers across Industry in Lynchburg Metropolitan Statistical Area*

Industry	Number of Workers	Percent of Labor Force
Educational Services, and Health Care and Social Assistance	32,768	27.5%
Manufacturing	15,771	13.2%
Retail Trade	14,785	12.4%
Professional, Scientific, and Management, and Administrative and Waste Management Services	10,418	8.7%
Arts, Entertainment, and Recreation, and Accommodation and Food Services	9,496	8%
Construction	7,587	6.4%
Other Services, Except Public Administration	6,934	5.8%
Finance and Insurance, and Real Estate and Rental and Leasing	5,667	4.8%
Transportation and Warehousing, and Utilities	5,378	4.5%
Public Administration	4,811	4%
Wholesale Trade	2,391	2%
Information	1,903	1.6%
Agriculture, Forestry, Fishing and Hunting, and Mining	1,392	1.2%

Source: ACS 2016

*Virginia Labor Market Information publishes updated information about employment in different regions of Virginia.*

Table 2-4 shows the top employers in CVPDC, excluding local governments. Employers are overwhelmingly clustered in Lynchburg. Table 2-5 lists the top 10 employers for each jurisdiction. Large employers are important to consult when developing the Hazard Mitigation Plan. See planning process and more information about how these employers were included in mitigation.



# Community Profile

*Table 2-4 Top Employers in CVPDC Area*

Employer	Domain	Employee Size	Jurisdiction
Liberty University	Educational Services	1000 and over	Lynchburg
BWXT Nuclear Operations Group	Fabricated Metal Product Manufacturing	1000 and over	Campbell
Centra Health	Hospitals	1000 and over	Lynchburg
J. Crew Outfitters	Nonstore Retailers	1000 and over	Lynchburg
Areva NP Inc. (Framatome)	Professional, Scientific, and Technical Services	1000 and over	Lynchburg
Genworth Life and Annuity Insurance Company	Insurance Carriers and Related Activities	1000 and over	Lynchburg
Centra Health	Hospitals	500 to 999	Bedford
Abbott Laboratories	Food Manufacturing	500 to 999	Campbell
BGF Industries Inc.	Textile Mills	500 to 999	Campbell
Lynchburg College	Educational Services	500 to 999	Lynchburg
GNA Corporation	Insurance Carriers and Related Activities	500 to 999	Lynchburg
WalMart	General Merchandise Stores	500 to 999	Lynchburg
Kdc Lynchburg	Chemical Manufacturing	500 to 999	Lynchburg
Harris Corporation	Merchant Wholesalers, Durable Goods		Lynchburg
Horizon Behavioral Health	Medical	500 to 999	Lynchburg
Glad Manufacturing Company	Plastics and Rubber Products Manufacturing	250 to 499	Amherst
Greif Packaging LLC	Paper Manufacturing	250 to 499	Amherst
Central Virginia Training Center	Nursing and Residential Care Facilities	250 to 499	Amherst
WalMart	General Merchandise Stores	250 to 499	Amherst
WalMart	General Merchandise Stores	250 to 499	Bedford
GP Big Island LLC	Paper Manufacturing	250 to 499	Bedford
Mail America Communications	Professional, Scientific, and Technical Services	250 to 499	Bedford
Elwood Staffing Services Inc	Administrative and Support Services	250 to 499	Bedford
Moore's Electrical and Mechanical	Specialty Trade Contractors	250 to 499	Campbell
WalMart	General Merchandise Stores	250 to 499	Campbell
Food Lion	Food and Beverage Stores	250 to 499	Campbell
Southern Air Inc.	Specialty Trade Contractors	250 to 499	Lynchburg
Sodexo	Food Services and Drinking Places	250 to 499	Lynchburg
Central Virginia Community Services	Ambulatory Health Care Services	250 to 499	Lynchburg
Frito Lay Inc	Food Manufacturing	250 to 499	Lynchburg



# Community Profile

Employer	Domain	Employee Size	Jurisdiction
Delta Star	Electrical Equipment, Appliance, and Component Manufacturing	250 to 499	Lynchburg
Harris Corporation	Merchant Wholesalers, Durable Goods	250 to 499	Lynchburg
Central Virginia Community College	Educational Services	250 to 499	Lynchburg
Westminster Canterbury	Nursing and Residential Care Facilities	250 to 499	Lynchburg
Young Men's Christian Association	Religious, Grantmaking, Civic, Professional, and Similar Organizations	250 to 499	Lynchburg
Startek	Administrative and Support Services	250 to 499	Lynchburg
Kroger	Food and Beverage Stores	250 to 499	Lynchburg
Convergys Customer Manage Inc.	Administrative and Support Services	250 to 499	Lynchburg
Randolph College	Educational Services	250 to 499	Lynchburg
Star Mark Company	Furniture and Related Product Manufacturing	250 to 499	Lynchburg
C.B. Fleet, Inc.	Chemical Manufacturing	250 to 499	Lynchburg
U.S. Pipe	Primary Metal Manufacturing	250 to 499	Lynchburg

(Source: Virginia Employment Commission, Economic Information & Analytics, Quarterly Census of Employment and Wages (QCEW), 3rd Quarter (July, August, September) 2019. Supplemented by Lynchburg's 2019 Comprehensive Annual Financial Report.)

*Table 2-5 Top 10 Employers in CVPDC Area by Jurisdiction*

Jurisdiction	Employer	Industry	Ownership	Employee Size
Amherst	Amherst County School Board	Educational Services	Local Government	500 to 999
Amherst	Glad Manufacturing Company	Plastics and Rubber Products Manufacturing	Private	250 to 499
Amherst	County of Amherst	Executive, Legislative, and Other General Government Support	Local Government	250 to 499
Amherst	Greif Packaging LLC	Paper Manufacturing	Private	250 to 499
Amherst	Central Virginia Training Center	Nursing and Residential Care Facilities	State Government	250 to 499
Amherst	WalMart	General Merchandise Stores	Private	250 to 499
Amherst	Sweet Briar College	Educational Services	Private	100 to 249
Amherst	Johnson Health Center	Ambulatory Health Care Services	Private	100 to 249
Amherst	Food Lion	Food and Beverage Stores	Private	100 to 249
Amherst	Centra Health	Hospitals	Private	100 to 249





# Community Profile

Jurisdiction	Employer	Industry	Ownership	Employee Size
Appomattox	Appomattox County Schools	Educational Services	Local Government	250 to 499
Appomattox	WalMart	General Merchandise Stores	Private	100 to 249
Appomattox	Appomattox County Board of Supervisors	Executive, Legislative, and Other General Government Support	Local Government	100 to 249
Appomattox	Delta Response Team, LLC	Ambulatory Health Care Services	Private	50 to 99
Appomattox	Gretna Health Care Center	Nursing and Residential Care Facilities	Private	50 to 99
Appomattox	Kroger	Food and Beverage Stores	Private	50 to 99
Appomattox	Virginia Department of State Police	Justice, Public Order, and Safety Activities	State Government	50 to 99
Appomattox	Farmers Bank of Appomattox	Management of Companies and Enterprises	Private	50 to 99
Appomattox	Home Recovery	Ambulatory Health Care Services	Private	20 to 49
Appomattox	McDonald's	Food Services and Drinking Places	Private	20 to 49
Bedford	Bedford County School Board	Educational Services	Local Government	1000 and over
Bedford	County of Bedford	Executive, Legislative, and Other General Government Support	Local Government	500 to 999
Bedford	Centra Health	Hospitals	Private	500 to 999
Bedford	WalMart	General Merchandise Stores	Private	250 to 499
Bedford	Georgia-Pacific Corporation Big Island LLC	Paper Manufacturing	Private	250 to 499
Bedford	Innovairre Communications	Professional, Scientific, and Technical Services	Private	250 to 499
Bedford	Elwood Staffing Services Inc	Administrative and Support Services	Private	250 to 499
Bedford	Barr Laboratories Inc	Merchant Wholesalers, Nondurable Goods	Private	100 to 249
Bedford	Food Lion	Food and Beverage Stores	Private	100 to 249
Bedford	Sentry Equipment and Erectors, Inc	Machinery Manufacturing	Private	100 to 249
Campbell	BWXT Nuclear Operations Group	Fabricated Metal Product Manufacturing	Private	1000 and over
Campbell	Campbell County Schools	Educational Services	Local Government	1000 and over
Campbell	Abbott Laboratories	Food Manufacturing	Private	500 to 999
Campbell	BGF Industries Inc.	Textile Mills	Private	500 to 999



# Community Profile

Jurisdiction	Employer	Industry	Ownership	Employee Size
Campbell	Moore's Electrical and Mechanical	Specialty Trade Contractors	Private	250 to 499
Campbell	Campbell County	Social Assistance	Local Government	250 to 499
Campbell	WalMart	General Merchandise Stores	Private	250 to 499
Campbell	Food Lion	Food and Beverage Stores	Private	250 to 499
Campbell	Schrader Bridgeport International Inc.	Transportation Equipment Manufacturing	Private	100 to 249
Campbell	Foster Fuels Inc.	Merchant Wholesalers, Nondurable Goods	Private	100 to 249
Lynchburg	Liberty University	Educational Services	Private	8000 and over
Lynchburg	Centra Health	Hospitals	Private	5000 to 5999
Lynchburg	Lynchburg City Schools	Educational Services	Local Government	1500 to 1999
Lynchburg	City of Lynchburg	Executive, Legislative, and Other General Government Support	Local Government	1000 to 1499
Lynchburg	Areva NP Inc. (Framatome)	Professional, Scientific, and Technical Services	Private	1000 to 1499
Lynchburg	Genworth Life and Annuity Insurance Company	Insurance Carriers and Related Activities	Private	1000 to 1499
Lynchburg	J. Crew Outfitters	Nonstore Retailers	Private	1000 to 1499
Lynchburg	Harris Corporation	Merchant Wholesalers, Durable Goods	Private	500 to 999
Lynchburg	Horizon Behavioral Health	Medical	Private	500 to 999
Lynchburg	KDC/Tri-tech Laboratories Inc.	Chemical Manufacturing	Private	500 to 999

(Source: Virginia Employment Commission, Economic Information & Analytics, Quarterly Census of Employment and Wages (QCEW), 3rd Quarter (July, August, September) 2019. Supplemented by Lynchburg's 2019 Comprehensive Annual Financial Report.)

## 2.6.3 Housing

According to the U.S. Census Bureau 2012-2016 American Community Survey 5-Year Estimates, there are 122,116 housing units in CVPDC. Over 85% of these units are occupied. A small majority of houses were built after 1970 (~52%) (Table 2-6).



# Community Profile

Table 2-6 Housing Statistics for CVPDC Area

Community	Housing Units	Occupied Housing Units			% of Housing Structures Built Before 1970	Median Value
		Total	Owner	Renter		
Virginia	3,445,357	3,090,178	2,032,761	1,057,417	32.32 %	\$248,400
Amherst County	14,067	12,306	9,434	2,872	35.25 %	\$149,400
Appomattox County	7,085	5,972	4,757	1,215	31.88 %	\$149,600
Bedford County	35,819	30,821	25,056	5,765	22.78 %	\$196,900
Campbell County	25,249	22,294	16,897	5,397	30.07 %	\$152,600
Lynchburg City	32,324	28,282	14,291	13,991	52.19 %	\$149,600

Source: U.S. Census Bureau 2012-2016 American Community Survey 5-Year Estimates

## 2.6.4 Development Trends

### 2.6.4.1 Land Cover Change

FEMA requires that the local mitigation plans provide a general description of community land uses and development trends so that mitigation options can be considered in future land use decisions to ensure safe development. Changes in urban, forest, and agricultural land cover may help to highlight areas within the region that should be considered in the long-term comprehensive plans.

The National Land Cover Dataset produced by the Multi-Resolution Land Characteristics Consortium (MRLC), was used to identify the land cover changes in CVPDC. The MLRC consortium is a group of federal agencies who coordinate and generate consistent and relevant land cover information at the national scale at a 30m resolution. The NLCD datasets for 2001 and 2011 were compared to map land cover changes during that decade.

Most of the change in CVPDC has occurred in forested lands followed by developed areas shown in Table 2-7. From 2001 through 2011, forested land cover has decreased, and developed and agricultural areas have increased across the region. Every county in the region saw an increase in developed land and decrease in forested land. Figure 2-8 and Figure 2-9 show the distribution of land cover for CVPDC Area.

Table 2-7 National Land Cover Change 2001 to 2011 in CVPDC Area

Jurisdiction	Developed Area Change (Acres)	Forest Change (Acres)	Agricultural Change (Acres)
Amherst County	870	-5306	98
Appomattox County	87	-6274	447
Bedford County	1385	-7931	308
Campbell County	686	-13914	2491
Lynchburg City	1101	-774	-20
CVPDC Total	4128	-34200	1081



# Community Profile

## **2.6.4.2 Future Growth Areas**

FEMA states that an effective way to reduce future losses in a community is to avoid development in known precarious locations and to enforce development of safe structures in other areas. Thus, a general description of population growth and development trends within the planning area is an important factor in formulating mitigation options that influence future land use and development decisions. The jurisdictions' comprehensive plans were used to identify future growth areas and Figure 2-9 identifies those areas.

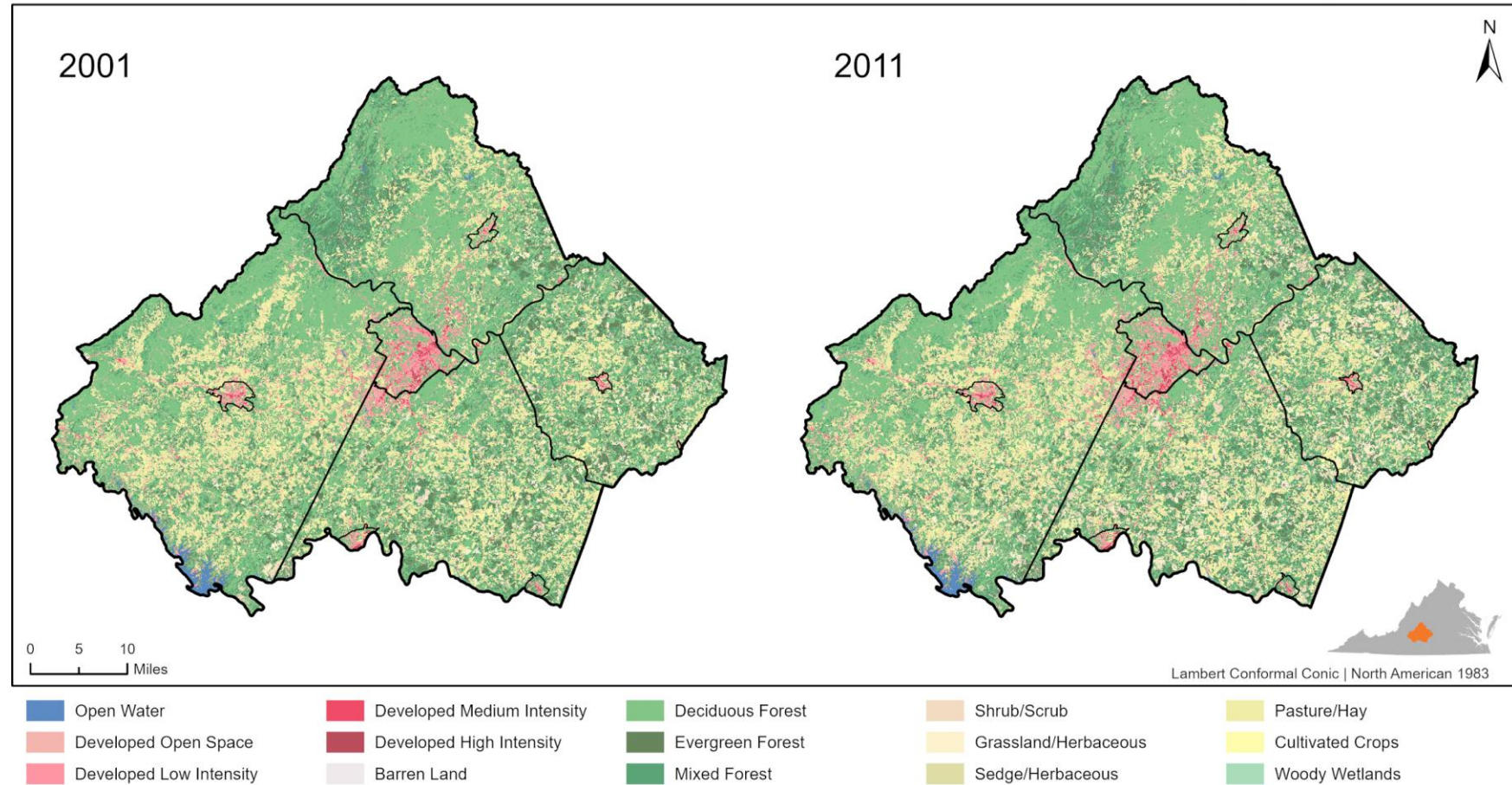




# Community Profile

## Land Cover Change in Central Virginia PDC, 2001 - 2011

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: National Land Cover Database (NLCD) 2001 and 2011  
Center for Geospatial Information Technology at Virginia Tech. 01/2020

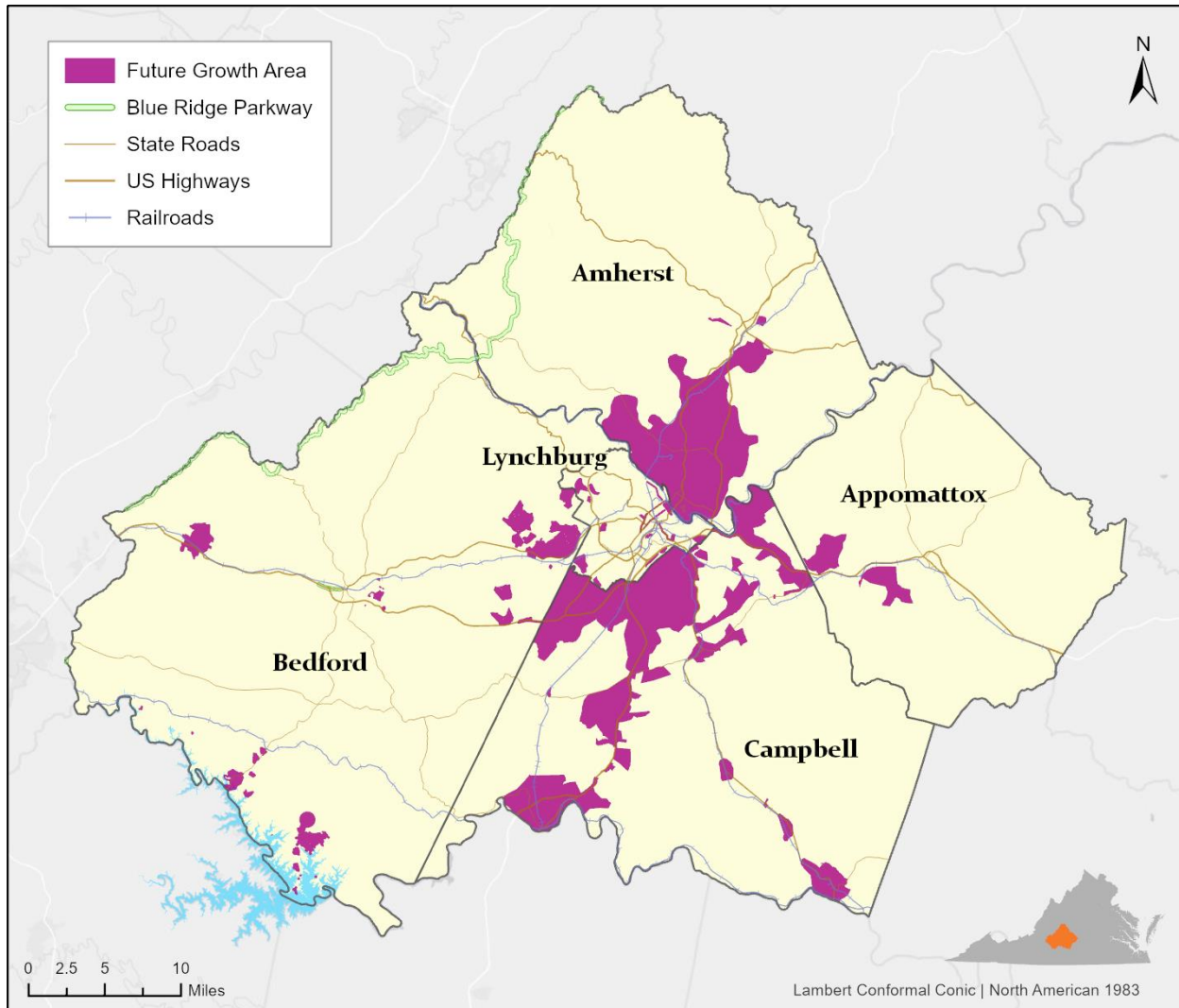
Figure 2-8 Land cover categories in CVPDC Area, 2001 and 2011



# Community Profile

## Future Growth Areas in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: US Census Bureau; CVPDC jurisdictions  
Center for Geospatial Information Technology at Virginia Tech. 01/2020



Figure 2-9 Future Growth Areas in CVPDC Area

### 2.6.4.3 Traffic Analysis Zones

The Census defines Transportation or Traffic Analysis Zones (TAZ) as a special-purpose geographic entity delineated by state and local transportation officials for tabulating traffic-related data from the decennial census, especially journey-to-work and place-of-work statistics from the Census Transportation Planning Package distributed by the Federal Bureau of Transportation Statistics. The TAZ data in the Central Virginia Metropolitan Planning Organization (MPO) was provided by the Virginia Department of Transportation Central Office Modeling Department. Population data are broken down into two data sets; year 2016 data and year 2045 projections both derived from Virginia population estimates by the Weldon Cooper Center. Table 2-8,



# Community Profile

Table 2-9, Table 2-10, and Table 2-11 provide TAZ characteristics in the MPO including population, employment, automobile, and household data.

*Table 2-8 Projected Population Change in Central Virginia MPO, 2016 - 2045*

Jurisdiction	% of Total Growth in MPO	2016 MPO Population	2045 MPO Population	MPO Absolute Change	% Growth
Amherst County	91%	22,986	23,605	619	2.7%
Bedford County	52%	26,626	34,733	8,107	30.4%
Campbell County	77%	32,585	39,070	6,485	19.9%
Lynchburg City	100%	80,299	100,089	19,790	24.6%
Total	---	162,496	197,497	35,001	21.5%

*Table 2-9 Projected Number of Households Change in Central Virginia MPO, 2016 - 2045*

Jurisdiction	2016 MPO Households	2045 MPO Households	MPO Absolute Change	% Growth
Amherst County	9,811	10,123	312	3%
Bedford County	11,072	14,921	3,849	35%
Campbell County	14,468	17,809	3,341	23%
Lynchburg City	35,045	44,362	9,317	27%
Total	70,396	87,215	16,819	24%

*Table 2-10 Projected Employment Change in Central Virginia MPO, 2016 - 2045*

Jurisdiction	2016 MPO Employment	2045 MPO Employment	MPO Absolute Change	% Change
Amherst County	7,714	8,824	1,110	14%
Bedford County	8,672	10,926	2,254	26%
Campbell County	10,378	13,031	2,653	26%
Lynchburg City	59,453	72,260	12,807	22%
Total	86,217	105,041	18,824	22%

*Table 2-11 Projected Number of Automobiles Change in Central Virginia MPO, 2016 - 2045*

Jurisdiction	2016 MPO Automobiles	2045 MPO Automobiles	MPO Absolute Change	% Change
Amherst County	18,043	18,599	556	3%
Bedford County	21,443	28,445	7,002	33%
Campbell County	25,989	31,782	5,793	22%
Lynchburg City	51,794	66,854	15,060	29%
Total	117,269	145,680	28,411	24%



# Community Profile

Figure 2-10 and Figure 2-11 are the projected employment and population changes in the Central Virginia MPO. According to these TAZ maps, there is regional growth in and around Lynchburg and in the MPO area, especially in the Wards Road (Liberty University) and Timberlake road areas.

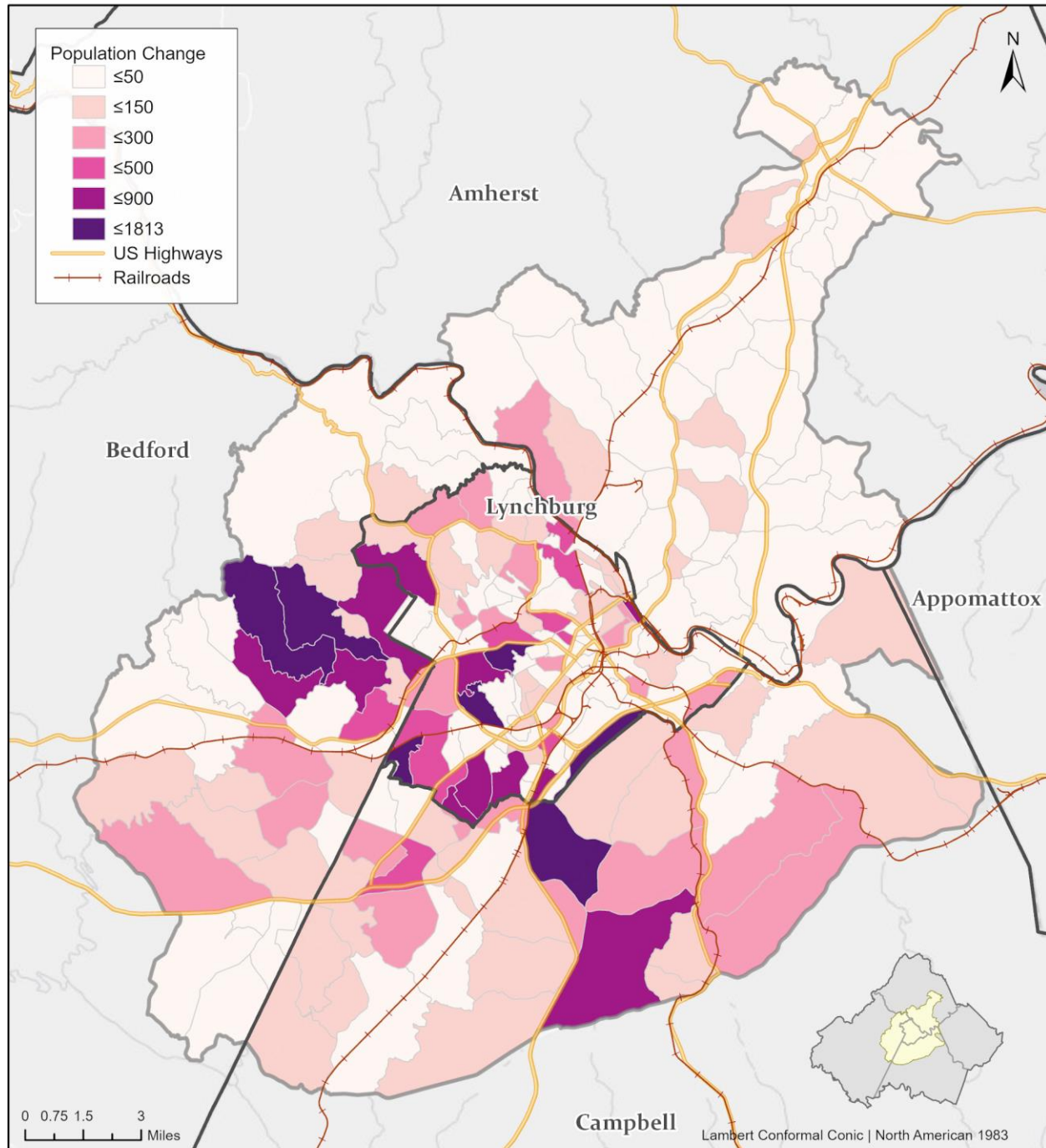




# Community Profile

## TAZ characteristics: Population Change in Central Virginia MPO, 2016-2045

Central Virginia PDC Hazard Mitigation Plan Update 2020



The Traffic Analysis Zones (TAZ) data in the Central Virginia Metropolitan Planning Organization (MPO) was provided by the Virginia Department of Transportation Central Office Modeling Department. Population data for year 2016 and 2045 projections both derived from Virginia population estimates by Weldon Cooper Center.

Data source: University of Virginia Weldon Cooper Center 2017; U.S. Census Bureau Center for Geospatial Information Technology at Virginia Tech. 01/2020



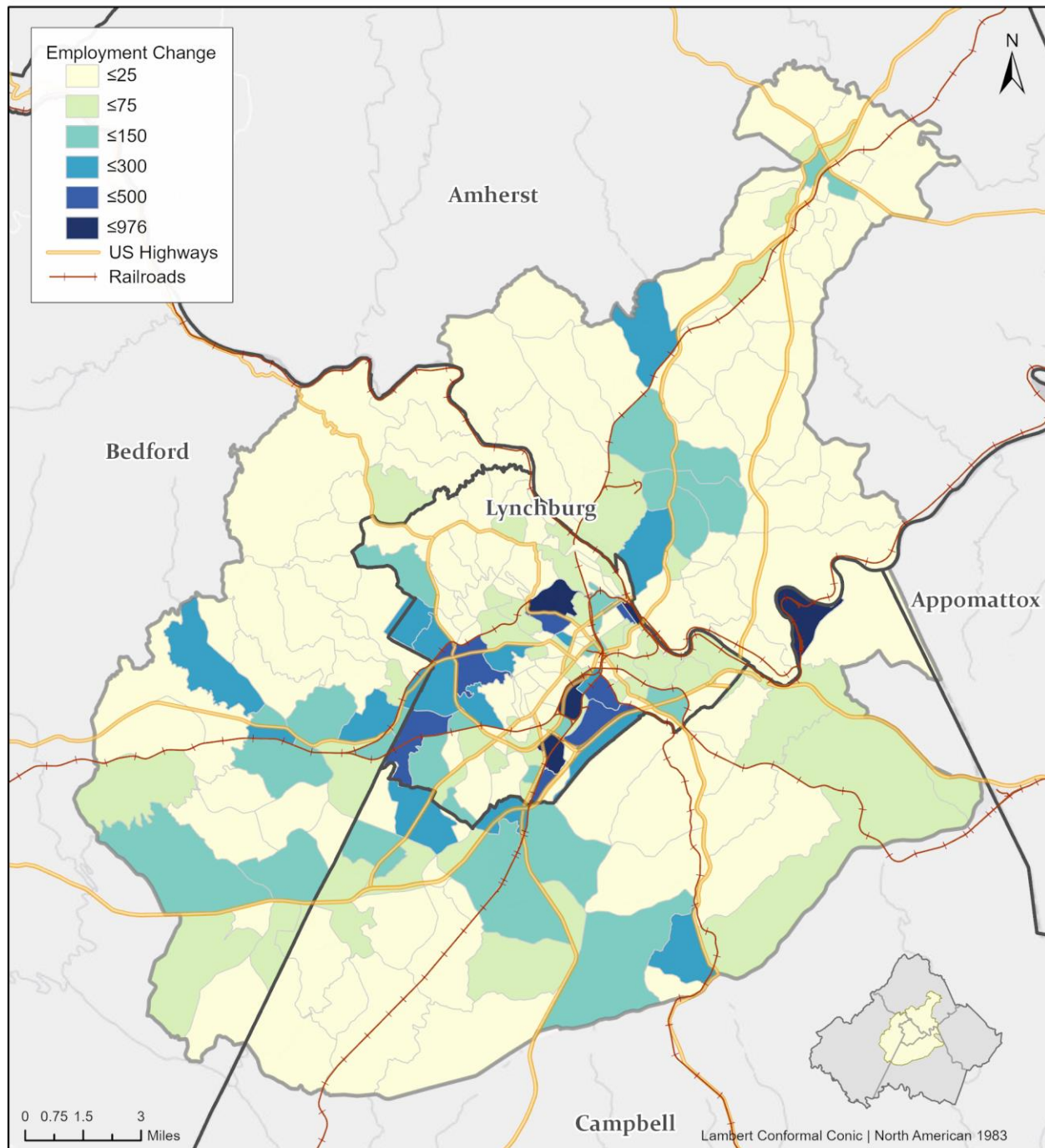
Figure 2-10 TAZ characteristics: Population Change in Central Virginia MPO, 2016-2045



# Community Profile

## TAZ characteristics: Employment Change in Central Virginia MPO, 2016-2045

Central Virginia PDC Hazard Mitigation Plan Update 2020



The Traffic Analysis Zones (TAZ) data in the Central Virginia Metropolitan Planning Organization (MPO) was provided by the Virginia Department of Transportation Central Office Modeling Department. Population data for year 2016 and 2045 projections both derived from Virginia population estimates by Weldon Cooper Center.

Data source: University of Virginia Weldon Cooper Center 2017; U.S. Census Bureau Center for Geospatial Information Technology at Virginia Tech. 01/2020



Figure 2-11 TAZ characteristics: Employment Change in Central Virginia MPO, 2016-2045



# Community Profile

## 2.7 References

- Bedford County. *Bedford County 2030 Comprehensive Plan*. August 10, 2015. <https://www.bedfordcountyva.gov/home/showdocument?id=3948>
- Central Virginia Metropolitan Planning Organization, and Virginia Department of Transportation Lynchburg District. *Traffic Analysis Zone (TAZ) Data: Technical Memorandum, 2045 Forecasts Modeling Methodology, TAZ Allocation*. March 2018.
- City of Lynchburg. 2019 Comprehensive Annual Financial Report. 2019. [https://www.lyncburgva.gov/sites/default/files/COLFILES/Financial-Services/Financial\\_Acct/2019%20CAFR.pdf](https://www.lyncburgva.gov/sites/default/files/COLFILES/Financial-Services/Financial_Acct/2019%20CAFR.pdf)
- FEMA. *Local Mitigation Planning Handbook*. March 2013 [https://www.fema.gov/media-library-data/20130726-1910-25045-9160/fema\\_local\\_mitigation\\_handbook.pdf](https://www.fema.gov/media-library-data/20130726-1910-25045-9160/fema_local_mitigation_handbook.pdf)
- Multi-Resolution Land Characteristics Consortium. *National Land Cover Database (NLCD)*. Retrieved from <https://www.mrlc.gov/data>
- Virginia's Region 2000 Local Government Council. *2035 Rural Long Range Transportation Plan*. 2011. <http://www.virginiadot.org/projects/resources/Rural/Region2000.pdf>
- Charlie Grymes. *Virginia Cities That Have "Disappeared" - and Why*. Virginia Places.org. <http://www.virginiaplaces.org/vacities/formercities.html>
- Virginia Land Cover. Virginia Geographic Information Network (VGIN). <https://www.vita.virginia.gov/integrated-services/vgin-geospatial-services/land-cover/>
- U.S. Census Bureau. American Community Survey: 2012—2016 ACS 5-Year Data Profile.
- Virginia Employment Commission. *Virginia Labor Market Information*. 2018
- University of Virginia Weldon Cooper Center, Demographics Research Group. *Virginia Population Estimates*. 2017. Retrieved from <https://demographics.coopercenter.org/virginia-population-estimates>
- US Geological Survey. *National Hydrography Dataset (NHD) & Watershed Boundary Dataset (WBD)*. Retrieved from <https://www.usgs.gov/core-science-systems/ngp/national-hydrography>



A person wearing a brown t-shirt, blue shorts, a grey cap, and a large green and black backpack is riding a bicycle away from the camera on a paved path. The path is surrounded by dense green trees and foliage. In the foreground, the back of a person wearing a light blue shirt and dark shorts is visible on the left. The text "PLANNING PROCESS" is overlaid in white, bold, sans-serif font on the lower left side of the image.

# PLANNING PROCESS





# Planning Process

## 3.0 Planning Process

### 3.1 2020 Update - Summary of Changes

The Central Virginia PDC Hazard Mitigation Plan is officially an update of the *Region 2000 Hazard Mitigation Plan*, approved by FEMA in 2013. However, the planning process and pre-hazard mitigation document have been developed through an entirely new evaluation, vulnerability analysis, and mitigation strategy evaluation and development process. Most importantly, this plan was developed through a more comprehensive stakeholder input and participation process (details provided in Appendix D and E). As such, this document does not build upon past efforts but rather has been developed to accurately reflect current data, goals, and strategies that better reflect the interconnection of hazard mitigation and resiliency planning to the broad range of policies and programs, including transportation, community development, housing, watershed protection, emergency services, and economic sustainability.

The updated Planning Process chapter differs from the previous plan in the following ways:

- **Additional stakeholders.** For the updated HMP, additional stakeholders from the colleges and universities, private sector, and non-profit were added to the Technical Advisory Committee or brought in for specific input during the process.
- **Modern outreach.** Social media was used in conjunction with the more traditional methods of public outreach such as television and newspapers.
- **More detailed HIRA, capabilities assessment, and mitigation selection process.** Additional, detailed data was available to conduct a better risk assessment especially for the flood and dam failure hazards. The capabilities assessment includes a checklist of what a community has and doesn't have instead of a subjective low, medium, and high ranking. The mitigation section includes several regional and local mitigation actions, identification of who will be working on them, and any programs, including grant opportunities, which can support them.

### 3.2 Introduction

On November 2, 2017, the Central Virginia Planning District Commission (CVPDC), previously known as the Region 2000 Local Government Council, entered into contract with FEMA and VDEM to execute an update to the Region 2000 Hazard Mitigation Plan. On April 25, 2018 the Central Virginia Planning District Commission, CVPDC, retained the services of Virginia Tech's Center for Geospatial Information Technology (CGIT) to lead and produce the regional mitigation plan document. CGIT, along with the sub-contractual services of Sobis, Incorporated, beginning on February 28, 2020, served in the following capacity to complete the regional hazard preparedness plan.

1. Data Collection
2. Hazard Prioritization
3. Asset Inventory and Evaluation
4. Loss Estimates
5. HIRA Results Presentation and Report



# Planning Process

6. Capability Assessment
7. Alternative Hazard Mitigation Measures and Needs
8. Development of Implementation Strategy
9. Production of Final Plan

The preparation of this plan update at the regional level was decided as the most cost and time effective solution for consistent and full coverage of the localities in CVPDC. In 2018, CVPDC began coordination with the counties of Amherst, Appomattox, Bedford, Campbell; City of Lynchburg; and the towns of Altavista, Bedford, Brookneal, Amherst, and Pamplin City to develop and implement the HMP update.

## 3.3 FEMA Hazard Mitigation Plan Process

FEMA provides guidance in its Local Mitigation Planning Handbook (FEMA 2013) for developing a local hazard mitigation plan. The nine-step process can be found in Figure 3-1. A *Local Mitigation Plan Review Tool*, found in Appendix B: FEMA Crosswalk, provides a detailed summary of FEMA's current minimum standards of acceptability for compliance with DMA2K and notes the location where each requirement is met within the Plan. These standards are based upon FEMA's Interim Final Rule as published in the Federal Register on February 26, 2002, and October 31, 2007, in Part 201 of the Code of Federal Regulations (CFR).



Figure 3-1 FEMA Guidance on Developing Local Hazard Mitigation Plans

## 3.4 Planning Team

The CVPDC was responsible for organizing and coordinating a team of stakeholders, that included representation from participating localities, and stakeholders from state and federal agencies, area businesses, and other interested citizen stakeholders.

Each of the region's participating jurisdictions, (except for the Town of Pamplin, which was represented by Appomattox County) were active participants in the development of this plan and had dedicated staff that participated in and directly guided its development.

## 3.5 Primary Technical Advisory Committee (TAC) Meetings

A project management team, comprised of locality representatives, was established to guide the planning process and plan development. The Planning and Development Deputy Director for CVPDC, Kelly Hitchcock, presided over the mitigation planning efforts for the region. Table 3-1 is a list of project management team members. Additionally, a Technical Advisory Committee (TAC), made up of local and state emergency, planning,



# Planning Process

resource management professionals, business, college, agency, and VDEM staff, and local citizens coordinated to review and evaluate data, develop strategies, and guided the plan development. Efforts to involve local and county departments, as well as other regional and community organizations that might have a role in the implementation of the mitigation actions or policies, included invitations to attend meetings and serve on the committee, emails of minutes and updates, and opportunities for input and comment on all draft deliverables. This effort pulls together many community-initiated actions and serves as a sounding board for all the stakeholders within the CVPDC planning area.

*Table 3-1 Project Management Team Members*

Representative	Title	Jurisdiction / Organization
Kelly Hitchcock	Planning and Development Coordinator	CVPDC
Sharon Williams	Community Development Director	Altavista, Town of
Thomas Fore	Director of Public Utilities	Altavista, Town of
Samuel Bryant	Director, Fire Chief - Marshal	Amherst County Public Safety
Robert "Bob" Hopkins	Director of Public Utilities	Amherst County Service Authority
Sara Carter	Town Manager	Amherst, Town of
Johnnie Roark	Director of Community Development	Appomattox County
Bobby Wingfield	Public Safety Director, Emergency Manager Coordinator	Appomattox County
Jeff Elder	Director of Operations	Appomattox, Town of
Gary Shanaberger	Town Manager	Appomattox, Town of
Jack Jones	Chief of Department, Dept. of Fire & Rescue	Bedford County
Jeff Johnson	Director of Emergency Communications	Bedford County
Mary Zirkle	Economic Development Coordinator	Bedford, Town of
Mike Crews	Public Works Director	Brookneal, Town of
Jonaaron Evans	Communications Technician	Campbell County
Tracy Fairchild	Director/Emergency Coordinator, CC Public Safety	Campbell County
Myra Simpson	Deputy-Director of Public Safety	Campbell County
Melissa Foster	Director, Dept. of Emergency Services	Lynchburg City
Erin Hawkins	Water Quality Manager, Water Resources Dept.	Lynchburg City
Jeff Martin	Assistant Director, Water Resources Dept.	Lynchburg City
Piper VanDePerre	Emergency Programs Specialist, Dept. of Emergency Services	Lynchburg City
Curt Whitlock	Managing Director Accreditation, Safety & Security	Centra Health
Brittany Powell	Local Health Emergency Coordinator	VDH - Central Virginia Health District
Christopher Bruce	All-Hazards Emergency Planner	VDEM Region 3
Jonathan Simmons	All-Hazards Emergency Planner	VDEM Region 6
Lauren Pillow	Hazardous Waste Inspector	VA DEQ
Gregory Bennett	Director Health & Environmental Safety	Liberty University
Ralph Lawson	Disaster Program Manager	Red Cross - Virginia Region
Bob Driskill	Director, Office of Campus Safety	University of Lynchburg



# Planning Process

While the plan development was primarily overseen by the Project Management Team, throughout the process there were locality staff and stakeholders, organizations and businesses, and hazard specialists including government agency experts attending meetings and providing technical information. This group of people served as the TAC and in many cases overlapped with the Project Management Team. The TAC focused on providing expertise for the development of hazard, vulnerability, and risk analysis; capability analysis; and mitigation strategy development. A review of the participation and range of contributors can be found with meeting summaries provided in Appendix D: Meeting Documentation. A list of the Technical Advisory Committee members is provided in Table 3-2.

*Table 3-2 Technical Advisory Committee Members for CVPDC Hazard Mitigation Plan 2020 Update*

Name	Community / Organization	Department and/or Expertise
Kelly Hitchcock	Planning and Development Coordinator	CVPDC
Sharon Williams	Altavista, Town of	Community Development Director
Thomas Fore	Altavista, Town of	Director of Public Utilities
Samuel Bryant	Amherst County Public Safety	Director, Fire Chief - Marshal
Robert "Bob" Hopkins	Amherst County Service Authority	Director of Public Utilities
Sara Carter	Amherst, Town of	Town Manager
Johnnie Roark	Appomattox County	Director of Community Development
Bobby Wingfield	Appomattox County	Public Safety Director, Emergency Manager Coordinator
Jeff Elder	Appomattox, Town of	Director of Operations
Gary Shanaberger	Appomattox, Town of	Town Manager
Jack Jones	Bedford County	Chief of Department, Dept. of Fire & Rescue
Jeff Johnson	Bedford County	Director of Emergency Communications
Mary Zirkle	Bedford, Town of	Economic Development Coordinator
Mike Crews	Brookneal, Town of	Public Works Director
Jonaaron Evans	Campbell County	Communications Technician
Tracy Fairchild	Campbell County	Director/Emergency Coordinator, CC Public Safety
Myra Simpson	Campbell County	Deputy-Director of Public Safety
Melissa Foster	Lynchburg City	Director, Dept. of Emergency Services
Erin Hawkins	Lynchburg City	Water Quality Manager, Water Resources Dept.
Jeff Martin	Lynchburg City	Assistant Director, Water Resources Dept.
Piper VanDePerre	Lynchburg City	Emergency Programs Specialist, Dept. of Emergency Services
Curt Whitlock	Centra Health	Managing Director Accreditation, Safety & Security
Kristin Owen	VA DCR	Acting NFIP Coordinator; CRS Coordinator
Anne Witt	DMME - Division of Geology and Mineral Resources	Geohazards Scientist





# Planning Process

Name	Community / Organization	Department and/or Expertise
Brittany Powell	VDH - Central Virginia Health District	Local Health Emergency Coordinator
Christopher Bruce	VDEM Region 3	All-Hazards Emergency Planner
Jonathan Simmons	VDEM Region 6	All-Hazards Emergency Planner
Lauren Pillow	VA DEQ	Hazardous Waste Inspector
Phil Hysell	National Weather Service/NOAA	Warning Coordination Specialist
Gregory Bennett	Liberty University	Director Health & Environmental Safety
Ralph Lawson	Red Cross - Virginia Region	Disaster Program Manager
Bob Driskill	University of Lynchburg	Director, Office of Campus Safety
Peter Sforza	CGIT	Consultant
Haitao Wang	CGIT	Consultant
Aishwarya Borate	CGIT	Consultant
Bill Bohn	Sobis, Inc.	Consultant

## 3.6 Coordination with other Agencies, Entities, and Plans

Development of this plan included outreach and consultation in establishment of plan data development, vulnerability data analysis, and in direct chapter review and plan comments. Agencies contacted or directly contributing to data review and plan development include:

- Virginia Department of Emergency Management (VDEM)
- Virginia Department of Conservation and Recreation (DCR), Dam Safety, and Floodplain Management
- Virginia Department of Mines, Minerals and Energy, Division of Geology and Mineral Resources (DMME)
- Virginia Department of Environmental Quality (DEQ)
- Virginia Department of Health, Central Virginia Health District
- City of Lynchburg, Department of Water Resources
- City of Lynchburg, Department of Emergency Services
- Liberty University, University of Lynchburg, Randolph College, and Sweet Briar College
- BWXT, Centra, Framatome, and Georgia Pacific
- Central Shenandoah, Roanoke Valley, Thomas Jefferson, and West Piedmont Planning Districts

## 3.7 Public Involvement

The plan was prepared in 4 main phases which are shown in Figure 3-2. The public outreach components are shown in green.



# Planning Process

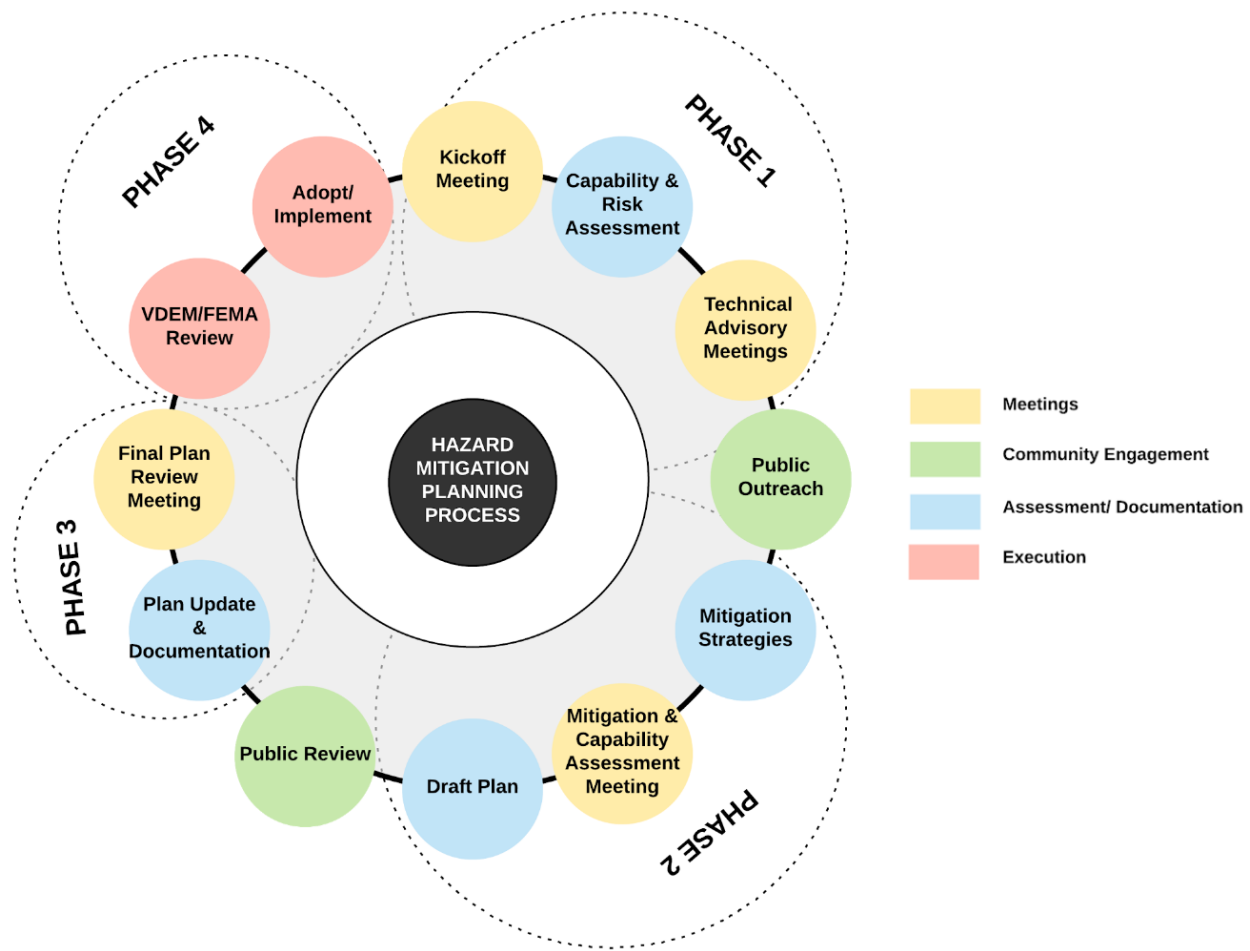


Figure 3-2 Hazard Mitigation Planning Process

Public input and participation in the plan development were solicited throughout the planning process. The CVPDC incorporated a mitigation plan development within its website, and meeting announcements and meeting materials were posted on the CVPDC and locality websites. Articles about the plan development, public participation, and an overview of hazard mitigation in general were featured with the CVPDC newsletter and social media postings.

Two public input sessions occurred during plan development. The first round of public input took place in late fall 2019. Activities to engage the public during the first public input season held on December 4, 2019 at the Miller Center (301 Grove Street in Lynchburg City) included: (1) using the local news outlets, locality websites, and social media to inform the general public; (2) adding the HMP information session as an agenda item at each policy board meeting, including CVPDC staff presentation at Amherst Town, Amherst County, and Altavista Town in November; (3) a public survey was conducted which results provided in the Hazard Identification and Risk Assessment (HIRA) section of this plan; and (4) posting information on the session in the Lynchburg City public newsletter. During the December public meeting and policy board information sessions, an overview of the HMP planning process, hazards that would be included, a review of the hazard analysis and vulnerability process, project timeline, and how the public could participate, including taking the hazard survey, was provided.



# Planning Process

The second public meeting was held virtually on June 25, 2020 due to COVID-19. Information and participation details of this meeting, as with the first meeting, were provided to all of the regional news outlets, including each locality and CVPDC website; posted on locality and CVPDC Facebook and other social outlet sites; and included in the CVPDC regional newsletter. During this meeting, participants were provided with: (1) a summary of the hazard vulnerability and analysis (HIRA) section; (2) an overview of the draft CVPDC Regional Hazard Mitigation Plan website, that included a review of the interactive mapping and how individuals could assess their homes, business, and other places of interest; (3) information on how to review and comment on regional strategies; and (4) an updated project schedule.

Additionally, the complete Draft CVPDC HMP will be provided to the surrounding PDCs, VDEM, and FEMA for review concurrently. As with every stage in the planning process, all comments will be recorded and may be made directly on the mitigation plan website or by directly contacting CVPDC staff.

Finally, the CVPDC Regional Hazard Mitigation Plan, after incorporation of review recommendations and upon approval by FEMA and VDEM, will be presented to each of the participating localities for review by the jurisdictions and public. Throughout the review, approval, and adoption process, the public will have the opportunity to provide comments.

Appendix C: Acronyms provides a list of Acronyms used in this plan. A summary of meeting agendas and participations is provided in Appendix D: Meeting Documentation, public outreach efforts are documented in Appendix E: Public Involvement Documentation, and plan comments are provided in Appendix F: Plan Comments.

## 3.8 Hazard Identification and Risk Analysis (HIRA)

The CVPDC is vulnerable to a wide array of natural, technological, and man-made hazards that threaten life and property. In the hazard identification process, the planning team reviewed the hazards in the CVPDC Regional Hazard Mitigation Plan and the Commonwealth of Virginia Hazard Mitigation Plan (2018), then identified and updated the list of potential hazards to conduct further risk and vulnerability assessment based on these hazards' previous occurrence and the communities' exposure to the hazards.

The project management team established a hazard risk assessment methodology to assess the potential risk and vulnerability of the entire planning area and of each participating jurisdiction. The risk assessment methodology utilizes a combination of public input and information provided by elected officials, key stakeholders, and residents throughout the planning area; publicly available data on previous occurrences; and other sources of information, when available.






This HMP update provides a more detailed hazard risk and vulnerability assessment for the planning area and can be found in the Hazard Identification and Risk Assessment chapter. This includes hazard identification, hazard background, historical occurrences, vulnerability assessment, potential losses, and future development and vulnerability for all participants. This detailed analysis was used to support the mitigation analysis in identifying vulnerable areas and understanding the hazards in which to focus. Additionally, the HMP update includes the inundation areas developed for the high hazard dam Emergency Action Plans (EAPs). These inundation areas were georeferenced if they weren't already in a GIS format and used to determine exposure.



# Planning Process



## 3.9 Capabilities Assessment

The CVPDC set up individual meetings with the jurisdictions to discuss their planning, legal, administrative, fiscal, and technical capabilities. The jurisdictions described their local staffing, budgets, plans and ordinances in place, and specialized experience. This information was used to help identify specific mitigation actions each jurisdiction could take over the next five years. The capabilities were defined by the following types:

Capabilities	Description
 Planning	Examines the plans, policies, and programs in place which can be used for hazard mitigation.
 Legal	Presents the authorities a jurisdiction can use to support hazard mitigation through regulations, acquisition, ordinances, and code enforcement.
 Administrative	Describes the local government and departments in a jurisdiction focusing on those entities that would be involved with hazard mitigation.
 Fiscal	Identifies the local budgets, taxation, and potential sources of funding.
 Technical	Provides information on the types and numbers of technical staff involved with hazard mitigation within the jurisdiction.

## 3.10 Mitigation Strategies




Through a series of meetings with the full TAC and through individual stakeholder outreach, regional mitigation goals, objectives, and actions were developed. The regional strategies provide the foundation for the CVPDC and individual localities and a menu of potential mitigation actions - programs, policies, and projects – with which to seek implementation opportunities. Both the regional and locality mitigation actions are defined and organized by the following strategy types:

Strategy Type	Purpose	Mitigation Action Goal
Information & Outreach (I) 	Actions to inform/educate on practices to lessen vulnerability and hazard impact to individuals and property.	Increase hazard awareness and preparedness activity participation by area individuals, property, and businesses.
Prevention Capacity (C) 	Programmatic and policy actions taken by locality or organization including planning, data evaluation,	Through government operations, business and private sector partnership, advance planning initiatives, voluntary and regulatory programs and





# Planning Process

Strategy Type	Purpose	Mitigation Action Goal
	regulatory programs, maintenance to lessen hazard vulnerability.	maintenance practices to lessen hazard impacts.
Property Protection (P) 	Measures to fortify structures or practices, such as removal, to reduce or eliminate hazard impacts.	Support property and infrastructure fortification programs and projects to lessen haze impacts to lives, property, and infrastructure.
Structural Project (S) 	Extensive modification of existing or new structure construction of the size and range that requires study(s), engineering, permitting, maintenance, comprehensive funding structure.	Execute measure that significantly lessen the impact of natural hazard impact to lives, communities, property and infrastructure in the region.
Natural System Resiliency 	Actions that maintain, restore, or preserve the function of natural resources to reduce hazard impact.	Preserve the function and resiliency of the region's natural resources and sensitive landscapes.

The CVPDC Regional Hazard Mitigation Plan was developed through a new evaluation process, incorporating vulnerability data analysis, a more comprehensive mitigation strategy development and evaluation process, and a more far-reaching stakeholder and outreach methodology than past regional mitigation efforts. Therefore, while officially an update of the Region 2000 Hazard Mitigation Plan, the planning process, mitigation strategies, and resulting document have not been built upon past efforts, rather, have been developed by the TAC and area stakeholders to represent recent goals and initiatives developed using more comprehensive data; strategies that more accurately reflect locality and stakeholder priorities; and the interconnection of hazard mitigation and resiliency planning to a comprehensive range of community programs, policies, and programs, including transportation, community development, housing, watershed protection, and economic sustainability.

## 3.11 Adoption and Evaluation

After FEMA and VDEM approval, each CVPDC membership jurisdiction shall adopt the HMP. As further outlined in the Monitoring and Maintenance Chapter, the essential oversight and implementation will begin in earnest. Plan strategy execution will ultimately be completed through a matrix of daily staff programmatic activities and project execution at the locality, regional, and state level. However, the process of monitoring progress, capturing successes, and, if necessary, being prepared to amend mitigation activities represents a committed process that will be maintained through the five-year FEMA pre-mitigation program eligibility associated with the CVPDC HMP 2020 approval.

A photograph of a road blocked by a fallen tree trunk. In the background, a car is visible behind a barrier. The scene is surrounded by lush green trees and foliage. The text "HAZARD IDENTIFICATION AND RISK ASSESSMENT" is overlaid in white, bold, sans-serif font.

# **HAZARD IDENTIFICATION AND RISK ASSESSMENT**





## 4.0 Hazard Identification and Risk Assessment (HIRA)

### 4.1 2020 Update - Summary of Changes

The updated HIRA chapter differs from the previous plan in the following ways:

- **Planning area changes.** Since the previous plan update, Bedford City reverted to a town in Bedford County in 2013. The Region 2000 Planning District Commission was renamed to the Central Virginia Planning District Commission in 2019. As such, all development and demographic information include updated data pertaining to these new changes.
- **Updated demographic information.** Demographic, social, economic, and housing data for the study area were updated with best available information from Census Bureau and other data sources. The 2010 census data was used for updating hazard analyses to replace the 2000 census data. In addition to the American Community Survey (ACS) Data which serves as primary data source, Virginia population estimates developed by Weldon Cooper Center at University of Virginia and LandScan ambient population distribution data developed by Oak Ridge National Laboratory (ORNL) were also incorporated into the hazard analysis.
- **Updated inventory of critical facilities and infrastructure.** The inventory of critical facilities and infrastructure was updated by combining several data sources, including local data submitted by jurisdictions, ESRI data, Hazus inventory data, and Homeland Infrastructure Foundation-Level Data (HIFLD). Additional types of facilities were taken into account for the inventory, such as public shelters (e.g., cooling centers), water storage facilities (e.g., water tanks), energy facilities (e.g., energy pipelines and electrical substations), tourist destinations (e.g. National D-Day Memorial), and large crowd venues (e.g. Lynchburg Hillcats minor league baseball stadium). More than 600 facilities were identified for the CVPDC area.
- **Additional natural, technological, and man-made hazards.** The previous plan analyzed 8 natural hazards plus 1 man-made hazard (Terrorism). This plan update expanded the list to 20 hazards, including 15 natural hazards and 5 man-made/technological hazards. (See Table 4-1 for the new hazards included in this plan update.)
- **Updated hazard history.** The historical occurrence of hazards was updated with information from FEMA Disaster Declarations Summary, National Center for Environmental Information (NCEI) Storm Events Database, Virginia Department of Conservation and Recreation, Virginia Department of Forestry, and other authoritative sources.<sup>2</sup>
- **High hazard potential dams.** High Hazard Potential means where an impounding structure failure could cause loss of life or serious economic damage. Compared to the previous plan, the new Dam Failure chapter added details about the impacts of high hazard dam failure for those high hazard dams listed in the Virginia Dam Safety Inventory System including general site information, mapped dam failure inundation zones, and vulnerable structures in the CVPDC area.

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<sup>2</sup> Since the 2013 plan, the National Climatic Data Center – NCDC – has been renamed as the National Centers for Environmental Information, or NCEI



# Hazard Identification and Risk Assessment

- **Enhanced level of analysis for HIRA.** The loss estimates from the previous plan update were produced through a Hazus analysis which used 2000 Census data for its calculations. In this update, the latest version of Hazus software equipped with 2010 Census data was used for HIRA. The assessment of hurricane wind and earthquake were based on Level 1 analysis that utilizes the default data provided by the Hazus. Level 2 analysis was applied for flooding and dam failure hazards to produce a more accurate prediction of damages and losses. The Level 2 analysis improves the results of Level 1 by supplementing default data with user-supplied data such as up-to-date building inventories and flood elevation data. The HIRA involved integrating local, site specific data for all structures in the floodplain and dam failure inundation areas to create a more comprehensive risk assessment.
- **Cascading hazards and multi-hazard interrelationships.** Preparing for and responding to hazard events could be improved by integrating information on hazard interactions and cascading effects. In this update, the management team explored various concurrent and causal interrelations between hazards in the CVPDC area and developed weighted network diagrams to depict relationships between hazards and their impacts. This multi-hazard network model is available as an interactive graph in the CVPDC HMP 2020 Update website.

## 4.2 Introduction

The purpose of the HIRA section of the plan is to:

1. Identify and profile the hazards that could affect the jurisdictions in the CVPDC area,
2. Determine which community assets are the most vulnerable to damage from these hazards, and
3. Estimate social, economic, and environmental losses from these hazards and prioritize the potential risks to the community.

The first step, identifying hazards, will determine all the natural hazards that might affect the area. The next step involves assessing all those hazards to determine how often they occur, where they occur, their magnitudes when they do occur, and documented impacts to help begin to prioritize which ones should be studied further. The last step is to determine estimate potential losses for those hazards which are well documented and those that are not well documented. The hazards are then ranked to determine what hazards are most likely to impact the communities of the CVPDC area. Hazards that are determined to have significant impact will be analyzed in the greatest detail to determine the magnitude of future events and the vulnerability for the community and the critical facilities. Hazards that receive a moderate impact ranking will be analyzed with available data to determine the risk and vulnerability to the specified hazard. The hazards with limited impact will be briefly outlined in the HIRA. This ranking will be used to help determine which mitigation actions to select and which are higher priorities.

### 4.2.1 Critical Facilities and Infrastructure

A comprehensive inventory of critical facilities and infrastructure is not readily available because there is no universally accepted definition of what constitutes critical facilities and infrastructure, nor is one associated with FEMA and DMA 2000 planning requirements. For the purpose of this plan update, a critical facility or infrastructure is defined as a facility in either the public or private sector that provides essential products and services to the general public, is otherwise necessary to preserve the welfare and quality of life in the county, or fulfills important public safety, emergency response, and/or disaster recovery functions. This includes the





# Hazard Identification and Risk Assessment

following facilities and systems based on their high relative importance for the delivery of vital services, the protection of special populations, and other important functions in the CVPDC area:

- Airports
- Attractions (tourism destinations, historic assets)
- Chemical facilities / hazardous material facilities
- Communication facilities
- Emergency Operations Centers (EOCs)
- Energy facilities and infrastructure
- Fire stations
- Hospitals
- Large population venues
- Major road bridges and tunnels
- Police stations
- Public shelters
- Railroad facilities and infrastructure
- Schools and colleges
- Special populations facilities (detention facilities, nursing homes)
- Transportation hubs
- Water storage facilities / potable water facilities
- Wastewater treatment facilities

Critical facilities for the CVPDC area were derived from a variety of sources. The best geospatial data provided by each jurisdiction for this plan update was supplemented with ESRI data, Hazus facilities inventory data, and HIFLD data. This resulted in the identification of over six hundred critical facilities for the CVPDC area. Many of the critical facilities from the previous plan are included in the update (except the dams which have their own chapter). A comprehensive list of critical facilities was given to the project management team for review. Please see Appendix G: Critical Facilities for a full list of critical facilities and their locations.

## 4.2.2 Limitations of Data

Inadequate information posed a problem for developing loss estimates for most of the identified hazards. The data sources used in the hazard identification and loss estimation are varied in their degree of completeness, accuracy, and precision. A major limiting factor for the data was that the hazard mapping precision is often at the jurisdiction or census tract level. Many of the hazards do not have defined damage estimate criteria.

The FEMA guidelines emphasize using “best available” data for this plan. The impact of these data limitations will be shown through the different vulnerability assessments and loss estimation methods used for hazards. Analysis for the CVPDC area was completed using the best available data. The level of detail for the data received from the jurisdictions drove the specifics of the vulnerability analysis. When detailed building footprint data and local parcel information was available, it was used to assess the vulnerability at a building specific level. When building specific data was not available, census tracts or blocks were used to assess the areas vulnerability to specific hazards. In the loss estimates section of the HIRA in this 2020 update, the “best available” data was from 2010 Census data because the 2020 Census data have not been available yet. Population estimates from various sources were used to supplement 2010 census data, such as ACS single-year



# Hazard Identification and Risk Assessment

estimates, Virginia population estimates developed by Weldon Cooper Center at University of Virginia, and LandScan ambient population distribution data developed by ORNL.

In the HIRA section of each hazard chapter, more detail was provided on the data and analysis limitations.

## 4.2.3 Types of Hazards

All jurisdictions in the CVPDC area are vulnerable to a wide range of natural, technological, and man-made hazards that threaten the safety of residents, and have the potential to damage or destroy both public and private property, cause environmental degradation, or disrupt the local economy and overall quality of life. While many disasters are possible for any given area in the United States, the most likely hazards to potentially affect the communities in the CVPDC area generally include the hazards in the 2020 plan update shown in Table 4-1.

*Table 4-1 Comparison of Hazards between 2013 and 2020 Plan Updates*

2013 Plan update	2020 Plan update
<ul style="list-style-type: none"><li>• Drought</li><li>• Earthquake</li><li>• Flooding</li><li>• Hurricane</li><li>• Landslide and land subsidence</li><li>• Terrorism</li><li>• Wildfire</li><li>• Tornado wind</li><li>• Winter storm (ice/snow)</li></ul>	<p>Natural hazards</p> <ul style="list-style-type: none"><li>• Drought</li><li>• Earthquake</li><li>• Extreme temperature: cold / wind chill *</li><li>• Extreme temperature: excessive heat *</li><li>• Flooding</li><li>• Fog *</li><li>• Hailstorm *</li><li>• Hurricane</li><li>• Land subsidence and karst</li><li>• Landslide</li><li>• Severe thunderstorm, heavy rain and lightning *</li><li>• Severe winter storm</li><li>• Tornado</li><li>• Wildfire</li></ul> <p>Man-made / technological hazards</p> <ul style="list-style-type: none"><li>• Communicable disease *</li><li>• Dam failure *</li><li>• Hazardous materials incident *</li><li>• Solar event *</li><li>• Terrorism</li><li>• Urban fire *</li></ul>

\* indicates new hazard in 2020 plan update



# Hazard Identification and Risk Assessment

## 4.2.4 Hazards Interrelationship

Most hazard mitigation plans at the regional or local level often focus on profiling individual hazards instead of considering connected chains of events. Risk assessment methods in the previous plan only consider one driver or hazard at a time, which likely underestimates risk. Relations and interactions between hazards are not often considered in local hazard mitigation planning and decision making.

Preparing for and responding to hazard events could be improved by integrating information on hazard interactions and cascading effects. In this plan update, the plan management team explored various concurrent and causal interrelations between hazards in the CVPDC area, and developed weighted network diagrams to depict relationships between hazards and their impacts on people, built environment, and infrastructure (Figure 4-1). In the network diagram, natural and man-made hazards are represented by nodes that are connected by edges. The edges represent two types of primary relations between hazards: causal and concurrent. A causal relation is one where one hazard is a prerequisite for a correlated hazard. A concurrent relation means hazards that are probable to occur at the same time due to common root causes. Multi-hazard network models can help develop timelines and guide decision making and planning at local level. These network diagrams could have multiple applications like communicating the risks to local officials and residents. This could be further considered in making zoning and land use decisions for communities with a strong history of multi-hazard events.

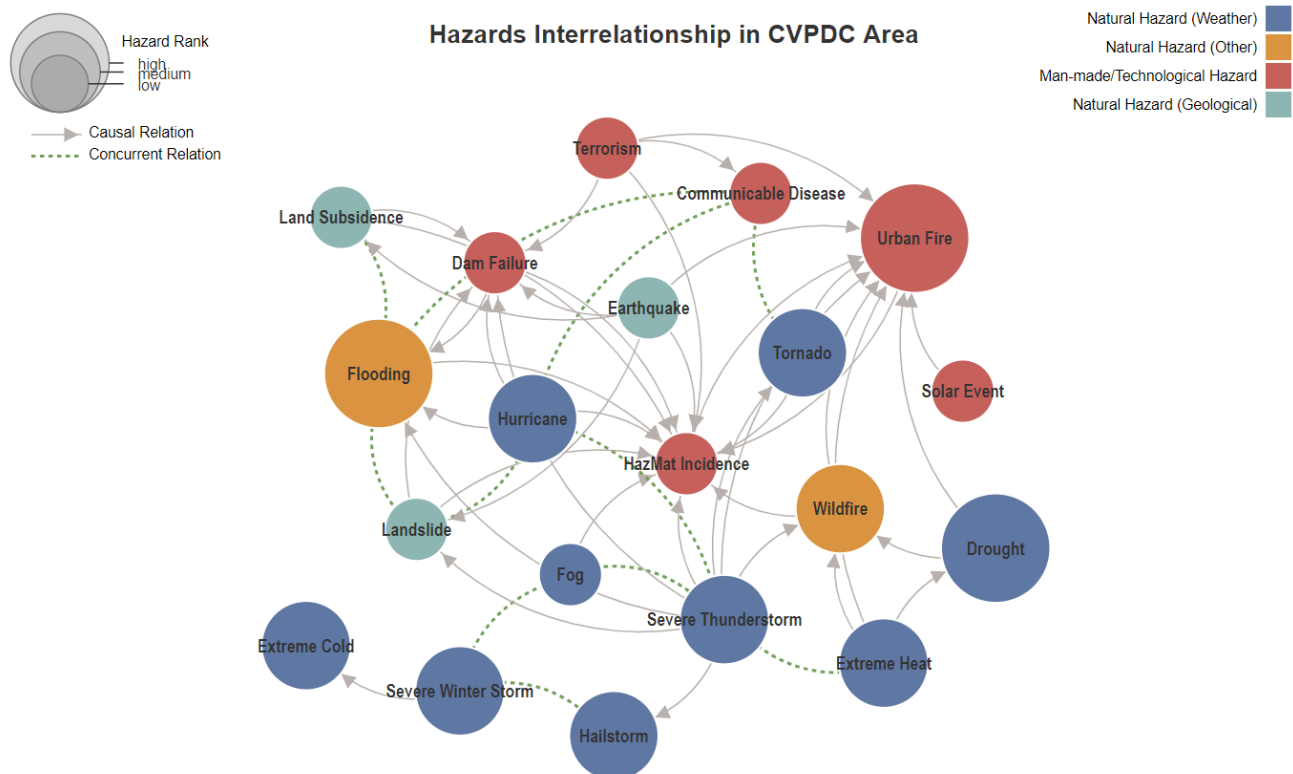


Figure 4-1 Interrelationship of Hazards for CVPDC area



# Hazard Identification and Risk Assessment

## 4.2.5 Hazard Ranking Methodology

Ranking hazards helps the localities set goals and mitigation priorities. To compare the risk of different hazards, and prioritize which are more significant, requires a scoring system for equalizing the units of analysis. As not all hazards assessed in this plan have precisely quantifiable probability or impact data, a scoring system based on multi-criteria decision analysis (MCDA) methodology was developed to rank all of the hazards. This multi-criteria ranking analysis approach prioritizes hazard risk based on a blend of quantitative factors from the available data, such as historical data, local knowledge, public survey, Hazus assessment, and general consensus opinions from the TAC. This hazard ranking analysis assigns varying degrees of risk to five categories for each of the hazards, including: probability (how often it can occur), impact (economic, social, and environmental loss), spatial extent (the size of the area affected), warning time (how long does a community have to prepare for the event), and duration. Each degree of risk was assigned a value ranging from 1 to 4. The weighting factor derived from a review of best practice plans and TAC's opinion. Some of these hazard characteristics, like probability and impact, are more important than others and are weighted more heavily.

To calculate a rank score value for a given hazard, the assigned risk value for each category was multiplied by the weighting factor. The sum of all five categories represents the final rank score, as demonstrated in the following equation:

$$\text{Hazard Score Value} = [(Probability \times 30\%) + (Impact \times 30\%) + (Spatial Extent \times 20\%) + (Warning Time \times 10\%) + (Duration \times 10\%)]$$

Table 4-2 provides the hazard characteristic, level description, level criteria, level index value, and weighting value. The weighting factors were presented to the TAC early in the planning process to get approval. The final hazard ranking for the CVPDC is presented at the Conclusion section of the HIRA chapter.





# Hazard Identification and Risk Assessment

Table 4-2 Hazard Ranking Criteria

Hazard Characteristic	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	30%
	Possible	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 100% annual probability	3	
	Highly Likely	100% annual probability	4	
Impact	Minor	Very few injuries, in any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of critical facilities.	1	30%
	Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one day.	2	
	Critical	Multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one week.	3	
	Catastrophic	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
Spatial Extent	Negligible	Less than 1% of area affected	1	20%
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	Long	More than 24 hours	1	10%
	Moderate	12 to 24 hours	2	
	Short	6 to 12 hours	3	
	Very short or no warning	less than 6 hours	4	
Duration	Very short	Less than 6 hours	1	10%
	Short	Less than 24 hours	2	
	Moderate	Less than one week	3	
	Long	More than one week	4	

## 4.2.6 Declared Disasters

Federal disaster declarations occur when response needed is greater than what state and local governments are capable of providing. The *Robert T. Stafford Disaster Relief and Emergency Assistance Act* of 1988 was enacted to support states and localities recovering from disasters that would otherwise exhaust local resources. Funding for recovery comes primarily from the FEMA managed President's Disaster Relief Fund.<sup>3</sup>

<sup>3</sup> A Guide to the Disaster Declaration Process and Federal Disaster Assistance. March 4, 2008. [https://www.fema.gov/pdf/rrr/dec\\_proc.pdf](https://www.fema.gov/pdf/rrr/dec_proc.pdf)



# Hazard Identification and Risk Assessment

Table 4-3 lists the major disasters including Presidential declared disasters that have occurred in the CVPDC area. The table shows which hazards impacted each of the jurisdictions in the CVPDC area, as well as the designated federal disaster number. The region has had 18 declared disasters and 5 declared emergencies since 1969; the most prominent disaster types are related to winter weather and flooding. Nine declared severe storms and flooding disasters have been noted for the time period prior to 1969, when FEMA began to denote disasters with declaration numbers. The updated table excludes these nine disasters due to lack of details, while complements the missing events occurred during the 1970s and 1980s in the previous plan. It also includes new declarations that occurred since the 2012 hazard mitigation plan was written. They encompass severe storms and the impact of Hurricane Sandy experienced in 2012, Hurricane Florence and Tropical Storm Michael in 2018, and ongoing pandemic of coronavirus disease (COVID-19) in 2020. Figure 4-2 summarizes the number of disaster declarations in CVPDC by hazard type, jurisdiction, month, and year.

*Table 4-3 Major Disasters Occurred in CVPDC Area*

Communities Impacted	Date of Declaration	Federal Declaration #	Disaster Type	Federal Description
Amherst, Bedford, Campbell	8/23/1969	274	DR	Hurricane - Severe Storms and Flooding
Amherst, Appomattox, Bedford, Bedford City, Campbell, Lynchburg City	6/23/1972	339	DR	Flood -Tropical Storm Agnes
Bedford City	10/7/1972	358	DR	Flood - Severe Storms and Flooding
Amherst, Appomattox, Bedford, Bedford City	10/10/1972	359	DR	Flood - Severe Storms and Flooding
Appomattox, Bedford, Campbell	10/15/1976	3018	EM	Drought
Amherst, Appomattox, Bedford, Campbell	7/23/1977	3046	EM	Drought
Amherst, Appomattox, Bedford, Campbell, Lynchburg City	11/9/1985	755	DR	Flood - Severe Storms and Flooding
Amherst, Bedford, Bedford City, Lynchburg City	5/19/1992	944	DR	Flood - Severe Storms and Flooding
Amherst, Appomattox, Bedford, Bedford City, Campbell, Lynchburg City	3/25/1993	3112	EM	Snow - Severe Winter Storm
Amherst, Appomattox, Bedford, Bedford City, Campbell, Lynchburg City	3/10/1994	1014	DR	Snow - Severe Ice Storms, Flooding
Amherst, Appomattox, Bedford, Campbell	4/11/1994	1021	DR	Severe Storms - Severe Winter Ice Storm
Amherst, Bedford, Bedford City, Campbell, Lynchburg City	7/1/1995	1059	DR	Severe Storm - Severe Storms and Flooding
Amherst, Appomattox, Bedford, Bedford City, Campbell, Lynchburg City	1/13/1996	1086	DR	Snow - Blizzard of 96 (Severe Snow Storm)



# Hazard Identification and Risk Assessment

Communities Impacted	Date of Declaration	Federal Declaration #	Disaster Type	Federal Description
Amherst, Appomattox, Bedford, Bedford City, Campbell, Lynchburg City	9/6/1996	1135	DR	Hurricane - Hurricane Fran and Associated Severe Storm Cond
Amherst, Appomattox, Bedford, Campbell, Lynchburg City	2/28/2000	1318	DR	Severe Storms - Severe Winter Storms
Bedford, Bedford City, Campbell	5/5/2002	1411	DR	Severe Storms - Severe Storms, Tornadoes, and Flooding
Appomattox	3/27/2003	1458	DR	Severe Storms - Severe Winter Storms, Record/Near Record Snowfall, Heavy Rain, Flooding, and Mudslide
Amherst, Appomattox, Bedford, Bedford City, Campbell, Lynchburg City	9/18/2003	1491	DR	Hurricane - Hurricane Isabel
Amherst, Appomattox, Bedford, Bedford City, Campbell, Lynchburg City	9/12/2005	3240	EM	Hurricane - Hurricane Katrina Evacuation
Amherst, Bedford	2/16/2010	1874	DR	Snow - Severe Winter Storms and Snowstorm
Appomattox	4/27/2010	1905	DR	Snow - Severe Winter Storms and Snowstorm
Amherst, Appomattox, Bedford, Bedford City, Campbell, Lynchburg City	7/27/2012	4072	DR	Severe Storms - Severe Storms and Straight-Line Winds
Amherst, Appomattox, Bedford, Bedford City, Campbell, Lynchburg City	10/29/2012	3359	EM	Hurricane - Hurricane Sandy
Amherst, Appomattox, Bedford, Campbell, Lynchburg City	9/13/2018	3403	EM	Hurricane - Hurricane Florence
Appomattox, Campbell, Lynchburg City	10/9/2018	4411	DR	Severe Storms - Tropical Storm Michael
Amherst, Appomattox, Bedford, Campbell, Lynchburg City	1/20/2020	3448	EM	Pandemic - Covid-19
Amherst, Appomattox, Bedford, Campbell, Lynchburg City	1/20/2020	4512	DR	Pandemic - Covid-19

Source: FEMA Disaster Declarations Summary - Open Government Dataset. <sup>4</sup> DR—Major Disaster Declaration; EM—Emergency Declaration

<sup>4</sup> <https://data.fema.gov/views/DisasterDeclarations> OpenFEMA/DisasterDeclarations



# Hazard Identification and Risk Assessment

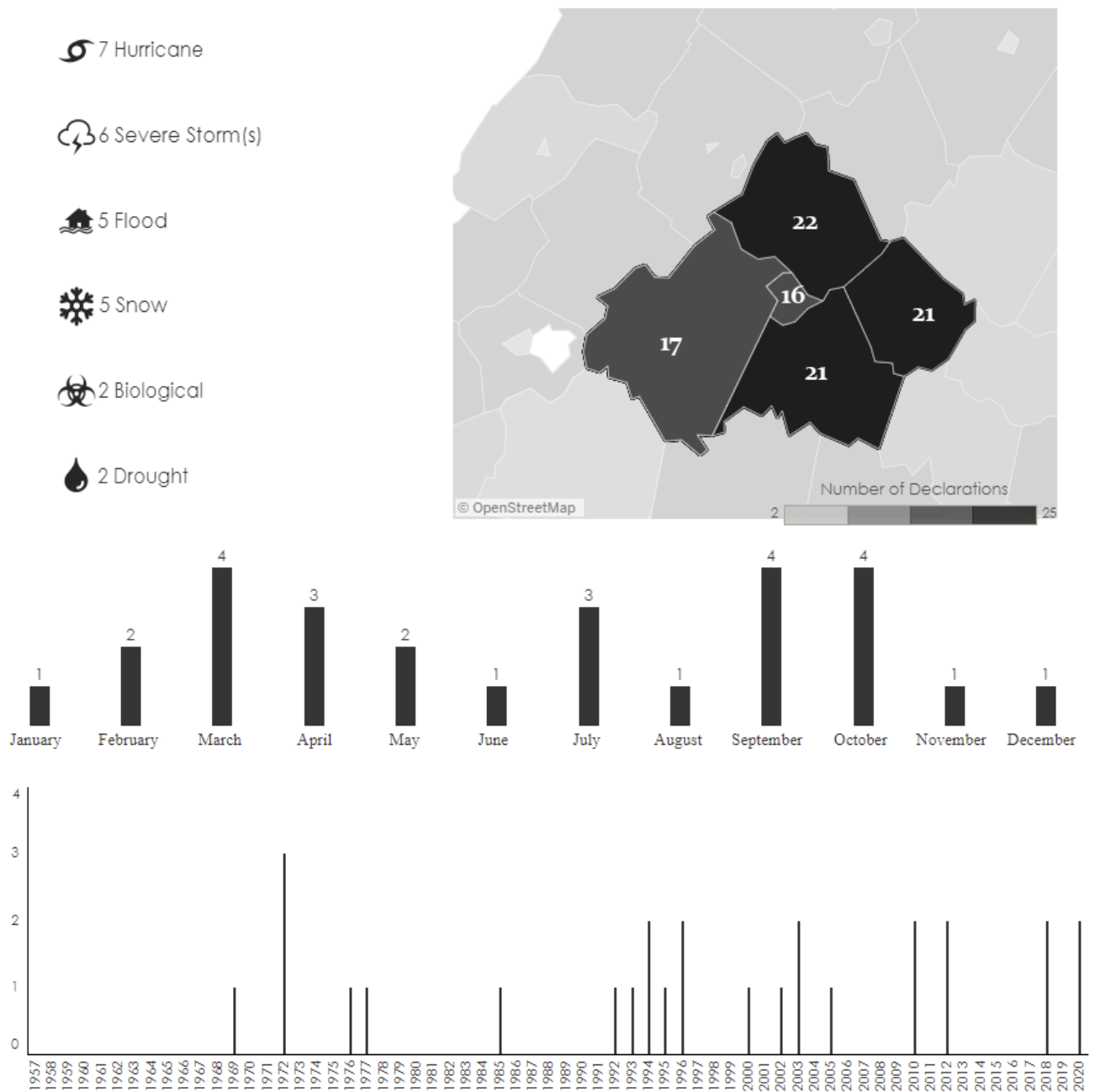


Figure 4-2 A Summary of Disaster Declarations in CVPDC Area

## 4.2.7 Hazus

Hazus is a geographic information system (GIS)-based, multi-hazard risk assessment computer program for analyzing potential losses. It is developed and freely distributed by FEMA. Hazus Version 4.2 was utilized for loss estimates of flooding, dam failure, earthquakes, and hurricanes in this plan update.

Hazus models the earthquake, flood, and hurricane risk in three steps. First, it calculates the exposure for a selected area and hazard scenario. Second, it characterizes the level or intensity of the hazard affecting the





# Hazard Identification and Risk Assessment

exposed area. Lastly, it uses the exposed area and the hazard scenario to calculate the potential losses in terms of economic loss, structural damage, displaced households, shelter requirements, and casualties (earthquake only).

The data provided in the Hazus software provides a uniform look at building stock in the study area and serves as the default when a user does not have better data available. There are approximately 108,471 buildings in the CVPDC area as estimated by Hazus, categorized as residential, commercial, industrial, agricultural, religious, government, and education. Table 4-4 provides information on the building counts provided by Hazus.

*Table 4-4 General building stock in CVPDC area*

Occupancy	Building Count	Percentage
Residential	100,600	93%
Commercial	4,717	4%
Other	3,154	3%

Note: building stock inventory data was available from the earthquake or hurricane module of Hazus software.

Table 4-5 provides summary statistics for building stock exposure by general building occupancy for the CVPDC area. It shows the dollar exposure by use of the structure. Residential structures have the highest exposure in terms of dollar exposure followed by commercial structures. Agriculture and government structures have the lowest exposure. Agricultural land has the least number of permanent structures and government buildings are rarely situated in flood prone areas. In total, the region has \$29.9 billion of buildings exposed to hurricanes in all occupancy categories. Residential buildings account for 78.6% of this total. Note the differences between the totals in the tables are due to rounding in the calculations in Hazus. Please note that the exposure values are structural replacement values and not market values.

*Table 4-5 Building Stock Exposure by General Occupancy*

Locality	Residential (\$K)	Commercial (\$K)	Industrial (\$K)	Ag. (\$K)	Religion (\$K)	Gov. (\$K)	Education (\$K)	Total (\$K)
Amherst	2,826,608	284,733	151,703	12,799	79,066	18,524	47,837	3,421,270
Appomattox	1,398,689	117,788	39,479	5,853	25,290	8,624	12,246	1,607,969
Bedford	7,298,433	552,598	265,843	32,357	117,849	26,184	47,770	8,341,034
Bedford City	558,700	172,723	122,475	897	27,491	16,623	17,582	916,491
Campbell	4,509,713	666,734	516,703	23,648	121,800	18,133	64,610	5,921,341
Lynchburg	6,909,983	1,717,534	604,807	17,212	308,508	26,722	119,087	9,703,853
<b>Total</b>	<b>23,502,126</b>	<b>3,512,110</b>	<b>1,701,010</b>	<b>92,766</b>	<b>680,004</b>	<b>114,810</b>	<b>309,132</b>	<b>29,911,958</b>

Table 4-6 provides summary statistics for building stock exposure by building type for each jurisdiction. It shows the dollar exposure by construction type. In the CVPDC area, wooden structures account for \$17,238,166,000 (i.e. 57% of the total building exposure), followed by Masonry as \$ 7,705,473,000 (i.e. 26% of the total building exposure). The wood exposure is highest due to the construction practices in this region of the country although Lynchburg City and some towns have high masonry exposure.



# Hazard Identification and Risk Assessment

Table 4-6 Building Stock Exposure by Building Type

Locality	Wood (\$K)	Masonry (\$K)	Concrete (\$K)	Steel (\$K)	MH* (\$K)	Total (\$K)
Amherst	2,053,510	868,738	109,901	294,765	94,357	3,421,271
Appomattox	1,014,495	393,737	24,765	96,028	78,944	1,607,969
Bedford	5,420,698	2,065,408	118,038	461,837	275,057	8,341,038
Bedford City	430,623	246,756	57,069	176,142	5,900	916,490
Campbell	3,348,321	1,460,891	161,222	698,221	252,685	5,921,340
Lynchburg	4,975,940	2,665,518	633,205	1,404,939	24,252	9,703,854
<b>Total</b>	<b>17,243,587</b>	<b>7,701,048</b>	<b>1,104,200</b>	<b>3,131,932</b>	<b>731,195</b>	<b>29,911,962</b>

\*Note: Manufactured Housing (MH)

The transportation system and utility system dollar exposure values are derived from the default Hazus facility inventory data for the CVPDC area (Table 4-7 and Table 4-8).

Table 4-7 Transportation System Dollar Exposure - Hazus

Locality	Highway (\$K)	Railway (\$K)	Bus Facility (\$K)	Airport (\$K)	Total (\$K)
Amherst County	840,892	67,968	-	-	908,860
Appomattox County	356,733	30,493	-	-	387,226
Bedford County	1,583,822	130,073	-	48,615	1,762,510
Campbell County	999,280	174,163	-	135,194	1,308,638
Lynchburg	552,309	86,953	1,014	48,615	688,891
<b>Total</b>	<b>4,333,036</b>	<b>489,650</b>	<b>1,014</b>	<b>232,424</b>	<b>5,056,125</b>

Table 4-8 Utility System Dollar Exposure

Locality	Potable Water (\$K)	Waste Water (\$K)	Electric Power (\$K)	Communication (\$K)	Total (\$K)
Amherst County	30,969	185,814	-	1,116	217,899
Appomattox County	30,969	-	-	186	32,169
Bedford County	92,907	247,752	-	651	651
Campbell County	61,938	309,690	-	558	372,186
Lynchburg	-	61,938	102,300	186	164,424
<b>Total</b>	<b>216,783</b>	<b>805,194</b>	<b>102,300</b>	<b>2,697</b>	<b>787,329</b>

## 4.2.8 Surveys

### 4.2.8.1 Locality Hazard Ranking Survey

The project management team asked the jurisdictions to evaluate the hazards that impact their community based on their local knowledge through a Locality Hazard Ranking Survey. The survey was available in Virginia Tech Qualtrics on March 2019. Nineteen local officials, city employees, and institutional and organizational partners from the localities completed this survey. The participants ranked the probability of occurrence and consequence of impact for natural, technological, and man-made hazards. The results of the survey are provided in Figure 4-3 and Figure 4-4.



# Hazard Identification and Risk Assessment

## **4.2.8.2 Public survey**

Area residents, stakeholders, and the business community were encouraged to provide input through a public survey. The Central Virginia Pre-Disaster Mitigation Plan Public Survey, which ran from November 20 - December 13, 2019 was designed to help the project management team identify the community's concerns about natural hazards, and to better understand the community needs in reducing risk and loss from such hazards. It was used to collect information from the public about household preparedness for hazards, the level of knowledge about tools and techniques for reducing loss from hazards, and areas of public concern about hazards, among others. The web-based survey tool "Survey Monkey" was advertised throughout the region, and every locality provided messaging and links on their websites and social media platforms. The survey also provided opportunities for additional comment. Some respondents provide feedback on their concerns and how they and their community prepare to be more resilient from natural disaster impacts. For example, identification and removal of dangerous trees that could fall over properties during extreme weather conditions; equipment and training of local fire/EMS agencies to mitigate and respond accordingly in the event of a disaster; and education and training opportunities to residents on disaster preparedness were some of the recommendations. Others commented that hazard mitigation planning is not only a key element of survival but also a mindset.



# Hazard Identification and Risk Assessment

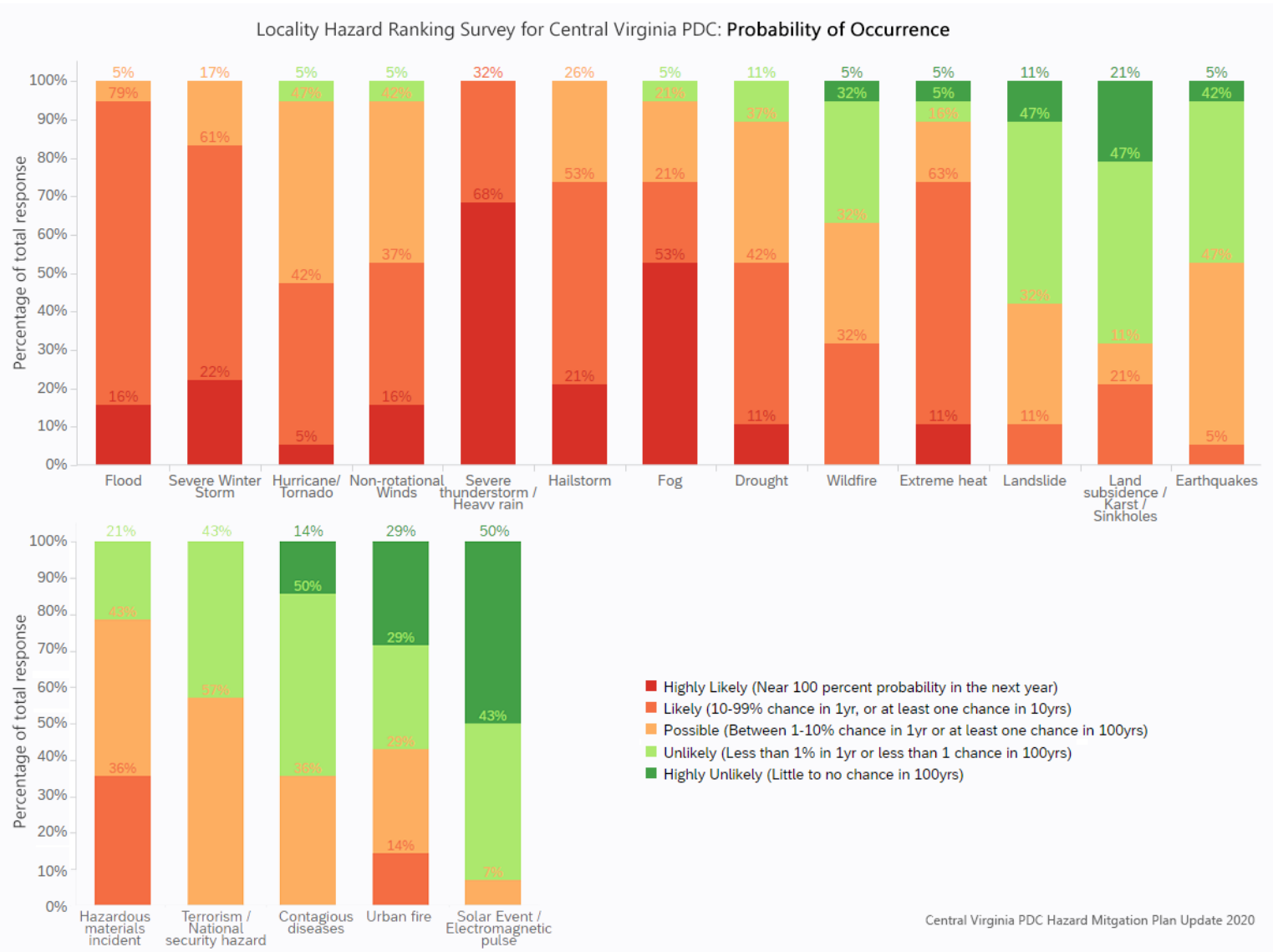


Figure 4-3 Locality Hazard Ranking Survey for CVPDC: Probability of Occurrence





# Hazard Identification and Risk Assessment

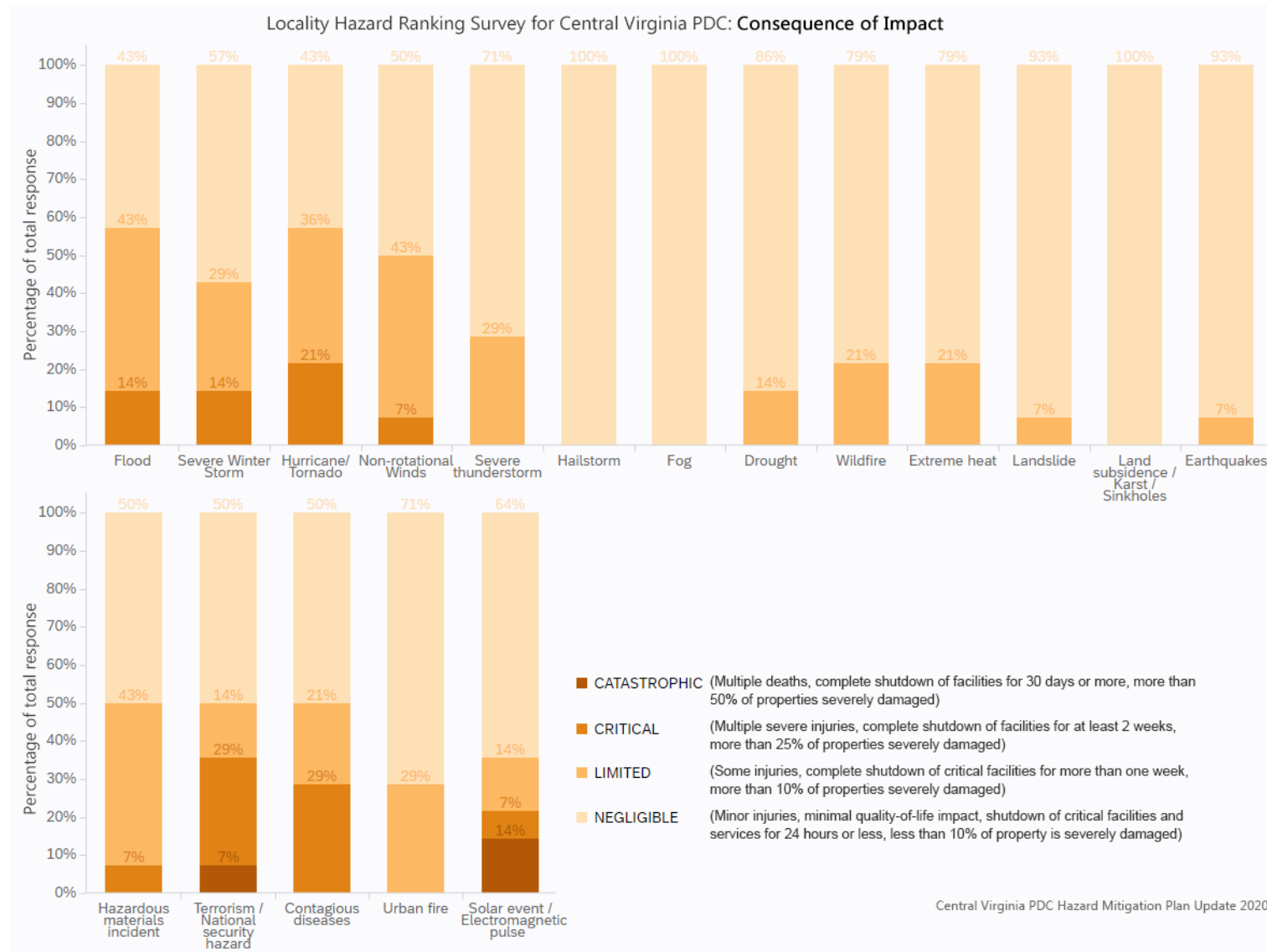


Figure 4-4 Locality Hazard Ranking Survey for CVPDC: Consequence of Impact



## 4.3 Flooding

### 4.3.1 Hazard Profile

A flood occurs when an area that is normally dry becomes inundated with water. Floods may result from the overflow of surface waters, overflow of inland and tidal waters, dam breaks, or mudflows. Flooding can occur at any time of the year, with peak in the late winter and early spring. Snowmelt and ice jam breakaway contribute to winter flooding; seasonal rain patterns and torrential rains from hurricanes and tropical systems also can contribute to flooding. Development of flood-prone areas usually increases the frequency and degree of flooding.

#### 4.3.1.1 Riverine Flooding and Flash Flooding

The two most common types of flooding that would affect the CVPDC area are riverine flooding (or inland flooding) and flash flooding (or urban flooding).

A *riverine flood* occurs when water levels rise over the top of river banks. This can occur from either excessive rain from tropical systems making landfall, persistent thunderstorms over the same area for extended periods of time, combined rainfall and snowmelt, or as a result of an ice jam (The National Severe Storms Laboratory), thus it is a naturally occurring and inevitable event. Some river floods occur seasonally when winter or spring rainfalls fill river basins with too much water, too quickly.

The two key elements to a *flash flood* are rainfall intensity and duration. Topography, soil conditions, and ground cover also play an important role. A flash flood is defined as being caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. Flash floods are usually characterized by post-heavy rainfall raging torrents that rip through river beds, urban streets, or mountain canyons, sweeping everything before them. They can occur within minutes or a few hours of excessive rainfall. They can also occur even if no rain has fallen, for instance after a levee or dam has failed, or after a sudden release of water by a debris or ice jam (National Weather Service).<sup>5</sup>

#### 4.3.1.2 Nuisance Flooding

Nuisance flooding (NF; aka. clear-sky or sunny-day flooding) refers to low levels of inundation that do not pose significant threats to public safety or cause major property damage. These floods can, however, disrupt routine day-to-day activities, put added strain on infrastructure systems such as roads and sewers, and cause minor property damage. Nuisance flooding usually refers to high tide flooding caused by climate-related sea level rise; however, low levels of flooding are widespread and deserve greater attention. Moftakhari, et al. (2018) define nuisance flooding as an extra layer of water that occurs at depths between 3 and 10 cm, regardless of the source, which travels at less than 3 meters per second.

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<sup>5</sup> National Weather Service. [https://www.weather.gov/mrx/flood\\_and\\_flash](https://www.weather.gov/mrx/flood_and_flash)



# Hazard Identification and Risk Assessment

This definition of NF is not limited to high tide flooding but rather is inclusive of all possible flood drivers, including pluvial, fluvial, and oceanic, and can capture trends in NF resulting from trends in, and compounding effects of, flood drivers.

Nuisance flood monitoring poses significant challenges given the number of processes capable of generating localized flood depths in the 3–10 cm range, including precipitation, extreme high tides, high river stage, channel and culvert blockages, surcharging sewers, leaks in flood walls, and broken water supply pipes. Indeed, NF is strongly linked to the interaction of natural processes and civil infrastructure systems, which in turn are linked to human activity.

While the science community has mainly focused on extreme events with large acute impacts, the cumulative impacts of chronic nuisance flooding may be greater in some areas than the acute impacts of a rare event. One of the main roadblocks in understanding NF and its impacts is lack of NF data. A promising direction for NF monitoring is mining real-time flood information from social media, combined with traffic/security cameras and/or drone imagery. Data records of NF will encourage more research in this area and frame the likely benefits of protection/adaptation measures.<sup>6</sup>

#### **4.3.1.3 Geographic Location/ Extent**

Low-lying areas in the region are subject to flooding. The occurrence of tropical storms during hurricane season (June - November) are responsible for the more severe flooding experienced in the region. Creek flooding can also occur after locally heavy thunderstorms.

The floodplains of the James River near Lynchburg are developed, containing warehouses, factories, businesses, and the necessary rail, highway, and utility services for the city. Floodplain development for all other streams in the city is mainly residential, with some commercial and industrial sites adjacent to the floodplain areas. In Appomattox County, lower ground along smaller streams is sometimes damaged by flooding of crops, deposition of silt on crops, and by channels silting up and preventing proper drainage. In Amherst County, Williams Run is much more

Flood or Flooding means:

(a) A general and temporary condition of partial or complete inundation of normally dry land areas from:

(1) The overflow of inland or tidal waters.

(2) The unusual and rapid accumulation or runoff of surface waters from any source.

(3) Mudslides (i.e., mudflows) which are proximately caused by flooding as defined in paragraph (a)(2) of this definition and are akin to a river of liquid and flowing mud on the surfaces of normally dry land areas, as when earth is carried by a current of water and deposited along the path of the current.

(b) The collapse or subsidence of land along the shore of a lake or other body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels or suddenly caused by an unusually high water level in a natural body of water, accompanied by a severe storm, or by an unanticipated force of nature, such as flash flood or an abnormal tidal surge, or by some similarly unusual and unforeseeable event which results in flooding as defined in paragraph (a)(1) of this definition.

(Source: Electronic code of federal regulations, Section 59.1 Definitions)

<sup>6</sup> <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018WR022828>



# Hazard Identification and Risk Assessment

responsive to localized storms with intense rainfall. The increased development in this area is changing watershed parameters and could cause more severe flooding in the future (FEMA, 2019). In Bedford County, floodplains usually consist of farmlands and woodlands. Principal concentrations of flood plain development lie along Hunting Creek in the Big Island community, along Mill Creek in the Moneta community, and along Roanoke River, including Smith Mountain Lake and Leesville Lake. Other minor concentrations of commercial and residential structures within flood plains are scattered throughout the county. Low-lying areas of the county are subject to periodic flooding caused by overflow of the following streams: Goose Creek, Big Otter River, and Little Otter River and their tributaries, which drain most of the county and empty into the Roanoke River. James River and its tributaries drain a small area in the northern portion of the county (FEMA, 2010). In Campbell County, the major portions of the floodplain are located along James and Roanoke (Staunton) Rivers, as well as larger creeks. Low-lying areas adjacent to these waters are subject to periodic flooding. The most severe flooding is usually a result of heavy rains from tropical storms, while, on the smaller creeks, the major floods are the result of local thunderstorms or frontal systems.

#### **4.3.1.4 Magnitude/Severity**

Floods are typically characterized in terms of severity and frequency of occurrence. The severity of a flood event is typically determined by a combination of several factors, including: stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and degree of vegetative clearing and impervious surface. Generally, floods are long-term events that may last for several days. Smaller floods occur more frequently, and larger floods have lower probabilities of occurrence.

The severity of a flood is determined by the duration and intensity of rainfall in the catchment of the river within the flood hazard area. The magnitude of a flood is based on flood depth and flood velocity. The Federal Emergency Management Agency (FEMA) categorizes areas on the terrain according to how the area will convey the discharge of flood water. The extent of flood damages can be expected to be more damaging in the areas where a base flood can occur. A base flood is defined by FEMA as a flood having a 1-percent chance of being equaled or exceeded in any given year. This is the regulatory standard also commonly referred to as the "100-year flood" or base flood. The 1-percent annual chance flood is the national standard used by the National Flood Insurance Program (NFIP) and all Federal agencies for the purposes of requiring the purchase of flood insurance and regulating new development.<sup>7</sup> A Special Flood Hazard Area (SFHA) is defined as an area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year. Moderate flood hazard areas are the areas between the limits of the base flood and the 0.2-percent annual chance flood (also commonly referred to as "500-year flood"). The areas of minimal flood hazard, are the areas outside the SFHA and higher than the elevation of the 0.2-percent annual chance flood (FEMA).<sup>8</sup> Figure 4-5 shows the 1-percent and 0.2-percent annual chance flood area in the CVPDC.

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<sup>7</sup> [https://floodmaps.fema.gov/tutorials/check-ras/0.3\\_glossary.shtml](https://floodmaps.fema.gov/tutorials/check-ras/0.3_glossary.shtml)

<sup>8</sup> <https://www.fema.gov/flood-zones>





# Hazard Identification and Risk Assessment

Flood zones are the categories that are mapped on Flood Insurance Rate Maps.<sup>9</sup> Table 4-9 provides a description of FEMA flood zones and the flood impact in terms of severity or potential harm. Flood Zone A, AE and X are the hazard areas that have mapped in the CVPDC area. Zone A is interchangeably referred to as the 100-year flood, 1-percent annual chance flood, Special Flood Hazard Area (SFHA), or more commonly, base flood. Zone A is the area where the base flood will occur, and therefore constitutes a threat to the region.

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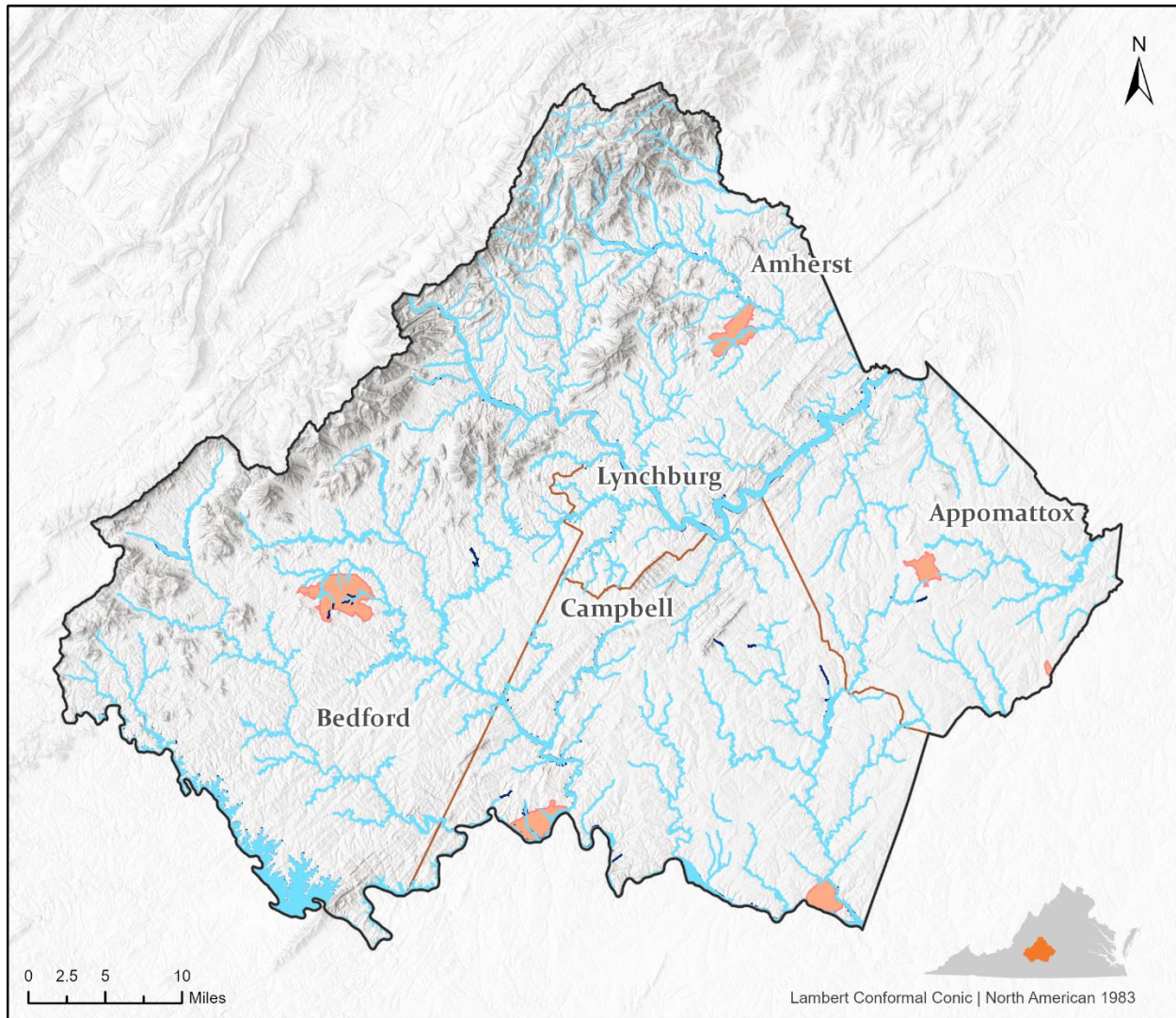
<sup>9</sup> <https://snmapmod.sncosco.us/fmm/document/fema-flood-zone-definitions.pdf>



# Hazard Identification and Risk Assessment

## FEMA Special Flood Hazard Area Map for Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



1 percent flood area 0.2 percent flood area County / City Town

Data source: FEMA Flood Map Service Center  
Center for Geospatial Information Technology at Virginia Tech. 08/2019



Figure 4-5 FEMA Special Flood Hazard Area Map for CVPDC Area (Source: FEMA Map Service Center) <sup>10</sup>

Table 4-9 Classification of Flood Zones

Intensity	Zone	Description
High	A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Detailed analyses are not performed for such areas; no depths or

<sup>10</sup> FEMA Flood Map Service Center. <https://msc.fema.gov/portal/advanceSearch>



# Hazard Identification and Risk Assessment

Intensity	Zone	Description
		base flood elevations are shown within these zones.
	AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs, instead of A1-A30 Zones
	A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a Base Flood Elevation (BFE) (old format).
	AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
	AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
	AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
Moderate to Low	A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones
	X500	An area inundated by 500-year flooding; an area inundated by 100- year flooding with average depths of less than 1 foot or with drainage areas less than 1 square mile; or an area protected by levees from 100-year flooding.

*Note: In communities that participate in the NFIP, mandatory flood insurance purchase requirements apply to all high risk zones. Source: FEMA*

## 4.3.1.5 Previous Occurrences

The CVPDC region has been impacted by several flooding events ranging in location, magnitude, and impact. A large percentage of the region's declared disasters were due to flooding. A table of all the major flood events that have occurred in the CVPDC area is included in the Appendix H: Hazard Events. Events have been broken down by the date of occurrence and when available, by individual community descriptions. When no community specific description is available, the general description should be used as representing the entire planning area. Historical data is provided by the Storm Prediction Center (NOAA) and National Centers for Environmental Information (NCEI) databases for the CVPDC area, by county, from 1996 through 2017. These historical flood and flash flood events and associated damages are provided in Table 4-10 and Table 4-11.

*Table 4-10 Flood Events in the CVPDC area (Source: NCEI database, 1996–2019) <sup>11</sup>*

<sup>11</sup> <https://www.ncdc.noaa.gov/stormevents/>



# Hazard Identification and Risk Assessment

Locality	Number of Flood Events	Property Damage (\$K)	Crop Damage (\$K)	Total (\$K)
Amherst County	17	50	0	50
Appomattox County	7	0	0	0
Bedford County	17	120	55	175
Campbell County	24	50	20	70
Lynchburg	3	5	0	5

*Towns included in the county numbers.*

*Table 4-11 Flash Flood Events in the CVPDC area (Source: NCEI database, 1996–2019)*

Locality	Number of Flash Flood Events	Property Damage (\$K)	Crop Damage (\$K)	Total (\$K)
Amherst County	24	820	0	820
Appomattox County	22	1,189	100	1,289
Bedford County	49	560	100	660
Campbell County	40	1,961	500	2,461
Lynchburg	11	18,020	0	18,020

*Towns included in the county numbers.*

#### **4.3.1.6 Relationship to Other Hazards**

Figure 4-6 shows the interrelationship (causation, concurrence, *etc.*) between this hazard and other hazards discussed in this plan update.

#### **4.3.2 Impact and Vulnerability**

The results of flooding can be moderate to severe and can affect both populations and property. Floods have the potential to pick up chemicals, sewage, and toxins from roads, factories, and farms. Therefore, any property affected by the flood may be contaminated with hazardous materials. Debris from vegetation and man-made structures may also be hazardous following the occurrence of a flood. In addition, floods may threaten water supplies and water quality, as well as initiate power outages.

Flooding can pose some significant secondary impacts to the area where the event has taken place. Some of the impacts to consider include infrastructure and utility failure, and impacts to roadways, water service, and wastewater treatment. These impacts can affect the entire planning district, making the area vulnerable to limited emergency services.

Many factors contribute to the relative vulnerability of areas within the floodplain. Some of these factors include development or the presence of people and property in the floodplain, flood depth, velocity, elevation, construction type, and flood duration. The principal flood problems in each locality are addressed in the jurisdictional analysis section of this chapter.





# Hazard Identification and Risk Assessment

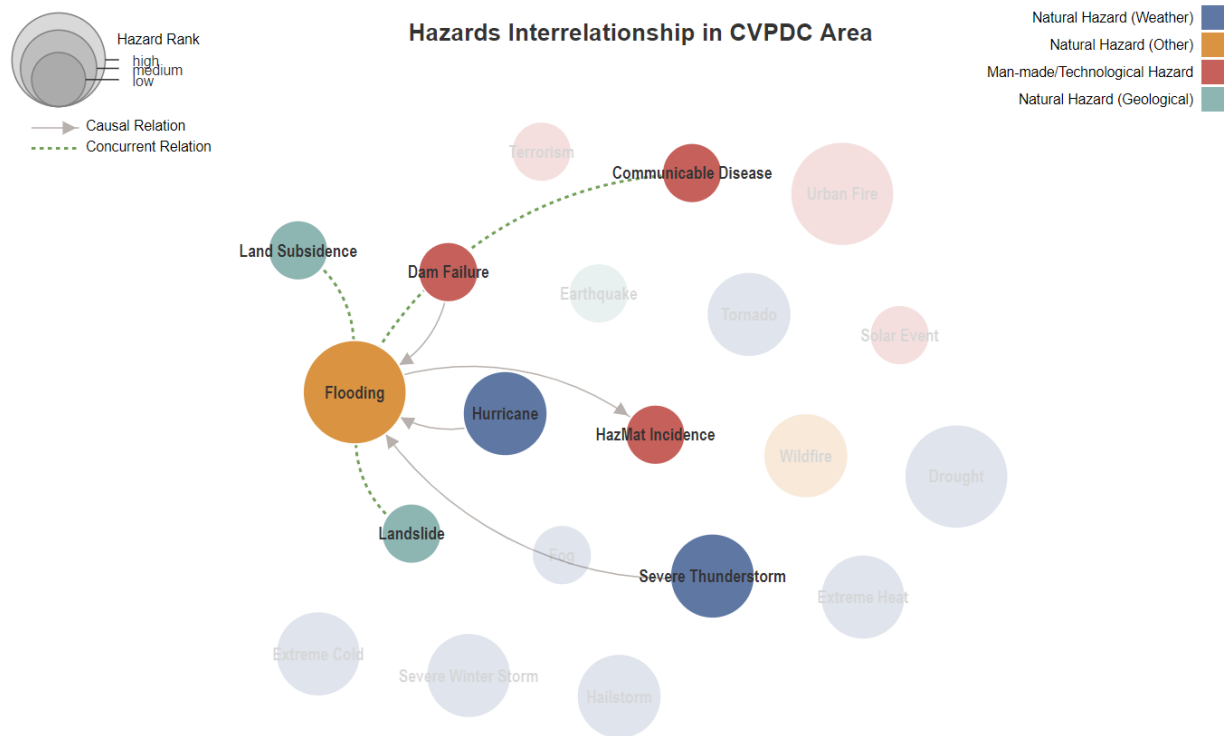


Figure 4-6 Hazards interrelationship

## 4.3.2.1 National Flood Insurance Program

The National Flood Insurance Program (NFIP) aims to reduce the impact of flooding on private and public structures by providing affordable insurance to property owners, renters, and businesses. It also encourages communities to adopt and enforce floodplain management regulations to help mitigate the effects of flooding on new and improved structures (FEMA).<sup>12</sup> Individual locality participation in the NFIP is voluntary. In addition, all participating communities can reduce the cost of policyholder premiums by participating in the Community Rating System (CRS) Program. This program awards points to communities that implement flood protection measures beyond minimum NFIP requirements, as well as other defined benchmarks. Twenty-six communities currently participate in CRS across Virginia, but zero are within the CVPDC (DCR).<sup>13</sup> Table 4-12 indicates the localities' participation in the NFIP.

Table 4-12 Communities participating in the NFIP (01/01/1978 - 09/30/2018)

<sup>12</sup> <https://www.fema.gov/national-flood-insurance-program>

<sup>13</sup> <https://www.dcr.virginia.gov/dam-safety-and-floodplains/fp-crs>



# Hazard Identification and Risk Assessment

Locality	Entry in NFIP	FIRM Current Effective Date	Flood Insurance Policies	Insured Value (\$K)		Total Loss Events	Total Value in Losses Paid (\$K)
				Insurance In-force whole	Written Premium In-force		
Amherst County*	7/17/1978	09/19/2007	35	8,591.7	53.51	49	1,363.68
Appomattox County*	7/17/1978	01/02/2008	7	915.7	7.98	9	256.14
Campbell County*	10/17/1978	08/28/2008	38	10,037.9	25.13	18	558.05
Bedford County*	9/29/1978	09/29/2010	127	34,145.5	108.45	30	229.68
City of Lynchburg	9/1/1978	06/03/2008	101	30,099.3	284.67	134	3,585.51
Town of Amherst	11/2/1977	09/19/2007	4	1,350	6.27	35	132.07
Town of Appomattox	5/25/1984	01/02/2008	2	604.8	2.92	-	-
Town of Brookneal	3/1/1978	08/28/2008	3	589.4	10.33	-	-
Town of Altavista	8/1/1978	08/28/2008	6	2,108.2	12.46	10	159.53
Town of Bedford	6/1/1978	09/29/2010	14	4,301.7	42.36	1	0

\* Unincorporated areas of the county only.<sup>14</sup>

## 4.3.2.2 Repetitive Loss Properties

The Hazard Mitigation Assistance Program defines Repetitive Loss as having incurred flood-related damage on two occasions, in which the cost of the repair, on average, equaled or exceeded twenty-five percent (25%) of the market value of the structure at the time of each such flood event; and, at the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage (FEMA).<sup>15</sup> The NFIP defines a repetitive loss property as any insurable building for which two or more claims of more than \$1,000 were paid by the NFIP within any rolling ten-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP.<sup>16</sup>

The identification of repetitive loss properties is an important element to conducting a local flood risk assessment, as the inherent characteristics of properties with multiple flood losses strongly suggest that they will be threatened by continual losses. Repetitive loss properties are also important to the NFIP, since structures that flood frequently put a strain on the National Flood Insurance Fund.

Since 1978, FEMA has provided a Repetitive Loss list of properties in communities that have received two or more flood insurance claims greater than \$1,000 from NFIP within a rolling ten-year period. The Repetitive Loss list includes pertinent information regarding the property address, dates of claims, amounts received, and owner information. Some of this information is protected by the Privacy Act of

<sup>14</sup> Losses paid - <https://bsa.nfipstat.fema.gov/reports/1040.htm#51>

NFIP Claims - <https://bsa.nfipstat.fema.gov/reports/1011.htm#VAT>

FIRM Current Effective Date - <https://msc.fema.gov/portal/advanceSearch>

<sup>15</sup> FY 2019 Flood Mitigation Assistance (FMA) Grant Program. [https://www.fema.gov/media-library-data/1578520288733-d372d995bdbb6aea6c88ed39636138fb/FMAFactSheetFY19\\_1.8.20.pdf](https://www.fema.gov/media-library-data/1578520288733-d372d995bdbb6aea6c88ed39636138fb/FMAFactSheetFY19_1.8.20.pdf)

<sup>16</sup> National Flood Insurance Program: Frequently Asked Questions. [https://www.fema.gov/txt/rebuild/repetitive\\_loss\\_faqs.txt](https://www.fema.gov/txt/rebuild/repetitive_loss_faqs.txt)



# Hazard Identification and Risk Assessment

1874 and has been withheld from Table 4-13. As of September 30, 2019, there are 27 repetitive loss properties in the CVPDC area, with a total payment of \$2,800,967.36 (an average payment of \$103,740 per structure, see Table 4-13). Most of the repetitive loss structures for the region are nonresidential properties. Note that FEMA designated counties, cities, and towns separately in the table. This table provides a listing of the structures that have repetitive loss and does not include all structures that have had damage due to flooding. Figure 4-7 shows a general location of the repetitive loss properties in the region. Due to privacy concerns, the general area is depicted instead of the individual sites.

### 4.3.2.3 Severe Repetitive Loss Properties

The NFIP also designates severe repetitive loss (SRL) properties in a community. As defined by the Flood Insurance Reform Act of 2004, SRLs are 1-4 family residences that either have had four or more claims of \$5,000 or more, or have had at least two claims that cumulative exceed the building's value. The CVPDC area has 11 SRL properties identified by NFIP.<sup>17</sup>

*Table 4-13 NFIP Repetitive Loss and Severe Loss Properties (As of September 30, 2019; Source: Virginia Department of Conservation and Recreation/FEMA)*

Locality	Number of Properties		Payment (\$K)		
	Repetitive Loss Properties	Severe Repetitive Loss Properties	Building Payment	Contents Payment	Total
Amherst County	1	1	65.78	8.95	74.73
Town of Amherst	1	1	99.00	23.01	122.01
Appomattox County	2	1	204.50	42.43	246.93
Town of Appomattox	-	-	-	-	-
Town of Pamplin City	-	-	-	-	-
Bedford County	3	1	103.85	18.42	122.27
Town of Bedford	-	-	-	-	-
Campbell County	-	-	-	-	-
Town of Altavista	1	0	56.84	3.58	60.42
Town of Brookneal	-	-	-	-	-
Lynchburg City	19	7	1,066.21	1,108.39	2,174.60

<sup>17</sup> NFIP/CRS: <https://crsresources.org/files/500/rlaa-guide-2017.pdf>



# Hazard Identification and Risk Assessment

## Repetitive Loss Areas in the Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020

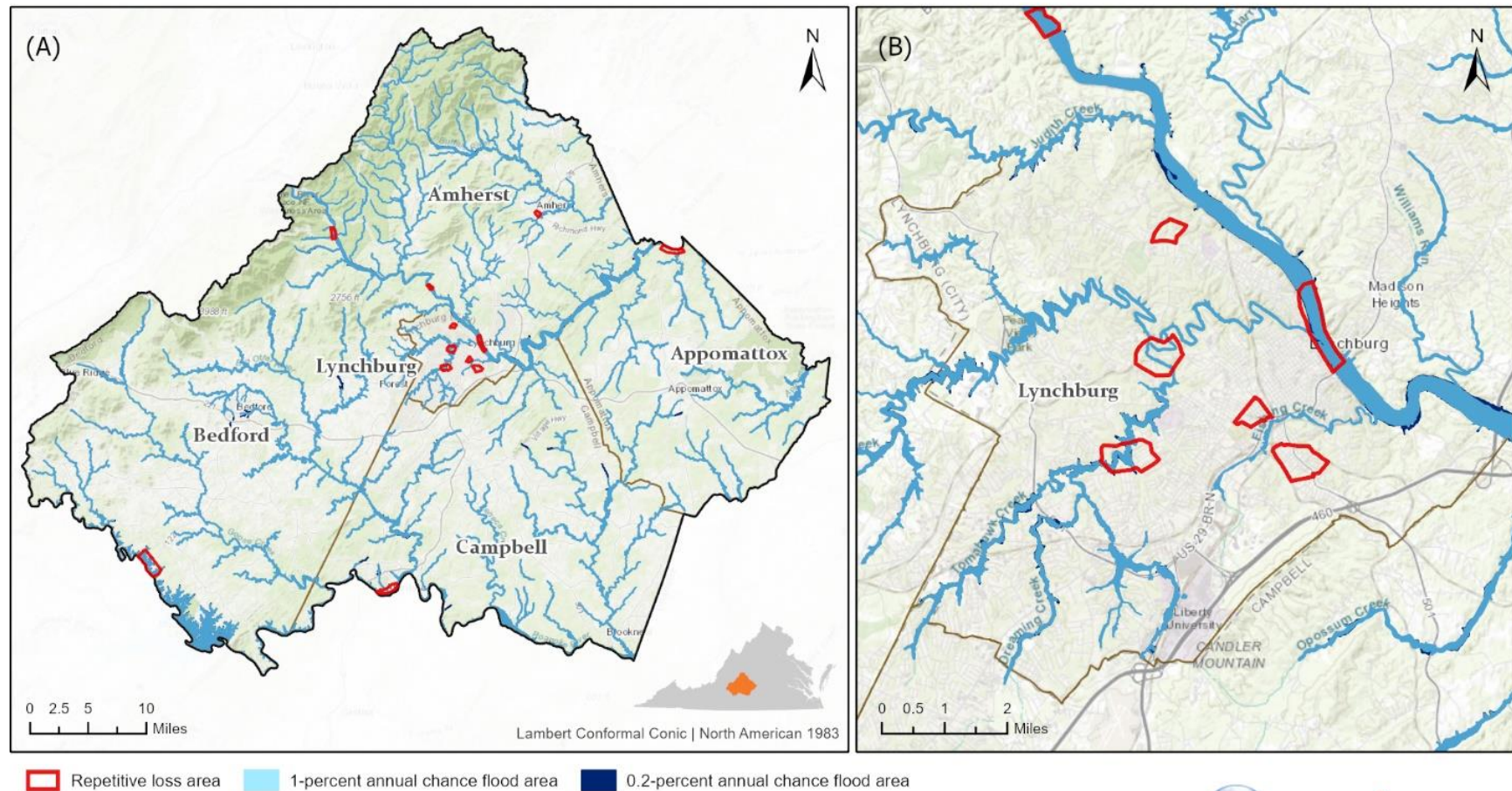


Figure 4-7 Repetitive Loss Areas in the CVPDC Area





# Hazard Identification and Risk Assessment

## 4.3.3 Risk Assessment

The 1-percent annual chance flood area in the CVPDC area covers 112.2 square miles, accounting for 5.2% of the entire CVPDC area. There are 827 vulnerable structures (primary structure only), 54 critical facilities, and 384 road bridges in the floodway. The 0.2-percent annual chance flood area is 117.4 square miles, which covers 5.5% of the area of the CVPDC. 1,369 primary structures, 60 critical facilities, and 393 road bridges are within this floodplain. Table 4-14 and Table 4-15 indicate the area and number of structures breakdown for each locality.

There are several reasons bridges fail during floods, such as:

- Water, salt, or debris damages critical parts of the structure.
- Pressure from water or debris breaks apart the bracing system.
- Water lifts the structure off its supports.
- Piers or abutments are knocked out by large debris, such as boats or vehicles that get caught in rapidly flowing water.
- Extreme scour compromises the foundation.
- Approach roads are cut, weakening structural supports.

Among those, the main reason bridges are destroyed by floods is because of a phenomenon known as scour. It is one of the three main causes of bridge failure (the others being collision and overloading) in the United States. Bridge scour is the removal of sediment such as sand and gravel from around bridge abutments or piers. Scour caused by floodwaters can remove large amounts of foundation material from under the footings of a bridge. A scour critical bridge is at risk of becoming unstable during a flood therefore must be monitored and identified. This is also required by Code of Federal Regulations; Chapter 23 Highways – Section 650.313(3)(3); 2005 National Bridge Inspection Standards. The Scour Critical ratings for all road bridges within CVPDC was derived from US DOT National Bridge Inventory. Those road bridges with lowest score and located in the floodplain were identified as at high risk.

Among the 393 road bridges located in 1-percent or 2-percent annual chance flood areas within CVPDC, 45 are identified at high risk (with Scour Critical rating as 1-4), and 1 in Amherst County has unknown status.

*Table 4-14 1-percent and 0.2-percent annual chance flood area by jurisdiction*

Locality *	Total Area (sq.mi)	1% Annual Chance Flood Area (sq. mi)	% of Total Area	0.2% Annual Chance Flood Area (sq. mi)	% of Total Area
Amherst County	478.9	25.3	5.3%	26.4	5.5%
Town of Amherst	4.9	0.3	6.1%	0.3	6.1%
Appomattox County	335.5	15.3	4.6%	15.5	4.6%
Town of Appomattox	2.3	0.02	0.9%	0.02	0.9%
Bedford County	776.3	40.6	5.2%	42.3	5.5%
Town of Bedford	8.7	0.4	4.6%	0.5	5.7%



# Hazard Identification and Risk Assessment

Locality *	Total Area (sq.mi)	1% Annual Chance Flood Area (sq. mi)	% of Total Area	0.2% Annual Chance Flood Area (sq. mi)	% of Total Area
Campbell County	507.1	28.0	5.5%	29.7	5.9%
Town of Altavista	5.2	1.0	19.2%	1.1	21.2%
Town of Brookneal	3.6	0.3	8.3%	0.3	8.3%
Lynchburg City	49.5	3.0	6.1%	3.5	7.1%

\* County data includes town data

Table 4-15 Number of structures, critical facilities and road bridges in floodplain by jurisdiction

Locality *	Within 1% Annual Chance Flood Area			Within 2% Annual Chance Flood Area		
	Primary Structure**	Critical Facility	Road Bridge	Primary Structure	Critical Facility	Road Bridge
Amherst County	163	9	115	182	9	118
Town of Amherst	4	1	7	4	0	7
Appomattox County	45	0	51	51	1	52
Town of Appomattox	2	0	0	2	1	0
Bedford County	368	26	120	787	29	121
Town of Bedford	29	7	2	38	7	2
Campbell County	91	13	78	114	14	79
Town of Altavista	21	4	4	23	4	4
Town of Brookneal	1	4	1	2	4	1
Lynchburg City	160	6	20	235	7	23
<b>CVPDC Total</b>	<b>827</b>	<b>54</b>	<b>384</b>	<b>1369</b>	<b>60</b>	<b>393</b>

\* County data includes town data. \*\* Only the primary structure within a parcel was taken into account; see "Data cleaning process" sidebar in Risk Assessment section.

## 4.3.3.1 Hazus Level 2 Analysis

Riverine Hazus level-2 analysis was completed for the 2020 revision using 1-percent and 0.2-percent annual chance scenarios. The Hazus methodology was developed for the Federal Emergency Management Agency (FEMA) by the National Institute of Building Sciences to provide a tool for developing loss estimates for various hazards. User-specified flood depth grids and extensive property data was used to estimate the losses for the CVPDC area.

Detailed building inventory at parcel level was prepared for the region and the following building related attributes were required to produce accurate loss estimates:

- Foundation type
- First floor height
- Occupancy type
- Number of stories
- Building replacement values/ cost



# Hazard Identification and Risk Assessment

- Contents replacement cost
- Location (latitude/ longitude)

The above information was obtained from a combination of sources and in place of missing values, assumptions were made. RSMeans standards from Hazus were used to estimate the property values.

Similarly, flood grids for a 1-percent annual chance flood were prepared for this analysis using 1/3 arc second Digital Elevation Models (DEMs) and National Flood Hazard Layer (NFHL) for the region.

## Data cleaning process

Development of a detailed building inventory in a flooding event damage assessment is vital and the first step to produce accurate flood loss estimates. When importing a building point dataset into the Hazus flood model for site specific analysis, the depth of water at a given point is applied from the depth grid to the structure based on its physical coordinate location. Having the building point locations as accurate as possible can greatly increase the results accuracy for the region. The potentially impacted buildings are identified from the intersection between building footprint data and the Standard Digital Flood Insurance Rate Map (DFIRM) data. These building footprints are converted to points using a polygon to point conversion. Some resulting point locations are adjusted within to make sure each point on a structure is placed inside the flooded area.

It is worth mentioning that only the primary structure within each parcel is involved in the building inventory data. A data cleaning process is applied to the initial inventory data to further reduce some building points. Such excluded building points include:

- Affiliated or small structures exist within the same parcel with conventional housing, such as sheds or detached garages
- Out-buildings that are less than 200 square foot for residential, agricultural, or commercial / industrial use
- Vacant or abandoned residential buildings in bad condition according to structure attributes in parcel information
- Recreational vehicles (RV) or trailer homes in the A Zones by Smith Mountain Lake
- Shelters and covered boat docks by water area

Although these aforementioned, non-conventional structures are excluded for loss estimate, it is important for the localities to notify owners of these structures to make them aware of the hazards. It is common that homeowners store fuel, oil, and machinery in the sheds, which could contaminate the surface water during the flood. RVs skirt around regulations because it is assumed they can be moved out of the floodplains to a safer location when a flooding threatens, but they should be identified, as they would pose potential risk.

**Foundation Type** information was readily available for all the counties except Appomattox. Foundation type and year built of the structure was further used to calculate the First Floor Height (FFH) of the structures. FFH and foundation data for Lynchburg was developed by the HMP Team. For Appomattox, the data was updated using realtor websites and google street maps, and assumptions were made where the data was not available.



# Hazard Identification and Risk Assessment

**Occupancy and number of stories information** for all the counties was derived from parcel data. Data for Lynchburg was already available.

**Square footage** of all the structures in the floodplain considered in this analysis was obtained using calculated geometry, parcel data. VGIN and Microsoft data was used for this.

Means Cost, Content Cost Percentage, and Residential and Non-Residential Locational Factors were obtained from Hazus software (version 4.2).

## 4.3.3.2 Economic Losses: 1-percent Annual Chance Flooding Scenario

The direct economic loss estimates at locality level by general occupancy in the 1-percent annual chance flooding scenario are generated from Hazus Flood analysis (Table 4-16 and Table 4-17).

*Table 4-16 Direct Economic Losses for User Defined facilities (1-percent annual chance flooding)*

Locality	Capital Stock Exposure		Capital Stock Losses			
	Building Exposure (\$K)	Contents Exposure (\$K)	Building Loss (\$K)	Contents Loss (\$K)	Inventory Loss (\$K)	Total Loss (\$K)
Amherst County	36,869	31,319	22,267	21,015	945	44,226
Appomattox County	8,379	4,190	2,900	1,319	0	4,218
Bedford County	57,964	33,526	19,397	12,970	89	32,456
Campbell County	24,859	17,080	7,761	8,199	186	16,146
Lynchburg	255,138	336,783	114,235	211,622	14,450	340,307
<b>Total</b>	<b>383,209</b>	<b>422,898</b>	<b>166,558</b>	<b>255,124</b>	<b>15,670</b>	<b>437,353</b>

*Notes: All values are in thousands of dollars. County totals include town loss estimates.*

Figure 4-8 displays the buildings that will be damaged from a 1-percent annual chance flood event based on the losses incurred in the CVPDC area. According to the analysis, Lynchburg has the highest susceptibility to a 1-percent annual chance flood event in the region. There is also a cluster of structures along the Smith Mountain Lake in the south-western portion of Bedford County that are exposed to damage from a 1-percent annual chance flood.

*Table 4-17 Direct Economic Losses by Building Occupancy - Total Loss (1-percent annual chance of flooding)*

Locality	Residential (\$K)	Commercial (\$K)	Industrial (\$K)	Government (\$K)	Religion (\$K)
Amherst County	17,060.9	11,147.3	14,026.8	-	769.2
Town of Amherst	276	-	-	-	-
Appomattox County	3,914.1	-	-	-	-
Town of Appomattox	304.3	-	-	-	-
Bedford County	25,084.4	2,592.1	296.9	-	4,071.9
Town of Bedford	3,518.3	5,321.4	-	-	-
Campbell County	6,994.3	765.3	-	-	-
Town of Altavista	1,532.2	2,304.8	-	4,031.3	-
Town of Brookneal	-	-	-	331.7	-





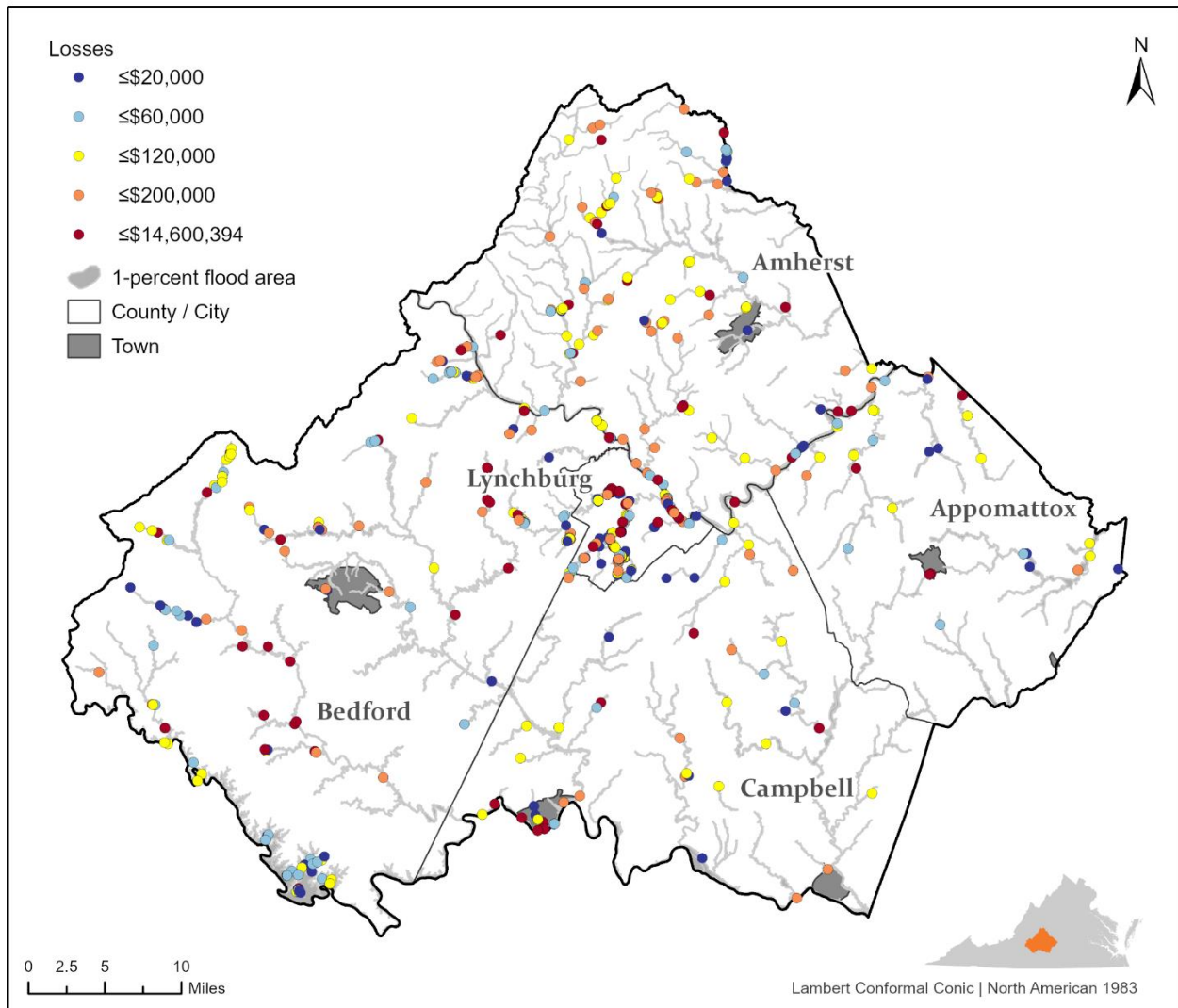
# Hazard Identification and Risk Assessment

Locality	Residential (\$K)	Commercial (\$K)	Industrial (\$K)	Government (\$K)	Religion (\$K)
Lynchburg City	38,903.6	20,748.5	26,6205.0	-	-

Notes: All values are in thousands of dollars. County totals do not include the town loss estimates

## Building Losses in 1-percent Annual Chance Flooding Scenario for Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: FEMA Flood Map Service Center  
Center for Geospatial Information Technology at Virginia Tech. 08/2019



Figure 4-8 Building Losses in 1-percent Annual Chance Flooding Scenario for CVPDC area



# Hazard Identification and Risk Assessment

## 4.3.3.3 Economic Losses: 0.2-percent Annual Chance Flooding Scenario

In most cases, the 1-percent annual chance flood is appropriate for risk identification and assessment of general structures. However, a higher standard (0.2-percent probability flood) may be appropriate for regulating certain types of structures to avoid losses from catastrophic failure, such as critical facilities and infrastructure. Errors may exist in the floodplain modeling considering the age of the current flood model (which was developed in 1978 with some revisions in 1983 and 2008). It would be safe to take additional flooding scenarios into consideration. Moreover, the 0.2-percent probability flood event can be used as a broad generalization of flood risk under unknown circumstances, such as debris blockages and future conditions when there may be more development and precipitation in the CVPDC.

The direct economic loss estimates in the 0.2-percent annual chance flooding scenario are provided in Table 4-18 and Table 4-19. For Bedford County, the number of structures and losses from a 0.2-percent annual chance flood increases significantly.

Table 4-20 and Table 4-21 shows the percentage difference of economic losses between 0.2-percent and 1-percent annual chance of flooding scenarios for all communities in CVPDC. The difference between the two scenarios is substantial for Bedford County. Most of the structures in the 0.2-percent flood zone are located near Smith Mountain Lake in the southwestern part of the county.

*Table 4-18 Direct Economic Losses for User Defined facilities (0.2-percent annual chance of flooding)*

Locality	Capital Stock Exposure		Capital Stock Losses			
	Building Exposure (\$K)	Contents Exposure (\$K)	Building Loss (\$K)	Contents Loss (\$K)	Inventory Loss (\$K)	Total Loss (\$K)
Amherst County	48,598	38,435	24,359	25,065	815	50,239
Appomattox County	13,659	7,161	6,740	2,850	7	9,597
Bedford County	209,621	111,417	84,109	36,918	138	121,165
Campbell County	54,775	32,459	19,909	14,356	232	34,497
Lynchburg	553,366	646,498	183,994	379,858	19,109	582,960
<b>Total</b>	<b>880,019</b>	<b>835,971</b>	<b>319,111</b>	<b>459,046</b>	<b>20,301</b>	<b>798,458</b>

*Notes: All values are in thousands of dollars. County totals include town loss estimates.*

*Table 4-19 Direct Economic Losses by Building Occupancy - Total Loss (0.2-percent annual chance of flooding)*

Locality	Residential (\$K)	Commercial (\$K)	Industrial (\$K)	Government (\$K)	Religion (\$K)
Amherst County	24,918.7	6,356.4	11,808.1	4,093.8	1,495.0
Town of Amherst	752.4	-	-	-	-
Appomattox County	8,737.3	-	-	-	-
Town of Appomattox	411.8	-	-	-	-
Town of Pamplin	-	-	-	-	-



# Hazard Identification and Risk Assessment

Locality	Residential (\$K)	Commercial (\$K)	Industrial (\$K)	Government (\$K)	Religion (\$K)
Bedford County	109,274.6	4,039.9	1,274.3	687.1	5,562.2
Town of Bedford	6,252.3	7,610.5	-	-	4,765.3
Campbell County	18,250.1	1,023.9	-	-	-
Town of Altavista	4,679.4	2,940.2	-	-	-
Town of Brookneal	77.5	-	-	-	-
Lynchburg City	73,029.3	214,938.9	275,372.9	510.2	-

Notes: All values are in thousands of dollars. County totals do not include the town loss estimates

Table 4-20 Percentage difference between 1-percent and 0.2-percent annual chance of flooding in direct economic losses for user defined facilities.

Locality	Capital Stock Exposure		Capital Stock Losses			
	Building Exposure	Contents Exposure	Building Loss	Contents Loss	Inventory Loss	Total Loss
Amherst County	14%	10%	4%	9%	7%	6%
Appomattox County	24%	26%	40%	37%	100%	39%
Bedford County	57%	54%	63%	48%	21%	58%
Campbell County	38%	31%	44%	27%	11%	36%
Lynchburg	37%	31%	23%	28%	14%	26%

Table 4-21 Percentage difference between 1-percent and 0.2-percent annual chance of flooding in direct economic losses by building occupancy - total loss

Locality	Residential	Commercial	Industrial	Government	Religion
Amherst County	19%	27%	9%	100%	32%
Town of Amherst	46%	-	-	-	-
Appomattox County	38%	-	-	-	-
Town of Appomattox	15%	-	-	-	-
Town of Pamplin	-	-	-	-	-
Bedford County	63%	22%	62%	100%	15%
Town of Bedford	28%	18%	-	-	100%
Campbell County	45%	14%	-	-	-
Town of Altavista	51%	12%	-	100%	-
Town of Brookneal	100%	-	-	100%	-
Lynchburg City	30%	82%	2%	100%	-

## 4.3.4 Jurisdictional Analysis

### 4.3.4.1 Amherst County and Town of Amherst

Amherst County is located near the geographic center of Virginia just north of the City of Lynchburg. The county was created in 1761 from Albemarle County and is named for Major-General Jeffery Amherst, a



# Hazard Identification and Risk Assessment

hero of the battle of Ticonderoga. It is bounded on the northwest by Rockbridge County, to the south and southwest by Bedford County, Campbell County, and the City of Lynchburg and on the northeast by Nelson County. James River borders the county on the south and east, with the crest of the Blue Ridge Mountains forming the western boundary. According to the American Community Survey, Amherst County's population dropped by 1.09 percent to 31,999 between 2010 and 2016. Half the population is located in the south central portion of the county near the City of Lynchburg and around Madison Heights. According to Virginia's Career and Workforce-Labor Market Information, the top five largest employers of Amherst County (excluding local government) in 2019 are Glad Manufacturing Company, Greif Packaging LLC, WalMart, Sweet Briar College, and Johnson Health Center.<sup>18</sup>

The Town of Amherst was incorporated in 1910 and is situated on the topographic divide separating Tribulation Creek and Rutledge Creek. It was renamed from its original names "The Oaks" and "Seven Oaks" in 1807, after Nelson County divided from Amherst County. The Town of Amherst serves as the county seat. As of the 2017 population estimate, the town has a total population of 2,519.

#### 4.3.4.1.1 Community Characteristics

Amherst County entered the National Flood Insurance Program (NFIP) on July 17, 1978, with emergency entry on March 1, 1974. The current effective date for the FIRMs is September 19, 2007. They are currently in good participating standing with the program. The unincorporated area of the county has 36 flood policies in force, of which 17 policies in the effective flood high hazard area. Total loss paid since 1978 is about \$1.2 M. Amherst County plans to continue NFIP compliance. There were 14 county wide presidential disaster declarations for Amherst County (Figure 4-9). The 1-percent and 0.2-percent annual chance flood areas in Amherst County take 25.3 and 26.4 square miles, accounting for 5.3% and 5.5% total area of the entire county, respectively.

The Town of Amherst entered into the NFIP November 2, 1977 with emergency entry on February 7, 1974. The current effective date for the FIRMs is also September 19, 2007. They are currently in good participating standing with the program. The town has 4 flood policies in force, including 2 policies in the effective flood high hazard area. \$132 K losses have been paid since 1978 (Figure 4-10). The Town of Amherst plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in the Town of Amherst take 0.3 and 0.3 square miles, accounting for 6.6% and 6.8% total area of the town, respectively.

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<sup>18</sup> <https://virginiaworks.com/download-center>



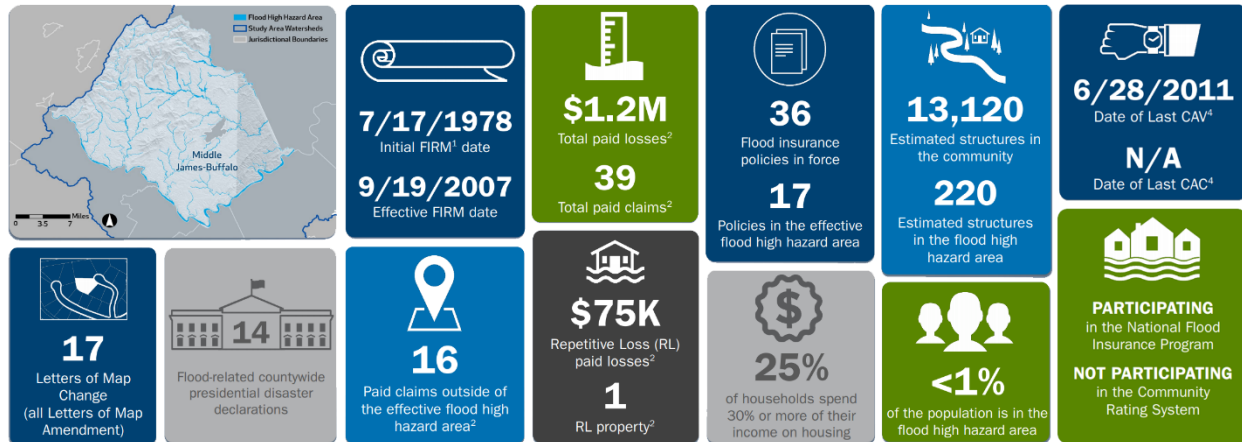


Figure 4-9 Community dashboard of Amherst County (Unincorporated Areas)

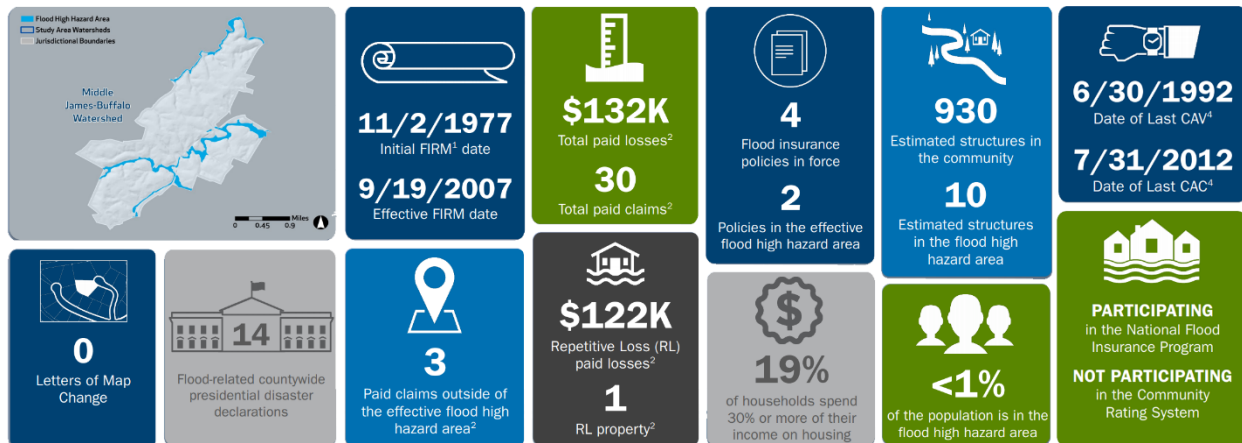


Figure 4-10 Community dashboard of Town of Amherst

#### 4.3.4.1.2 Principal Flood Problems

This flood risk assessment identifies impacts to the people and property of Amherst County using the Flood Risk Discovery Report of Middle James-Buffalo Watershed (FEMA, 2019) developed under FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program and the detailed risk analysis developed for this Hazard Mitigation Plan. The following principal flood problems have been identified for Amherst County and Town of Amherst.

- Low-lying areas along James River are subject to periodic flooding.
- Tropical storms are responsible for some of the larger floods experienced on James River. Flooding from these storms almost always occurs in the period of May through November, which is hurricane season.
- Williams Run is much more responsive to localized storms with intense rainfall. Most flooding along Williams Run is minor backyard-type flooding. The increased development in this area is changing watershed parameters and could cause more severe flooding in the future.



# Hazard Identification and Risk Assessment

- Critical facilities located in the floodplain include: Henry L. Lanum, Jr. Water Filtration Plant, Williams Run Sewage Pump Station, ACSA's major sewage pump station along James River, Water Treatment Plant and raw water intake on Harris Creek, Rutledge Creek WWTP, the Town's raw water intake, Pedlar Volunteer Fire and Rescue, and Monacan Ancestral Museum.
- Trunk line for the public sewer serving half of Madison Heights, the County's commercial hub and largest town, is on the north bank of James River and threatened by river bank erosion. Some of the water lines and many of the sewer lines follow the streams. A pump station is also in the base floodplain and other pump stations are inaccessible during flood events.
- Natural gas line located in floodplain.
- 20 high risk bridges and 1 bridge with unknown status in the floodplain.
- Two repetitive loss properties and two severe repetitive loss properties
- Older population located in the floodplain.

## 4.3.4.1.3 Vulnerable Population and Structures

Certain people and households are especially sensitive to flooding events (or other natural hazards), such as low-income households, children, elderly, disabled, and minorities. These vulnerable populations are typically less likely to prepare for hazards, may be unable to undertake self-protective actions, or lack the resources to take recommended loss-reduction or evacuation measures.

*Demographic data with dasymetric mapping techniques at census block level were used for profiling the vulnerable population in or adjacent to floodplains within the incorporated area of Amherst County. The dasymetric census blocks have attempted to remove the unpopulated areas from the official census blocks. FEMA's Risk Map program identified "Less than 1% of the population is in the floodplain" for the county. However, up to 10.9% (or 11.2%) of the county's population have the potential to be impacted by flooding because of living in or close to 1-percent (or 0.2-percent) flood zones. Among those populations, 6.3% of them are at a low-income level, 21.7% are young (age < 16), and 19.2% are seniors (age > 65). Whites make up the largest share (75.7%) of the total residents in Amherst County. Likewise, whites dominate in or around the floodplain, representing 82.9% of the vulnerable population. Blacks are 11.9% of the vulnerable population, Hispanic or Latino are 0.1%, Asians are 0.1%, and Native Americans are 0.4%. Table 4-22 and*

Table 4-23 provide more demographics of the vulnerable population in Amherst County, in terms of ethnic group, income level, and age group.

*Table 4-22 Ethnic group in and adjacent to floodplains of Amherst County and Town of Amherst*

	Population	Households	White	Black	Hispanic	Asian	Native Am
Amherst	32353	12560	24491 (75.7%)	6104 (18.9%)	625 (1.9%)	153 (0.5%)	296 (0.9%)
1% Floodplain	3539 (10.9%)	1363	2933 (82.9%)	420 (11.9%)	90 (2.5%)	4 (0.1%)	13 (0.4%)
0.2% Floodplain	3636 (11.2%)	1403	3026 (83.2%)	421 (11.6%)	92 (2.1%)	4 (0.1%)	14 (0.4%)

*Table 4-23 Income level and age group in floodplains of Amherst County and Town of Amherst*



# Hazard Identification and Risk Assessment

	Population	Households	Income <\$20k/Yr	Age <16	Age >65
Amherst	32353	12560	2404 (7.4%)	6940 (21.5%)	5330 (16.5%)
1% Floodplain	3539	1363	222 (6.3%)	768 (21.7%)	679 (19.2%)
0.2% Floodplain	3636	1403	230 (6.3%)	786 (21.6%)	705 (19.4%)

The unincorporated area of Amherst County has 159 (or 178) primary structures identified in the 1-percent (or 0.2-percent) floodplain and are shown in Figure 4-11. Most vulnerable structures are located in the following areas:

- Woodson / Lowesville area. This remote residential area has about 30 structures in the floodplain, including houses, retail stores, and a church along Woodson Rd (Figure 4-12, Panel D).
- Willow / Forks of Buffalo area. Approximately 20 structures (including the Pedlar Volunteer Fire And Rescue facility) along Route 60 and N Fork Rd (Figure 4-12, Panel F).
- Bank of James River in the south border of the county. There are over 30 homes and retail stores in the floodplain (Figure 4-12, Panel A). This is also part of the county's community growth area (Figure 4-15).
- Stapleton area. 16 homes on Galts Mill Rd along James River (Figure 4-12, Panel E).
- The north end of Thrashers Creek Rd along the South Fork Thrashers Creek and tributary streams in the north of the county (Figure 4-12, Panel B).
- Dancing Creek Rd and Wagon Trail Rd near Pera area (Figure 4-12, Panel C).

The Town of Amherst has 4 (or 4) structures (single family homes) in the 1-percent (or 0.2-percent) floodplain shown in Figure 4-14. As mentioned in the data cleaning process section of this chapter, only primary structures are identified in the floodplain. It is possible that small outbuildings/sheds of the primary structure may exist in the floodplain as well.

There are 8 critical facilities and infrastructure in both 1-percent and 0.2 percent floodplain of the unincorporated area of Amherst County. These include 2 campgrounds (Oronoco Campground and Otter Creek Campground), 2 energy facilities (Snowden Hydro Power Plant and Cushaw Hydro Power Plant), 1 HazMat facility (Lynchburg Steel & Specialty Co., Inc.), Monacan Ancestral Museum, Pedlar Volunteer Fire and Rescue, Henry L. Lanum, Jr. Water Filtration Plant, Williams Run Sewage Pump Station, ACSA's major sewage pump station along James River, Water Treatment Plant and raw water intake on Harris Creek, and a pump station by Route 718 (Table 4-24). According to the Locality Vulnerability Meeting, a trunk sewer which collects about 50% of waste produced by Madison Heights, the County's commercial hub and largest town is on the north bank of James River. Also, a portion of a natural gas line is within the flood zone.

In the Town of Amherst, Rutledge Creek Waste Water Treatment Plant (WWTP) is identified in the 1-percent flood zone. The headworks of the facility are not in a high elevation area. It is known that the town's raw water intake is also in the flood zone.

*Table 4-24 Critical facility and infrastructure in floodplain of Amherst County and Town of Amherst*



# Hazard Identification and Risk Assessment

Facility Name	Address	Facility Type	Coordinates	Flood Zone *
Monacan Ancestral Museum	2009 Kenmore Rd, Amherst	Attractions	37.5729, -79.1270	1%; 0.2%
Oronoco Campground	Jordan Rd, Vesuvius	Campground	37.7488, -79.2653	1%; 0.2%
Otter Creek Campground	60851 Blue Ridge Pkwy, Monroe	Campground	37.5760, -79.3379	1%; 0.2%
Cushaw Hydro Power Plant	Mt Grove Cr-01 600 N., Warm Springs	Energy Facility	37.5929, -79.3813	1%; 0.2%
Snowden Hydro Power Plant	7443 Elon Road, Big Island	Energy Facility	37.5736, -79.3715	1%; 0.2%
Pedlar Volunteer Fire and Rescue	4893 Lexington Turnpike, Amherst	Fire Stations	37.6725, -79.2171	1%; 0.2%
Lynchburg Steel & Specialty Co Inc	275 Francis Avenue, Monroe	HazMat Facility	37.5075, -79.1230	1%; 0.2%
Sewer Pump Station	Route 718 / Buffalo River, Amherst	Sewer Pump Station	37.6091, -79.0384	1%; 0.2%
Rutledge Creek WWTP **	731 Industrial Dr, Amherst	Wastewater Treatment Plant	37.5844, -79.0304	1%; 0.2%
ACSA Henry L. Lanum Water Filtration Plant	1355 Elon Road, Madison Heights	Water Treatment	37.4846, -79.166	1%; 0.2%
ACSA Williams Run Sewage Station	101 Carolina Avenue, Madison Heights	Sewage Pump Station	37.4053, -79.1004	1%; 0.2%
ACSA Madison Heights Trunk Sanitary Sewer	North bank, James River	Sanitary Sewer	37.3992, -79.1157	1%; 0.2%

Note: \* 1% (or 0.2%) indicates 1-percent (or 0.2-percent) annual chance flood zone. \*\* Located in the Town of Amherst.

In the unincorporated areas of Amherst County, there are 183 flood-prone roads (13 are US or state primary roads), with a total of over 51 miles road segments in the floodplain (Table 4-25). The top five susceptible roads are all US or state primary roads, including Blue Ridge Pkwy, Lexington Tpke, N. Fork Rd, Galts Mill Rd, and Woodson Rd. Some other roads that have more than multiple flood-prone locations along their route include: Buffalo Springs Tpke, Wagon Trail Rd, Elon Rd, River Rd, Thrashers Creek Rd, Little Piney Rd, and Little Irish Rd. Among the county's total 150 road bridges, 108 (or 111) are within 1-percent (or 0.2-percent) flood zones which includes 20 bridges at high risk (scour potential between 1- 4) and 1 bridge with unknown risk status (unknown scour potential). These are shown in Table 4-27 and Figure 4-13.

*In the Town of Amherst, there are 12 roads that may be impacted during flooding. Road segments in the floodplain total about 1.7 miles and are shown in Table 4-26 and Figure 4-14. The five most susceptible roads are the ramp on Route 29NB (near Amherst County High School), Monacan Pkwy, S Amherst Hwy, N Amherst Hwy, and Scotts Hill Rd. There are 7 road bridges in the floodplain (*

*Table 4-28). Two locations (79.04443°W, 37.58063°N; 79.03949°W 37.58328°N) on Norfolk Southern Railroad tracks along Rutledge Creek are within 1-percent annual chance floodplain. The tracks could be overtopped during flooding events, as there*





# Hazard Identification and Risk Assessment

are no bridges or culverts underneath the railroad at these locations. Besides, 7 broad bridges across Rutledge Creek and Buffalo River in the town are identified inside the floodplain (

Table 4-28), but none of them are rated at high risk (scour critical).

*Table 4-25 Top 50 flood-prone roads in Amherst County (unincorporated area)*

Rank	Road Name	Road Type	Road Segments in Floodplain	
			Count	Total Length (mi)
1	Blue Ridge Pkwy	USPRI	10	6.49
2	Lexington Tpke	USPRI	15	2.99
3	N Fork Rd	STPRI	18	2.95
4	Galts Mill Rd	USPRI	1	2.53
5	Woodson Rd	USPRI	2	2.41
6	Buffalo Springs Tpke	SEC	9	1.61
7	Wagon Trail Rd	USPRI	10	1.48
8	Elon Rd	SEC	13	1.47
9	River Rd	USPRI	4	1.39
10	Thrashers Creek Rd	SEC	4	1.37
11	Little Piney Rd	SEC	16	1.36
12	Little Irish Rd	SEC	16	1.35
13	Puppy Creek Rd	SEC	10	1.23
14	Monacan Pkwy	SEC	12	1.21
15	E Perch Rd	SEC	1	1.07
16	Fancy Hill Rd	SEC	1	0.98
17	Ashby Woods Rd	URB	4	0.84
18	Franklin Creek Rd	URB	7	0.83
19	High Peak Rd	SEC	3	0.82
20	Alhambra Rd	SEC	14	0.79
21	Coffeytown Rd	UMS	7	0.78
22	Reservoir Rd	SEC	9	0.77
23	Bateau Ln	URB	1	0.77
24	Hercules Rd	USPRI	10	0.75
25	Perkins Mill Rd	SEC	5	0.72
26	Mount Horeb Rd	SEC	8	0.72
27	Pedlar River Rd	SEC	12	0.69
28	Lynchburg Expy	SEC	2	0.68
29	C And O Ln	SEC	1	0.65
30	Salt Creek Rd	URB	1	0.61
31	Riverville Rd	SEC	3	0.59
32	Beck Creek Rd	URB	5	0.59
33	Slapp Creek Rd	SEC	12	0.55
34	Dancing Creek Rd	SEC	3	0.54
35	Lowesville Rd	SEC	6	0.54
36	Monacan Park Rd	SEC	1	0.54
37	Amelon Expy	SEC	6	0.53



# Hazard Identification and Risk Assessment

Rank	Road Name	Road Type	Road Segments in Floodplain	
			Count	Total Length (mi)
38	S Amherst Hwy	URB	12	0.53
39	Matohe Rd	SEC	4	0.52
40	Indian Creek Rd	SEC	9	0.51
41	Dillard Hill Rd	SEC	2	0.46
42	Moss Rock Rd	SEC	2	0.46
43	Waugh's Ferry Xing	SEC	5	0.46
44	Wilderness Creek Rd	SEC	3	0.43
45	Poor House Farm Rd	URB	1	0.40
46	Wiggins Spring Rd	SEC	6	0.37
47	Fiddlers Green Way	SEC	2	0.37
48	Wares Gap Rd	SEC	2	0.35
49	Peters Hollow Rd	SEC	3	0.32
50	Angel Hollow Ln	SEC	1	0.31

Table 4-26 Flood-prone roads in Town of Amherst

Rank	Road Name	Road Type	Road Segments in Floodplain	
			Count	Total Length (feet)
1	Ramp on Route 29NB	Ramp	2	2,470
2	Monacan Pkwy	Primary	3	1,945
3	S Amherst Hwy	Primary	5	1,109
4	N Amherst Hwy	Primary	2	825
5	Scotts Hill Rd	Secondary	1	595
6	Amherst Hwy	Primary	3	522
7	Industrial Park Dr	Secondary	1	498
8	Union Hill Rd	Secondary	1	472
9	Richmond Hwy	Primary	1	168
10	Lexington Tpke	Primary	1	124
11	S Main St	Primary	1	113
12	Macadam Rd	Secondary	1	50

Table 4-27 Road bridges at high risk (scour critical) in floodplain in Amherst County

Name	Location	Crossing	Coordinate
Winesap Road	.35-Rt.1430/2.37-Rt.652	Harris Creek	37.4932, -79.1526
Elon Road	0.80-Rt 635 / 8.63-Rt 501	Maple Creek	37.5455, -79.2660
Patrick Henry Hwy.	2.99-Nel CL / .40-Rt 662	Naked Creek	37.6640, -79.0109
Toytown Road	0.70-Rt.765/1.00-Rt.739	Turner Creek	37.6134, -78.9946
Puppy Creek Road	2.20-Rt 717 / .10-Rt 60	Buffalo River	37.6558, -79.1496
Dancing Creek Road	1.40-Rt 635 / 1.00-Rt 641	Pedlar River	37.6005, -79.2639
Sandidges Road	0.50-Rt.617/0.60-Rt.632	Thrashers Creek	37.6658, -79.1350
Puppy Creek Rd	0.02-Rt.803/1.00-Rt.636	Puppy Creek	37.6301, -79.1868



# Hazard Identification and Risk Assessment

Name	Location	Crossing	Coordinate
Dancing Creek Rd.	0.40-Rt.641/2.00-Rt.635	Dancing Creek	37.5980, -79.2706
Earley Farm Road	6.75-Rt.604/1.35-Rt.814	Partridge Creek	37.4827, -78.9928
Earley Farm Road	1.20-Rt.814/6.90-Rt.604	Partridge Creek	37.4810, -78.9931
Dug Hill Road	.70-Rt.713/.20-Rt.758	Mill Creek	37.6909, -79.0909
Little Piney Road	2.20-RT.698/1.20-RT.781	Little Piney River	37.7430, -79.1020
Meadow Hollow Road	1.00-Dead End/0.80-Rt 799	Horsley Creek	37.5926, -79.2345
Ramsey Road	0.00-Rt 643/3.70-Rt 647	Pedlar River	37.5734, -79.2592
Glade Road	.53-Rt 663 / 1.17-Rt 670	Stovall Creek	37.4623, -79.0574
Pryors Creek Road	0.10-Rt 610/0.70-Dead End	Pryor Creek	37.6059, -79.2124
Pierce Mountain Rd	.15-Rt 617/.65-Dead End	Thrashers Creek	37.6983, -79.1458
Possum Island Rd	0.25-Rt 1349/0.35-Rt 701	Trib Mf Stovall Creek	37.4775, -79.0861
Rte 210 Connector	0.50-Rt.622/1.70-Rt.29BYP	Williams Run	37.4162, -79.1119

Table 4-28 Road bridges in floodplain in Town of Amherst

Location	Crossing	Name	Coordinates	Floodplain
.47-SCL Amherst/.97-29Byp	Williams Creek	Route 29 Business	37.5728, -79.0590	1%; 0.2%
.09-29 Bus/1.76-Rt 60	Rutledge Creek	Route 29	37.5611, -79.0638	1%; 0.2%
1.18-S Bus 29 / .67-Rt 60	Rutledge Creek	NBL&SBL Amherst Hwy	37.5733, -79.0522	1%; 0.2%
.84-S Bus 29 / 1.01-Rt 60	Rutledge Creek	NBL Amherst Hwy	37.5715, -79.0527	1%; 0.2%
0.00-Rt.608 / 0.60-Rt.739	Buffalo River	Amherst Highway	37.6052, -79.0264	1%; 0.2%
0.15-Rt 838/0.22-ECL	Rutledge Creek	Richmond Highway	37.5776, -79.0433	1%; 0.2%
0.10-Rt.1125/0.80-Rt.606	Rutledge Creek	Union Hill Road	37.5767, -79.0483	1%; 0.2%

Note: None of the bridges in the Town of Bedford is rated as at high risk (scour critical).



# Hazard Identification and Risk Assessment

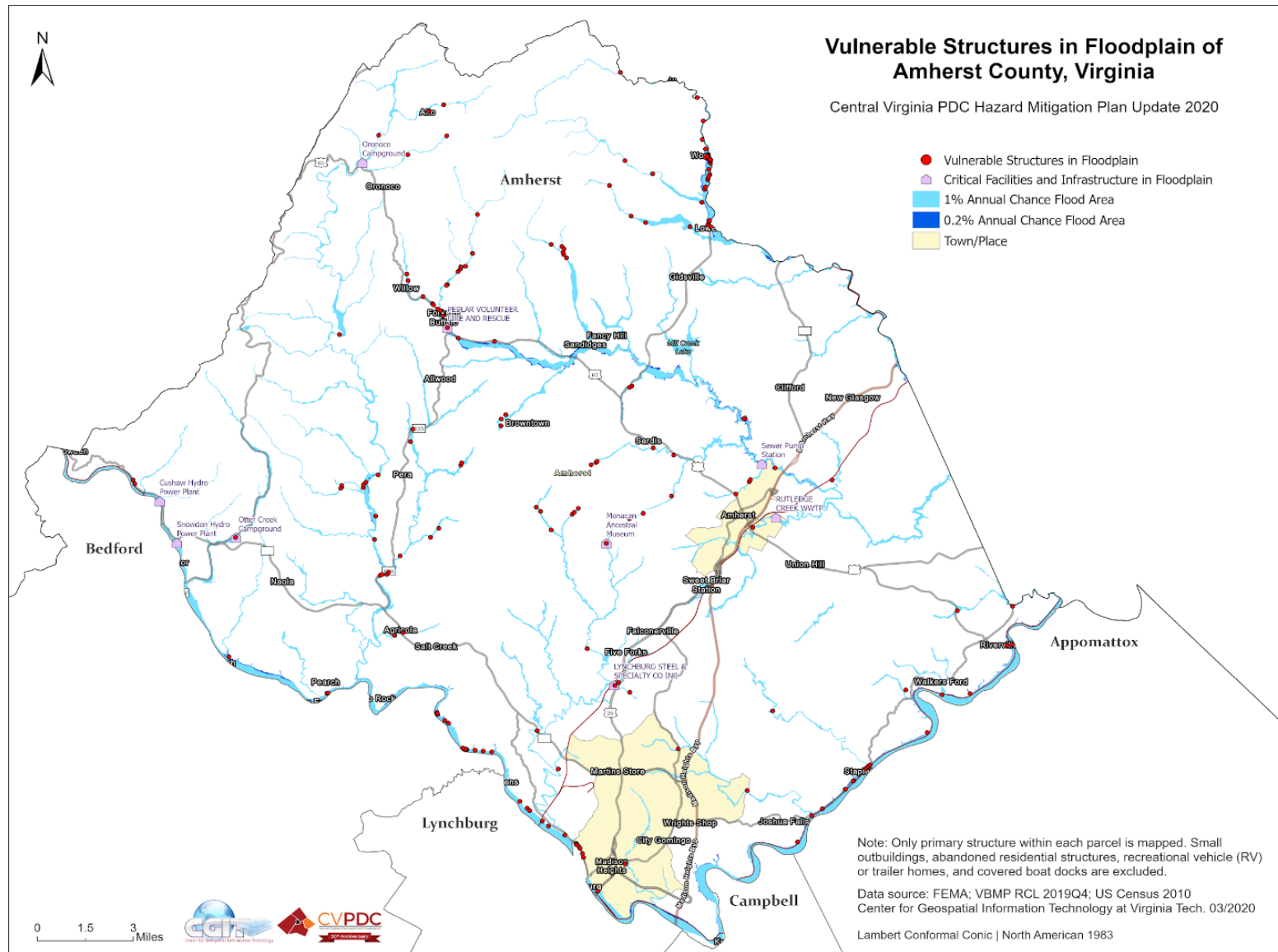


Figure 4-11 Vulnerable structures in floodplain of Amherst County, Virginia (overview map)





# Hazard Identification and Risk Assessment

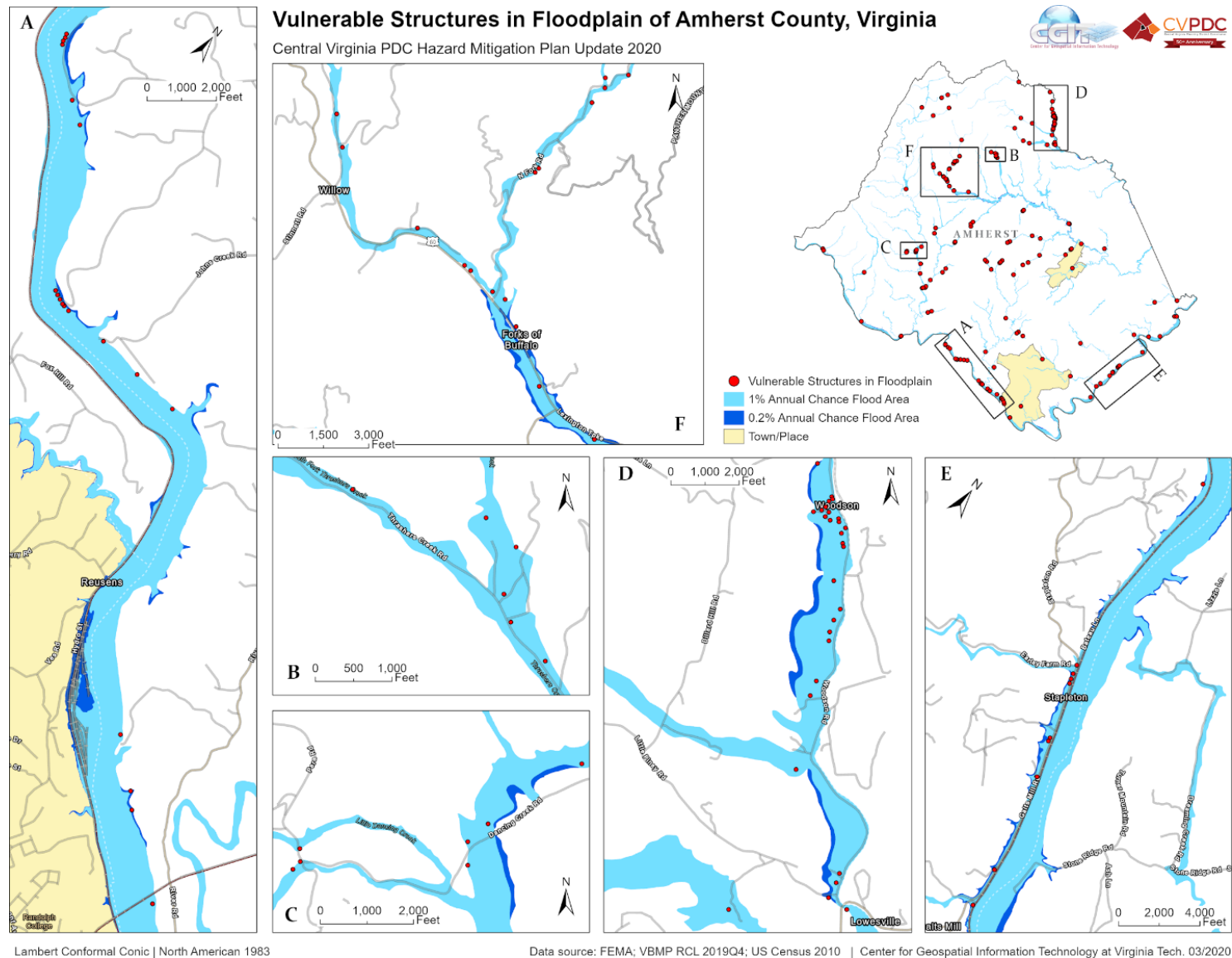


Figure 4-12 Vulnerable structures in floodplain of Amherst County, Virginia (detailed map)



# Hazard Identification and Risk Assessment

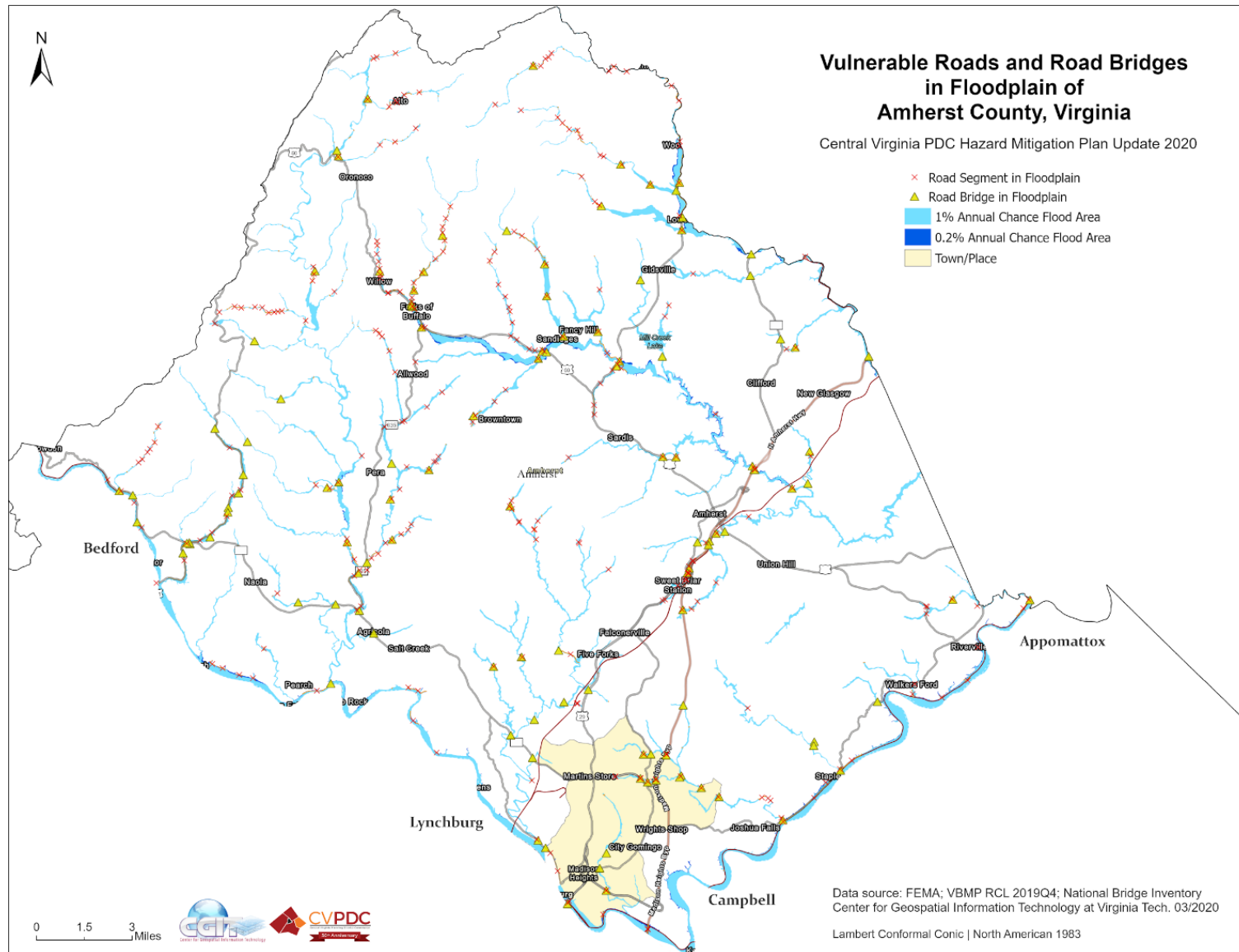
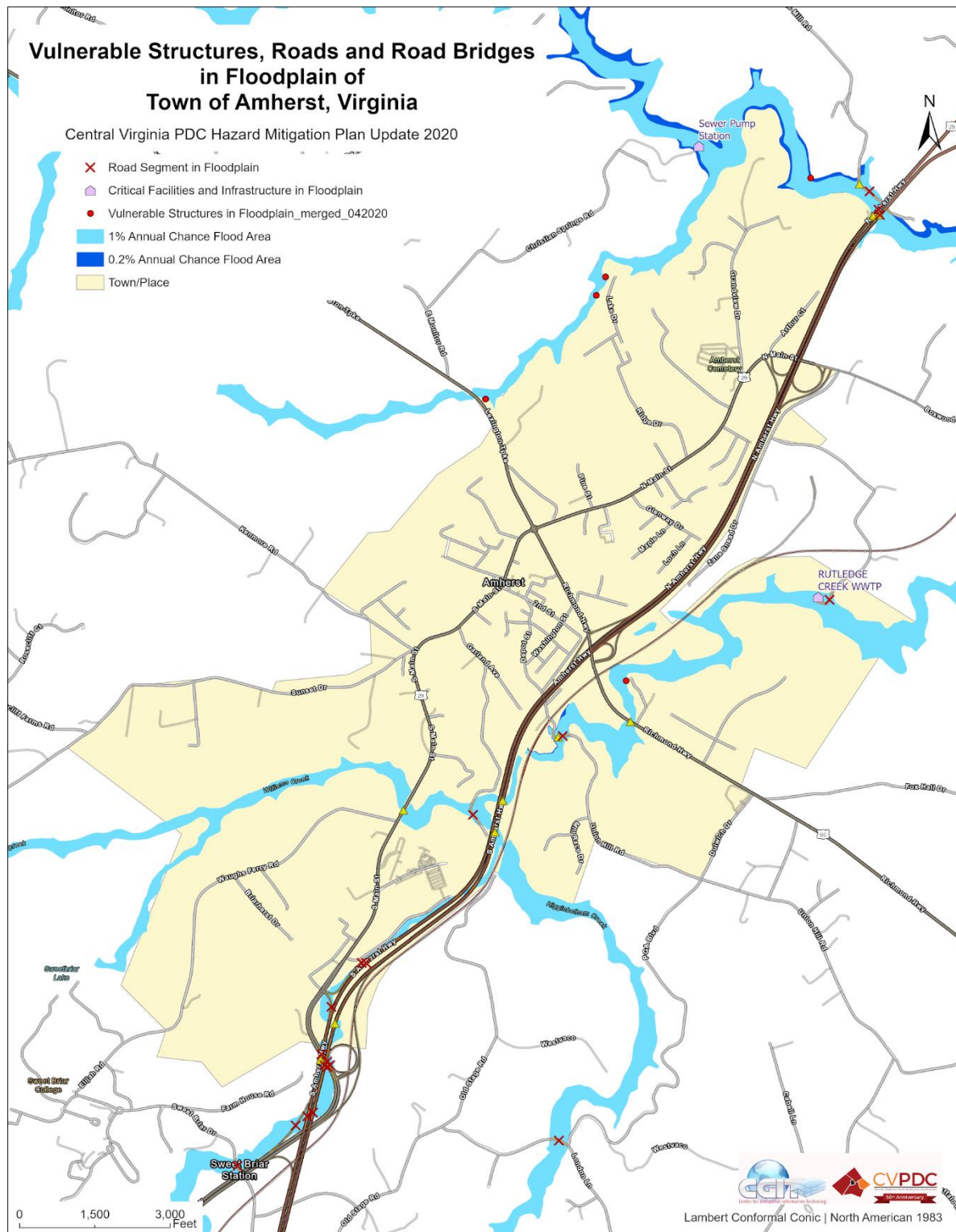


Figure 4-13 Vulnerable roads and bridges in floodplain of Amherst County, Virginia



# Hazard Identification and Risk Assessment



Data source: FEMA; VBMP RCL 2019Q4; US DOT National Bridge Inventory | Center for Geospatial Information Technology at Virginia Tech. 03/2020

Figure 4-14 Vulnerable structures, roads and road bridges in floodplain of Town of Amherst, Virginia





# Hazard Identification and Risk Assessment

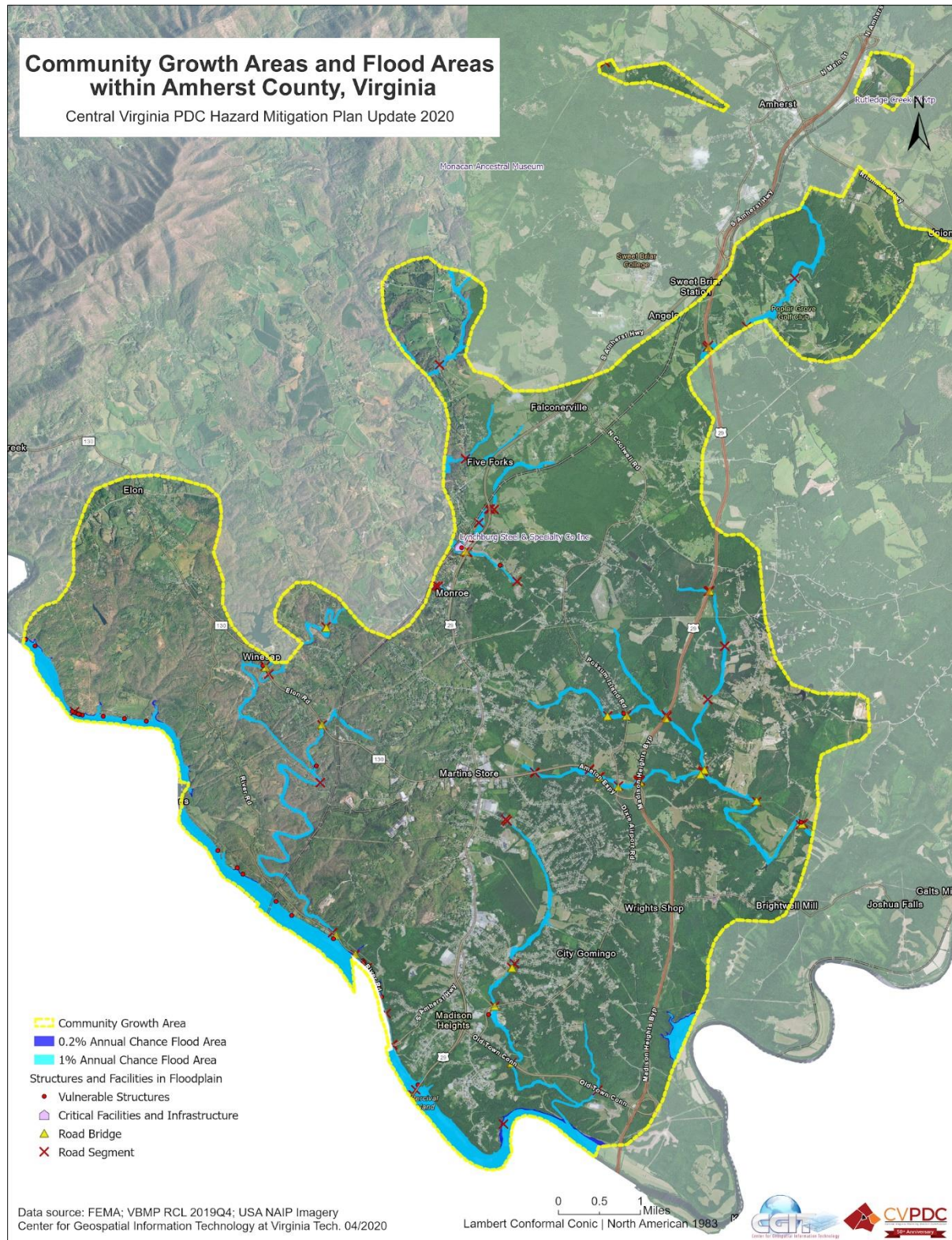


Figure 4-15 Community growth areas and floodplain within Amherst County, Virginia



# Hazard Identification and Risk Assessment

## 4.3.4.2 Appomattox County and Town of Appomattox

Appomattox County is located at the geographic center of Virginia. The county consists of 343 square miles of gently rolling terrain indicative of Virginia's Piedmont Region. Elevations range from 460 feet to 1,151 feet above sea level. Drainage is provided by James River, Appomattox River, Roanoke River Drainage Area, and Bent and Wreck Island Creeks. Appomattox County is perhaps best known in history as the site of the end of the Civil War at Appomattox Court House. The county is bordered to the north by Amherst County, Buckingham County, and Nelson County, to the south by Charlotte County, to the east by Prince Edward County, and Campbell County to the west. James River serves as the northwest border. The towns of Pamplin and Appomattox are within the county, with the Town of Appomattox being the county seat. The 2016 population of Appomattox County was 15,314. The top six employers (excluding local government) in Appomattox are WalMart, Delta Response Team LLC, Kroger, Gretna Health Care Center, Petrochem Recovery Services, and Farmers Bank of Appomattox.

### 4.3.4.2.1 Community Characteristics

Appomattox County entered into the NFIP on July 17, 1978, with emergency entry on February 11, 1974. The current effective date for the FIRMs is January 2, 2008. It is currently in good participating standing with the program. The county has 8 flood policies in force, with \$256,000 losses paid. Appomattox County plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance floodplain in unincorporated areas of Appomattox County cover 15.3 and 15.5 square miles, accounting for 4.6% and 4.6% total area of the county, respectively. The community dashboard for Appomattox County is shown in Figure 4-16.

The Town of Appomattox entered into the NFIP on May 25, 1984 with emergency entry on February 22, 1974. The current effective date for the FIRMs is January 2, 2008. It is currently in good participating standing with the program. The town has 2 flood policies in force, with no loss paid. The Town of Appomattox plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in the Town of Appomattox both cover approximately 0.2 square miles, accounting for 0.7% total area of the town. The community dashboard for the Town of Appomattox is shown in Figure 4-17.



Figure 4-16 Community dashboard of Appomattox County (Unincorporated Areas)





# Hazard Identification and Risk Assessment

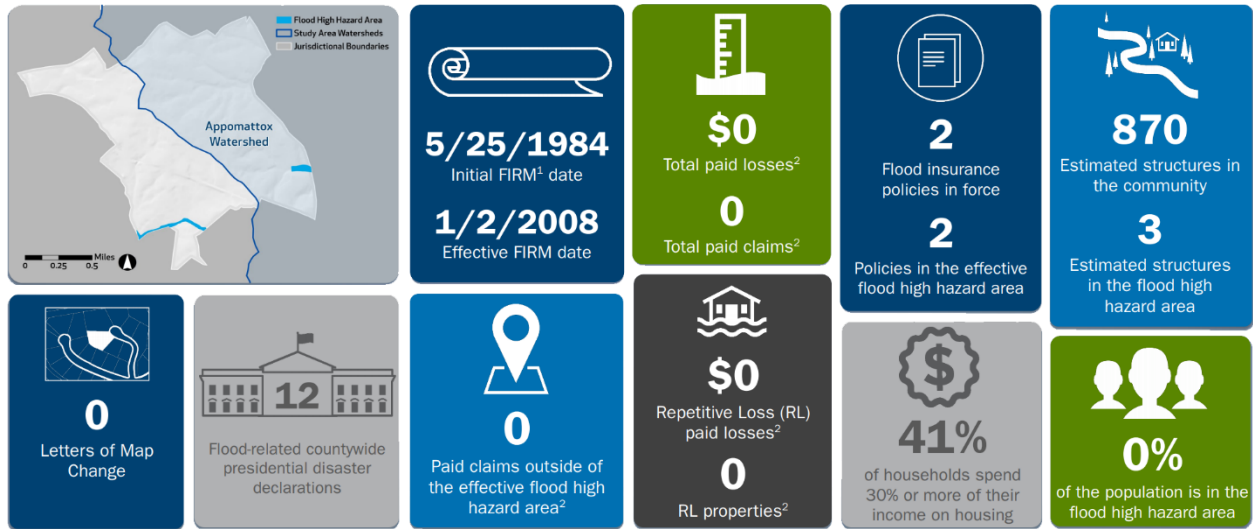


Figure 4-17 Community dashboard of Town of Appomattox

## 4.3.4.2.2 Principal Flood Problems

This flood risk assessment identifies impacts to the people and property of Appomattox County using the Flood Risk Discovery Report of Appomattox Watershed (FEMA, 2018) developed under FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program and the detailed risk analysis developed for this Hazard Mitigation Plan. The following principal flood problems have been identified for Appomattox County.

- Lower grounds along the county's smaller streams are sometimes damaged by flooding of crops, deposition of silt on crops, and by channels silting up and preventing proper drainage.
- Low-lying areas along James River are subject to periodic flooding.
- Tropical storms are responsible for some of the larger floods experienced on James River. Flooding from these storms almost always occurs in the period of May through November, which is hurricane season.
- Flooding on James River, however, may also be caused by heavy rains at any time.
- Streambank stabilization issues in the Sunnydale/ South Church area.
- Natural gas line located in floodplain.
- 9 high risk bridges in the floodplain.
- Two repetitive loss properties and one severe repetitive loss property
- Lower income population located in the floodplain.

## 4.3.4.2.3 Vulnerable Population and Structures

Demographic data with dasymetric mapping techniques at census block level were used for profiling the vulnerable population in or adjacent to floodplains within the Appomattox County incorporated area. FEMA's Risk Map program identified zero of the population is in the floodplain for the county. However, the county's up to 3.6% (or 5%) population have the potential to be impacted by flooding because of living in or close to 1-percent (or 0.2-percent) flood zones. Among those populations, 9.2% of them are at a low-income level, 23.3% are young, and 13.2% are seniors. Whites make up the largest percentage (76.7%) of Appomattox County residents. Likewise, whites also predominate in or around the floodplain,



# Hazard Identification and Risk Assessment

representing 73.9% of the vulnerable population. Blacks are 21.8% of the vulnerable population, Hispanic or Latino are 1.5%, Asians are 0.2%. There are no Native Americans in the floodplain. Table 4-29 and Table 4-30 provide more demographics of the vulnerable population in Appomattox County, in terms of ethnic group, income level, and age group.

*Table 4-29 Ethnic group in floodplains of Appomattox County*

	Population	Households	White	Black	Hispanic	Asian	Native Am.
Appomattox	14973	6033	11483 (76.7%)	2998 (20.0%)	167 (1.1%)	35 (0.2%)	28 (0.2%)
1% Floodplain	532 (3.6%)	211	393 (73.9%)	116 (21.8%)	8 (1.5%)	1 (0.2%)	0 (0.0%)
0.2% Floodplain	748 (5.0%)	304	589 (78.7%)	126 (16.8%)	16 (2.1%)	1 (0.1%)	0 (0.0%)

*Table 4-30 Income level and age group in floodplains of Appomattox County*

	Population	Households	Income <\$20k/Yr	Age <16	Age >65
Appomattox	14973	6033	1280 (8.5%)	3325 (22.2%)	2607 (17.4%)
1% Floodplain	532 (3.6%)	211	49 (9.2%)	124 (23.3%)	70 (13.2%)
0.2% Floodplain	748 (5.0%)	304	82 (11.0%)	161 (21.5%)	118 (15.8%)

The unincorporated area of Appomattox County has only 43 (or 49) primary structures identified in the 1-percent (or 0.2-percent) floodplain shown in Figure 4-18. Most are scattered within the county. No critical facility or infrastructure was found in the floodplains. The growth areas do contain floodplains shown in Figure 4-21. Two clusters of vulnerable structures are located in the following areas:

- Bent Creek area along James River. About 10 homes or commercial buildings are in the floodplain.
- North bank of James River near the river bend, where 5 homes are concentrated.

The Town of Appomattox has 2 primary structures inside of both 1-percent and 0.2-percent floodplains shown in Figure 4-20. One pump station near State Rte. 1036 (between Hunter St and Morris Ave) is in the 0.2-percent floodplain (very close to the 1% floodplain) shown in Table 4-31.

*Table 4-31 Critical facility and infrastructure in floodplain of Appomattox County and Town of Appomattox*

Facility Name	Address	Facility Type	Coordinates	Flood Zone *
Pump Station	State Rte. 1036, Appomattox	Sewer Pump Station	37.3481, -78.8272	0.2%

Note: 1% (or 0.2%) indicates 1-percent (or 0.2-percent) annual chance flood zone

In the unincorporated areas of Appomattox, there are 75 flood-prone roads, with a total of about 14 miles road segments in the floodplain (Figure 4-19). The top five susceptible roads are located along James River, including Chase Trail Ln, Dreaming Creek Rd, Stone Ridge Rd, Oakville Rd, Riverside Dr, and Mill Pond Rd.



# Hazard Identification and Risk Assessment

Wheelers Spring Rd and Whispering Pine Rd have multiple flood-prone locations along their route. Among the 52 road bridges located in the floodplains, 9 are scour critical bridges which identified as at high risk (Table 4-32).

There are very few road segments in the Town of Appomattox within the floodplain. These include Morris Ave, Dogwood St, Richmond Hwy (Route 460), Red House Rd, and Church St. Total flood-prone road segments are about 0.1 miles (Table 4-33). No vulnerable road bridges are found within the town boundary.

*Table 4-32 Top 50 flood-prone roads in Appomattox County (unincorporated area)*

Rank	Road Name	Road Type	Road Segments in Floodplain	
			Count	Total Length (mi)
1	Chase Trail Ln	STR	1	1.01
2	Dreaming Creek Rd	SEC	7	0.93
3	Stone Ridge Rd	SEC	3	0.78
4	Oakville Rd	STR	4	0.76
5	Riverside Dr	STR	3	0.71
6	Mill Pond Rd	SEC	3	0.61
7	Coleman Mountain Rd	SEC	1	0.59
8	River Bottom Ln	SEC	2	0.53
9	Holiday Lake Rd	STR	1	0.39
10	Red House Rd	SEC	2	0.34
11	Jersey Ln	SEC	1	0.30
12	River Ridge Rd	USPRI	2	0.28
13	Wheelers Spring Rd	SEC	7	0.27
14	Blackberry Ln	SEC	2	0.25
15	Aldridge Ln	SEC	2	0.24
16	Hixburg Rd	SEC	2	0.24
17	Whispering Pine Rd	SEC	5	0.23
18	Buck Creek Rd	SEC	2	0.22
19	Anderson Hwy	SEC	2	0.22
20	Cutbanks Rd	SEC	1	0.21
21	Quarry Rd	STR	2	0.19
22	Horseshoe Rd	STR	1	0.18
23	James River Rd	SEC	2	0.18
24	Silo Rd	STR	1	0.18
25	Old Courthouse Rd	STR	1	0.17
26	Old Grist Mill Rd	SEC	1	0.17
27	Little Cub Rd	SEC	1	0.16
28	Hancock Rd	SEC	2	0.15
29	Hollywood Rd	SEC	1	0.15
30	Mount Pleasant Rd	STR	3	0.14
31	Spring Grove Rd	SEC	2	0.14
32	Fork Rd	STR	1	0.13
33	Whipoorwill Rd	SEC	1	0.13



# Hazard Identification and Risk Assessment

Rank	Road Name	Road Type	Road Segments in Floodplain	
			Count	Total Length (mi)
34	Watt Abbitt Rd	SEC	1	0.13
35	Creek Rd	SEC	1	0.13
36	Liberty Chapel Rd	STR	1	0.12
37	Rock Spring Rd	STR	1	0.11
38	Cedar Bend Rd	UMS	1	0.11
39	Hummingbird Ln	SEC	1	0.11
40	Colemans Mill Rd	SEC	1	0.11
41	Trents Mill Rd	SEC	1	0.10
42	Swan Rd	STR	1	0.10
43	Old Bethany Rd	SEC	1	0.10
44	Rough Creek Rd	SEC	1	0.09
45	County Line Rd	INST	1	0.09
46	Rocks Church Rd	STR	1	0.09
47	Poorhouse Creek Rd	SEC	1	0.09
48	Willow Oak Rd	STR	1	0.09
49	Paradise Rd	SEC	2	0.07
50	Salem Rd	STR	1	0.07

Table 4-33 Flood-prone roads in Town of Appomattox

Rank	Road Name	Road Type	Road Segments in Floodplain	
			Count	Total Length (feet)
1	Morris Ave	Secondary	1	187
2	Dogwood St	Secondary	1	160
3	Richmond Hwy	Primary	1	135
4	Red House Rd	Primary	1	107
5	Church St	Secondary	1	65

Table 4-34 Road bridges at high risk (scour critical) in floodplain in Appomattox County

Name	Location	Crossing	Coordinate
Route 24	0.52-Rt 627 / 0.66-Rt 656	Appomattox River	37.3819, -78.7898
Mt. Pleasant Road	0.40-Rt.626/2.50-Rt.601	Cabin Branch	37.3501, -78.6057
Liberty Chapel Rd.	0.68-Rt 686 / 1.10-Rt 616	Bent Creek	37.4767, -78.8208
Oakville Road	0.80-Rt 660 / 0.65-Rt 711	North Creek	37.4158, -78.8575
Stonewall Road	0.05-Rt.666/2.65-Rt.665	Wreck Island Creek	37.4382, -78.9081
Bellview Road	1.30-Rt 667 / 0.20-Rt 666	Wreck Island Creek	37.4541, -78.9192
Poorhouse Creek Rd	0.40-Rt 633 / 0.45-Rt 639	Rough Creek	37.3359, -78.6959
Hummingbird Lane	1.60-Rt.608 / 1.30-Rt.668	Holts Branch	37.3925, -78.9275
Arrowhead Road	0.60 -Rt611 / 0.60 -Rt610	Stonewall Creek	37.4088, -78.9825





# Hazard Identification and Risk Assessment

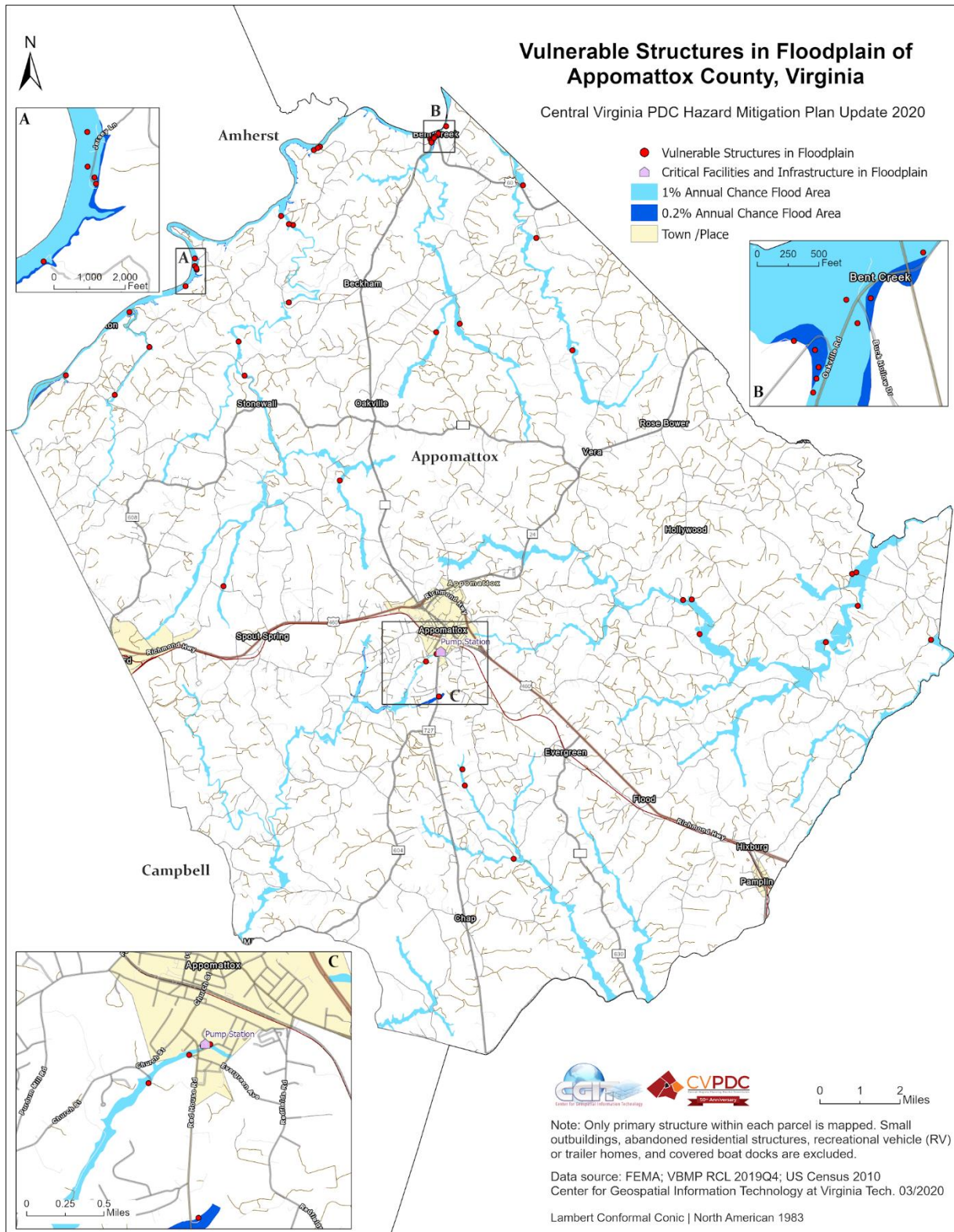


Figure 4-18 Vulnerable structures in floodplain of Appomattox County, Virginia



## Central Virginia PDC Hazard Mitigation Plan Update 2020

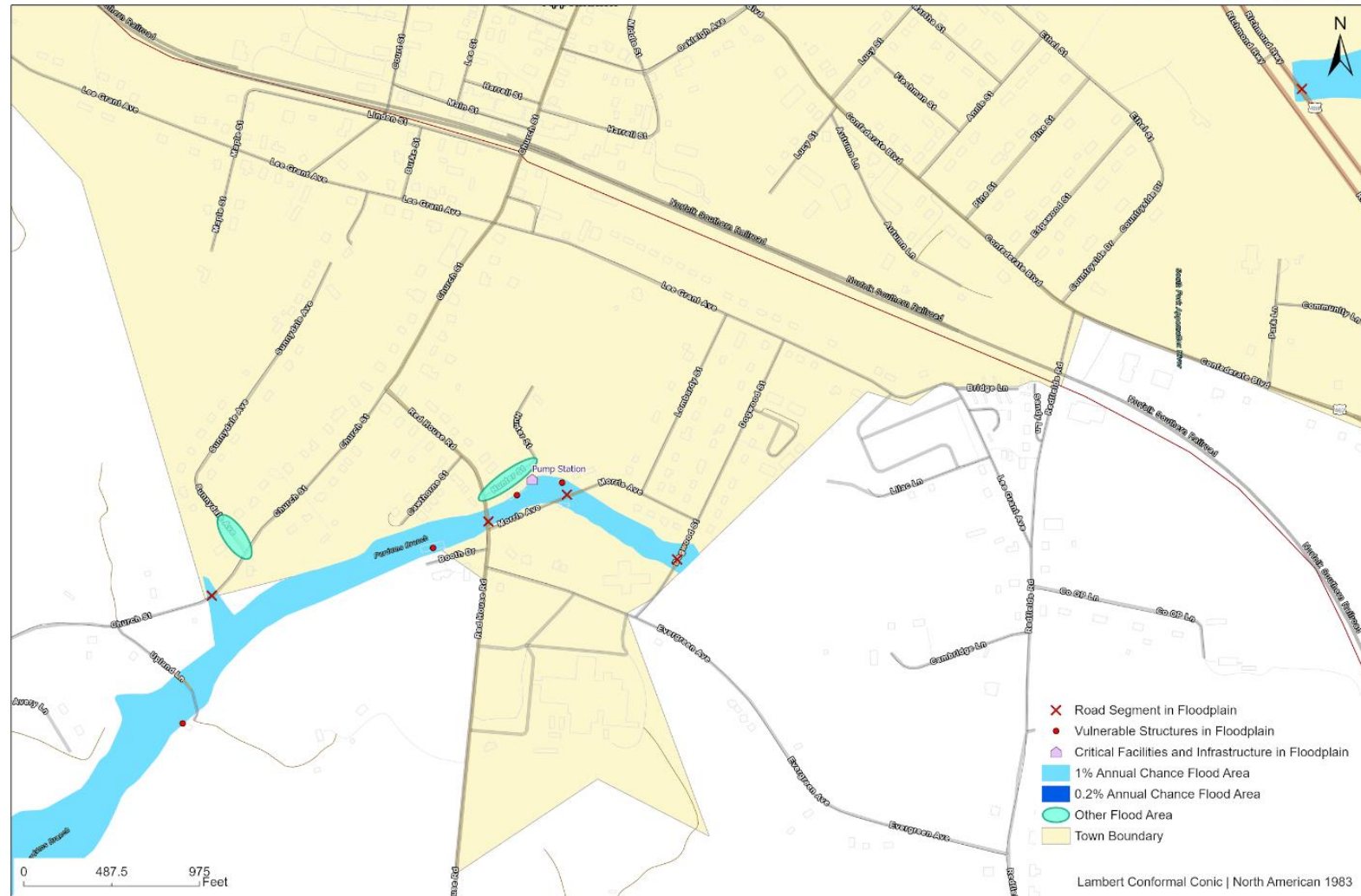




# Hazard Identification and Risk Assessment

## Vulnerable Structures, Roads, and Road Bridges in Floodplain of Town of Appomattox, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020



Note: Only primary structure within each parcel is mapped. Small outbuildings, abandoned residential structures, recreational vehicle (RV) or trailer homes, and covered boat docks are excluded.

Data source: FEMA; VBMP RCL 2019Q4; US Census 2010; US DOT National Bridge Inventory | Center for Geospatial Information Technology at Virginia Tech. 03/2020

Figure 4-20 Vulnerable structures, roads and road bridges in floodplain of Town of Appomattox, Virginia



# Hazard Identification and Risk Assessment

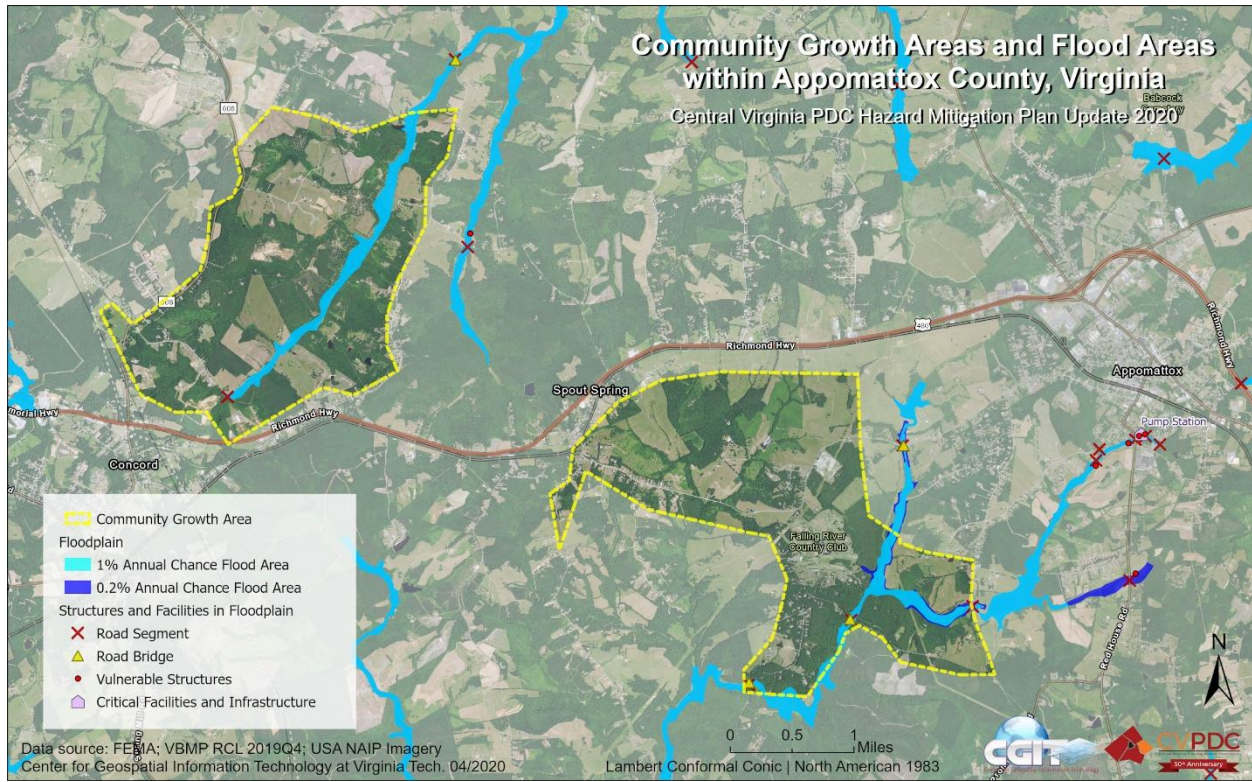


Figure 4-21 Community Growth Areas and Flood Areas within Appomattox County, Virginia





# Hazard Identification and Risk Assessment

## 4.3.4.3 Bedford County and the Town of Bedford

Bedford County consists of 764 square miles located in west-central Virginia, just east of the Roanoke metropolitan area. Bedford County was formed in 1754 and named for the Fourth Duke of Bedford, a British Government official. In 1839, the Town of Liberty (now Town of Bedford) was established within the county limits. The scenic Blue Ridge Mountains make up the county's western border. James River forms the northeast boundary. The 23,400-acre Smith Mountain Lake is situated to the south on Roanoke River. The area has rolling to hilly terrain, with elevations from 800 feet to 4,200 feet above sea level, including the famous Peaks of Otter, Sharp Top and Flat Top along the Blue Ridge Parkway on the county's western border. Communities bordering Bedford include Rockbridge County to the northwest, Amherst County to the north and northeast, Campbell County to the east, Pittsylvania County to the south and Franklin, Roanoke, and Botetourt Counties to the west. According to the 2016 American Community Survey five year estimates, the population of Bedford County is 68,676, a 12% increase from the 2010 U.S. Census. The top five largest employers in Bedford County in 2019 are Centra Health, Elwood Staffing Services Inc, WalMart, Mail America Communications Inc, and GP Big Island LLC.

In 2013, Bedford City abandoned its status as an independent city and became a town in Bedford County. The reversion of Bedford City added approximately 6,222 residents (2010 Census) and nearly seven square miles to Bedford County. Additionally, it increased the town's boundaries by 1.5 square miles. The reversion brought changes to the tax structure, utility provision, public safety, schools, representation, election districts, etc.

### 4.3.4.3.1 Community Characteristics

Bedford County entered into the NFIP on September 29, 1978, with emergency entry on January 16, 1974. The current effective date for the FIRMs is September 29, 2010. It is currently in good participating standing with the program. The county has 128 flood policies in force (122 policies within the unincorporated areas), with \$227,000 losses paid by 2019 (Figure 4-22). Bedford County plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in Bedford County cover 40.6 and 42.3 square miles, accounting for 5.2% and 5.5% total area of the entire county, respectively.

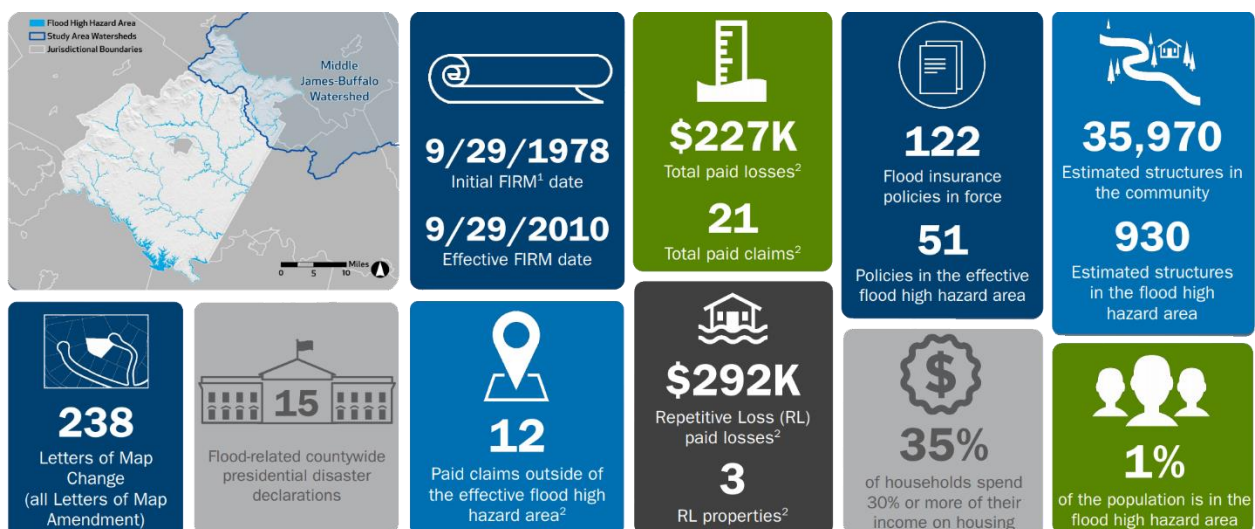


Figure 4-22 Community dashboard of Bedford County (Unincorporated Areas)



# Hazard Identification and Risk Assessment

The Town of Bedford entered into the NFIP on June 1, 1978, with emergency entry on March 12, 1974 (Figure 4-23). The current effective date for the FIRMs is also September 29, 2010. It is currently in good participating standing with the program. The town plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in the Town of Bedford cover 0.4 and 0.5 square miles, accounting for, respectively, 4.3% and 5.2% total area of the town.



Figure 4-23 Community dashboard of Town of Bedford

## 4.3.4.3.2 Principal Flood Problems

This flood risk assessment identifies impacts to the people and property of Bedford County. Using the Flood Risk Discovery Report of Middle James-Buffalo Watershed (FEMA, 2019) developed under FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program and the detailed risk analysis developed for this Hazard Mitigation Plan, the following principal flood problems have been identified for Bedford County and the Town of Bedford:

- Low-lying areas of Bedford County are subject to periodic flooding caused by overflow of the streams.
- The most severe flooding is usually the result of heavy rains from tropical storms; however, creek flooding occurs after locally heavy thunderstorms.
- Fill placement in the floodway has modified water-surface elevations from the downstream end of the Westgate Shopping Center culvert to West Main Street due to loss of storage and changes to the type, diameter, and length of drainage structures.
- Critical facilities located in the floodplain include: three pump stations and three electric substations.
- 6 high risk bridges in the floodplain.
- Three repetitive loss properties and one severe repetitive loss property.
- Older and lower income population located in the floodplain.



# Hazard Identification and Risk Assessment

## 4.3.4.3.3 Vulnerable Population and Structures

Demographic data with dasymetric mapping techniques at census block level of Bedford County (incorporated area) were used for profiling the vulnerable population in or adjacent to floodplains. FEMA's Risk Map program identified around 1% of the County population is in the floodplain. However, the county's up to 13.8% (or 17.7%) population have the potential to be impacted by flooding because of living in or close to 1-percent (or 0.2-percent) flood zones. Among those populations, 6.8% are at a low-income level, 20.9% are young (age < 16), and 17.9% are seniors (age > 65). Whites make up the vast majority (90.3%) of Bedford County residents. Likewise, whites predominate in or around the floodplain, representing 90.7% of the vulnerable population. Blacks are 5.1% of the vulnerable population, Hispanic or Latino are 1.7%, Asians are 0.9%, and Native Americans are 0.2%. Table 4-35 and Table 4-36 provide more demographics of the vulnerable population in Bedford County, in terms of ethnic group, income level, and age group.

*Table 4-35 Ethnic group in floodplains of Bedford County*

	Population	Households	White	Black	Hispanic	Asian	Native Am
Bedford	68676	27465	62035 (90.3%)	3909 (5.7%)	1090 (1.6%)	700 (1.0%)	172 (0.3%)
1% Floodplain	9443 (13.8%)	3965	8562 (90.7%)	481 (5.1%)	160 (1.7%)	88 (0.9%)	20 (0.2%)
0.2% Floodplain	12129 (17.7%)	5162	10825 (89.2%)	789 (6.5%)	196 (1.6%)	105 (0.9%)	36 (0.3%)

*Table 4-36 Income level and age group in floodplains of Bedford County*

	Population	Households	Income <\$20k/Yr	Age <16	Age >65
Bedford	68676	27465	3914 (5.7%)	15305 (22.3%)	11147 (16.2%)
1% Floodplain	9443	3965	646 (6.8%)	1969 (20.9%)	1672 (17.7%)
0.2% Floodplain	12129	5162	854 (7.0%)	2392 (19.7%)	2467 (20.3%)

The unincorporated area of Bedford County has 339 (or 749) primary structures and 19 (or 22) critical facilities and infrastructures identified in the 1-percent (or 0.2-percent) floodplain (shown in Figure 4-24). Most vulnerable structures are located in the following areas:

- Smith Mountain Lake / Roanoke River. More than half of the vulnerable structures are concentrated here (Figure 4-28, Panel B and C). Several vulnerable campgrounds or RV park resorts are also located in this area. As mentioned in the data cleaning process section of this chapter, recreational vehicles or trailer homes and covered boat docks in this area are excluded from inventory and loss analysis. However, it is important to know their existence and to notify owners of these structures to make them aware of the potential hazard.
- Major / Powells Store area. Over 50 homes and a church near James River and Big Island Hwy are in the floodplain (Figure 4-29, Panel D). The Georgia-Pacific Corporation Big Island LLC, one of the top 5 employers of the county, is also in the floodplain of this area.



# Hazard Identification and Risk Assessment

- Forest area. This area is also designated as the largest one of the community growth areas (Figure 4-32). Approximately 50 homes are in the floodplain (Figure 4-29, Panel E).
- Montvale area. A row of homes north of W Lynchburg Salem Tpke (Route 221) are in the floodplain (Figure 4-27, Panel A).

The Town of Bedford has 29 (or 38) primary structures and 7 (or 7) critical facilities and infrastructures identified in the 1-percent (or 0.2-percent) floodplain (shown in Figure 4-27). Most of the vulnerable structures are located along Route 221 (E Main St and W Main St) of the town.

Table 4-37 provides the vulnerable critical facilities and infrastructures of Bedford County and the Town of Bedford (shown in Figure 4-25). Within the Bedford County unincorporated areas, there are 6 campgrounds, 2 electrical substations, 4 energy facilities, 6 sewer pump stations, 1 water booster pump station, and 2 wastewater treatment plants situated in the floodplain. In the Town of Bedford, there are 2 electrical substations, 4 sewer pump stations, and the Bedford Wastewater Treatment Plant (partially in floodplain) in either 1-percent or 0.2-percent floodplain (Table 4-37).

It is worth mentioning that 5 facilities not in the floodplain still need attention. It is either because a corner of the parcel is in a flood zone but the structure isn't, or the property is very close to the floodplain. Table 4-38 lists these potential vulnerable structures adjacent to floodplains, including 3 schools, 1 assisted care facility, 1 hazmat facility, and 1 sewer pump station. For example, the athletic field of Montvale Elementary is in the floodplain, but the school buildings are not.

*Table 4-37 Critical facility and infrastructure in floodplain of Bedford County and the Town of Bedford*

Facility Name	Address	Facility Type	Coordinates	Flood Zone*
Halesford Harbour Rv Park Resort	1336 Campers Paradise Trl, Moneta	Campground	37.1583, -79.6617	1%; 0.2%
Hannabass-Crouch Campground	1241 Hannabass Dr, Goodview	Campground	37.1548, -79.6994	1%; 0.2%
Mitchell'S Point Marina & Campground	3553 Trading Post Rd, Huddleston	Campground	37.0622, -79.5601	1%; 0.2%
Moorman Marina	1510 Moorman Rd, Goodview	Campground	37.2232, -79.7753	1%; 0.2%
Tri-County Marina	1261 Sunrise Loop, Lynch Station	Campground	37.0595, -79.4468	1%; 0.2%
Waterfront Park Campground	1000 Waterfront Dr, Moneta	Campground	37.1397, -79.6464	1%; 0.2%
Electrical Substation **	678 Orange St, Bedford	Electrical Substation	37.3334, -79.5123	1%; 0.2%
Electrical Substation **	Macon St, Bedford	Electrical Substation	37.3393, -79.5414	1%; 0.2%
Electrical Substation	Big Island Hwy / North Otter Creek	Electrical Substation	37.4599, -79.4651	1%; 0.2%
Electrical Substation	1026 Churchill Rd, Big Island	Electrical Substation	37.5411, -79.3978	1%; 0.2%
Coleman Falls Dam Hydro	6007 Lee Jackson Hwy,	Energy	37.5021,	1%; 0.2%





# Hazard Identification and Risk Assessment

Facility Name	Address	Facility Type	Coordinates	Flood Zone*
Plant	Coleman Falls	Facility	-79.3006	
Georgia-Pacific Big Island Plant	9363 Lee Jackson Highway, Big Island	Energy Facility	37.5351, -79.3573	1%; 0.2%
Holcomb Rock Dam Hydro Plant	4839 Holcomb Rock Road, Holcomb Rock	Energy Facility	37.5036, -79.2628	1%; 0.2%
Smith Mountain Dam Hydro Plant	Route 1, Penhook	Energy Facility	37.0413, -79.5356	1%; 0.2%
Georgia Pacific Corp - Big Island Mill	9363 Lee Jackson Highway, Big Island	HazMat Facility	37.5328, -79.3556	1%; 0.2%
Lake Vista Pump Station	2474 Cottontown Rd, Forest	Sewer Pump Station	37.3953, -79.2606	1%; 0.2%
Moneta Wwtp/ Influent Pump Station Ps 3	1622 White House Rd, Moneta	Sewer Pump Station	37.1722, -79.6121	1%; 0.2%
Pump Station	Craddock Creek / Coves End Rd, Huddleston	Sewer Pump Station	37.0934, -79.5646	1%
Pump Station	Huddleston	Sewer Pump Station	37.0874, -79.5700	1%; 0.2%
Pump Station #2 **	1725 Whitfield Dr, Bedford	Sewer Pump Station	37.3504, -79.5224	1%; 0.2%
Pump Station #3 **	1012 Orange St, Bedford	Sewer Pump Station	37.3388, -79.4941	1%; 0.2%
Pump Station #5**	Oliver St, Bedford	Sewer Pump Station	37.3559, -79.5081	1%
Pump Station #6	Peaks Rd / Woods Rd, Bedford	Sewer Pump Station	37.3894, -79.5516	1%; 0.2%
Pump Station #8 **	Villa Oak Cir, Bedford	Sewer Pump Station	37.3537, -79.5212	1%; 0.2%
Sewer Pump Station #2	13080 S Old Moneta Rd, Moneta	Sewer Pump Station	37.1820, -79.6157	1%; 0.2%
Bedford Wastewater Treatment Plant **	852 Orange St, Bedford	Wastewater Treatment Plant	37.3336, -79.5067	1%; 0.2%
Moneta Regional WWTP	Rte 608, White House Rd, Moneta	Wastewater Treatment Plant	37.1727, -79.6128	1%; 0.2%
Montvale Wastewater Treatment	185 Little Patriot Dr, Bedford	Wastewater Treatment Plant	37.3752, -79.7078	1%
Water Pump Station - 5 (Town of Bedford Water)	4690 Peaks Rd, Bedford	Water Booster Pump Station	37.3897, -79.5531	1%; 0.2%

Note: \* 1% (or 0.2%) indicates 1-percent (or 0.2-percent) annual chance flood zone. \*\* Located in the Town of Bedford.



# Hazard Identification and Risk Assessment

*Table 4-38 Critical facility and infrastructure located outside of (but adjacent to) floodplain of Bedford County and Town of Bedford*

Facility Name	Address	Facility Type	Coordinates	Note
Bedford Science and Technology Center	600 Edmund Street, Bedford	Schools	37.3272, -79.5251	Corner of parcel in floodplain - bus lot
Buckeye Terminals, LLC - Roanoke Terminal	1070 Oil Terminal Rd, Montvale	HazMat Facility	37.3842, -79.7342	The lot is in floodplain not building
English Meadows Elks Home Campus	931 Ashland Avenue, Bedford	Assisted Care	37.3429, -79.5349	Parts of property are in floodplain (pathways)
Forest Middle	100 Ashwood Drive, Forest	Schools	37.3693, -79.3096	Back of property in floodplain
Montvale Elementary	1 Little Patriot Drive, Montvale	Schools	37.3759, -79.7084	Athletic field in floodplain
Pump Station #1	1601 Nichols Rd, Bedford	Sewer Pump Station	37.3524, -79.5363	Very close to floodplain

In the unincorporated areas of Bedford County, there are 236 flood-prone roads (including primary and secondary roads, and ramps) with a total of about 51 miles road segments in the floodplain (Table 4-39). The top 10 susceptible roads are Rocky Mountain Rd, Lee Jackson Hwy, Elk Valley Rd, Oslin Creek Rd, Fontella Rd, Big Island Hwy, Bore Auger Rd, Goose Creek Valley Rd, Turner Branch Rd, and Blue Ridge Pkwy. All these roads have multiple flood-prone locations along their route. There are 6 high risk (scour critical) road bridges identified (Table 4-41).

In the Town of Bedford, there are 25 roads that could be impacted during flooding. Road segments in the floodplain are about 2 miles in total (Table 4-40). The top five most susceptible roads are Macon St, Blue Ridge Ave, Dr Martin Luther King Jr Byp, Woodhaven Dr, and Peaks Rd. Among these roads, Blue Ridge Ave and Dr Martin Luther King Jr Byp have multiple locations that could be flooded. Two road bridges on Peaks road and Route 112 within the town boundary are in floodplain but not rated as at high risk (Table 4-42).

*Table 4-39 Top 50 flood-prone roads in Bedford County (unincorporated area)*

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (mi)
1	Rocky Mountain Rd	SEC	15	3.47
2	Lee Jackson Hwy		11	2.64
3	Elk Valley Rd	UMS	8	1.79
4	Oslin Creek Rd	SEC	8	1.62
5	Fontella Rd	SEC	2	1.61
6	Big Island Hwy	SEC	11	1.51
7	Bore Auger Rd	SEC	9	1.47
8	Goose Creek Valley Rd	SEC	12	1.19



# Hazard Identification and Risk Assessment

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (mi)
9	Turner Branch Rd	SEC	5	1.06
10	Blue Ridge Pkwy	UMS	5	1.03
11	Hunting Creek Rd		1	1.02
12	Drewrys Hill Rd	SEC	1	0.97
13	W Lynchburg Salem Tpke	SEC	2	0.81
14	Peters Creek Rd	STR	6	0.64
15	Hardy Rd	STR	4	0.62
16	Nemmo Rd	STR	1	0.62
17	Peaks Rd	STR	3	0.59
18	Fishermans Cove Rd	SEC	1	0.57
19	Wilkerson Mill Rd	STR	1	0.53
20	Wyatts Way	STR	2	0.52
21	Oil Terminal Rd	STR	1	0.52
22	Battery Creek Dr	SEC	2	0.51
23	Riverside Cir	SEC	5	0.51
24	Roaring Run Rd	SEC	2	0.50
25	Stewartsville Rd	STR	5	0.50
26	Hawkins Ridge Rd	SEC	1	0.48
27	Simmons Mill Rd	USPRI	4	0.48
28	Patterson Mill Rd	SEC	7	0.47
29	Red Hill Rd	SEC	3	0.47
30	Hurricane Dr	STR	3	0.46
31	Woods Rd	SEC	2	0.45
32	E Lynchburg Salem Tpke	SEC	6	0.43
33	Lankford Mill Rd	STR	3	0.42
34	Sheep Creek Rd	STR	2	0.42
35	Lazenbury Rd	UMS	1	0.41
36	Jordantown Rd	STR	5	0.39
37	Forest Rd	SEC	5	0.35
38	Churchill Rd	SEC	1	0.34
39	Lick Mountain Dr	SEC	1	0.34
40	Goodview Rd	STR	4	0.33
41	Moneta Rd	SEC	4	0.33
42	Anthony Home Rd	SEC	1	0.31
43	Forbes Mill Rd	SEC	2	0.31
44	Smith Mountain Lake Pkwy	SEC	2	0.30
45	Otterville Rd	SEC	2	0.28
46	Stony Brook Rd	SEC	1	0.28
47	Saunders Rd	URB	3	0.28
48	Penns Mill Rd	SEC	2	0.28
49	Holcomb Rock Rd	STR	1	0.27
50	Cove Creek Farm Rd	URB	1	0.27



# Hazard Identification and Risk Assessment

Table 4-40 Flood-prone roads in Town of Bedford

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (feet)
1	Macon St	Secondary	1	2,036
2	Blue Ridge Ave	Primary	5	1,408
3	Dr Martin Luther King Jr Byp	Primary	4	1,312
4	Woodhaven Dr	Secondary	1	656
5	Peaks Rd	Primary	1	610
6	Panorama Ln	Secondary	1	431
7	Liberty St	Secondary	1	386
8	Independence Blvd	Primary	1	326
9	Summit St	Secondary	1	321
10	Activity Pl	Secondary	1	305
11	Gold Rd	Secondary	1	287
12	Jeter St	Secondary	1	266
13	E Main St	Primary	2	265
14	Monroe St	Secondary	1	233
15	Park St	Secondary	1	227
16	Burks Hill Rd	Primary	1	209
17	W Cook St	Secondary	1	187
18	Crenshaw St	Primary	1	187
19	Pinecrest Ave	Secondary	1	186
20	Roberts Ln	Secondary	1	181
21	Orange St	Secondary	1	163
22	Haynes Aly	Secondary	1	117
23	Nichols Rd	Secondary	1	107
24	Whitfield Dr	Secondary	1	102
25	Maxwell Cir	Secondary	1	98

Table 4-41 Road bridges at high risk (scour critical) in floodplain in Bedford County

Name	Location	Crossing	Coordinate
Wyatts Way/24	1.79-Camb Co; 0.19-Rt 709	Br. Of Big Otter River	37.2456, -79.3450
Lee-Jackson Hwy501	0.02 Rt 604; 0.02 Rt 122	Hunting Creek	37.5369, -79.3665
Goshen Road / 664	0.40 Rt 646; 0.30 End Mt	Elk Creek	37.3853, -79.3487
Goose Ck Vly R 695	0.02 Rt 680; 3.72 BRPkwy	N. Fork Goose Creek	37.4436, -79.6686
Dickerson Mill 746	0.65 Rt 691; 2.05 Rt 801	Goose Creek	37.2806, -79.6143
BLUE RIDGE PARKWAY	2.0 MILES TO VA ROUTE 130	James River & U.S. Route	37.5549, -79.3699





# Hazard Identification and Risk Assessment

*Table 4-42 Road bridges in floodplain in Town of Bedford*

Name	Location	Crossing	Coordinates	Floodplain
PEAKS RD./43	0.00 NCL BEDFORD; 0.00 BEDFORD COUNTY	Little Otter River	37.3553, -79.5355	1%; 0.2%
RTE. 122	0.87 RT.460;0.91 RT. 221	Rt.122 Over Johns Creek	37.3372, -79.4964	1%; 0.2%

*Note: No high risk (scour critical) bridge is identified in the Town of Bedford*



# Hazard Identification and Risk Assessment

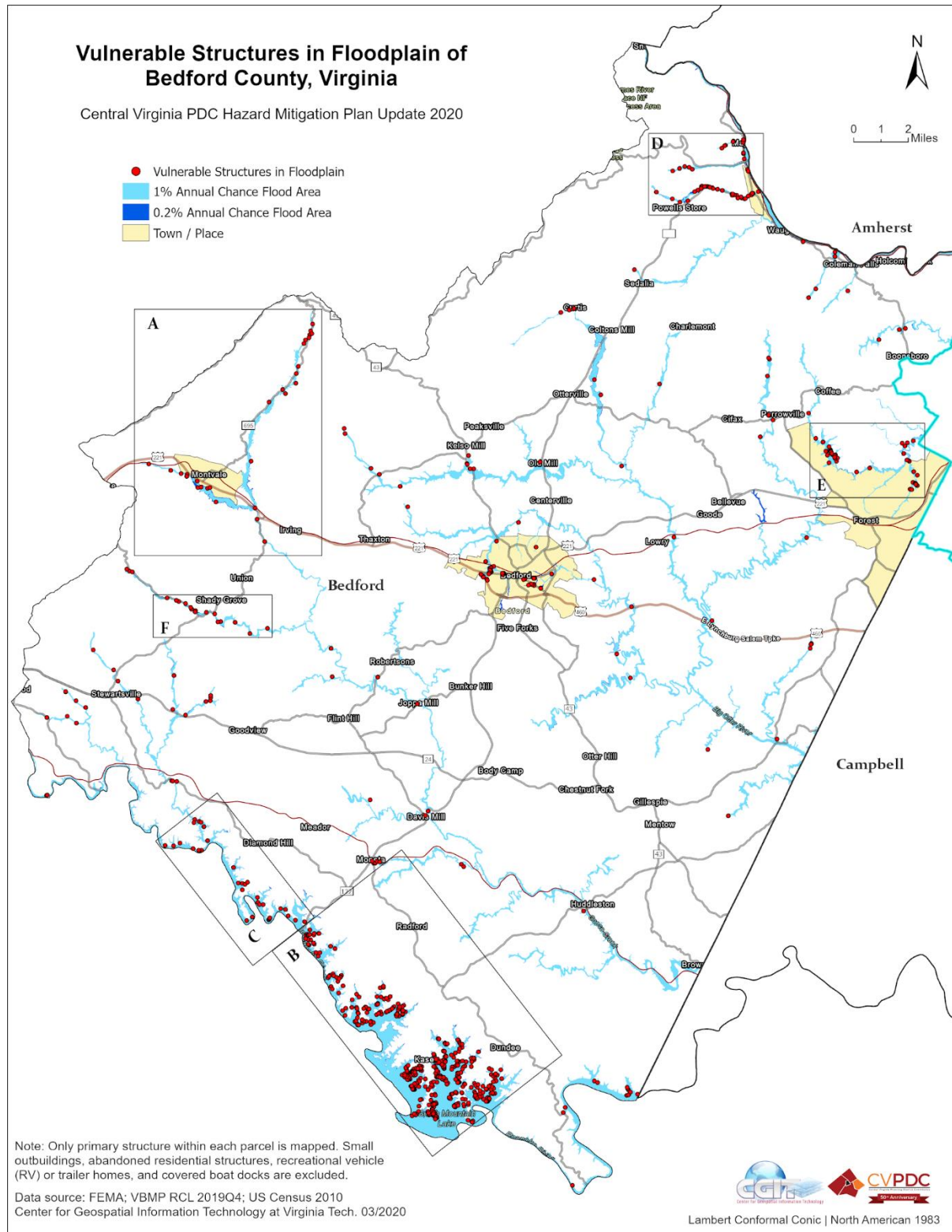


Figure 4-24 Vulnerable structures in floodplain of Bedford County, Virginia



# Hazard Identification and Risk Assessment

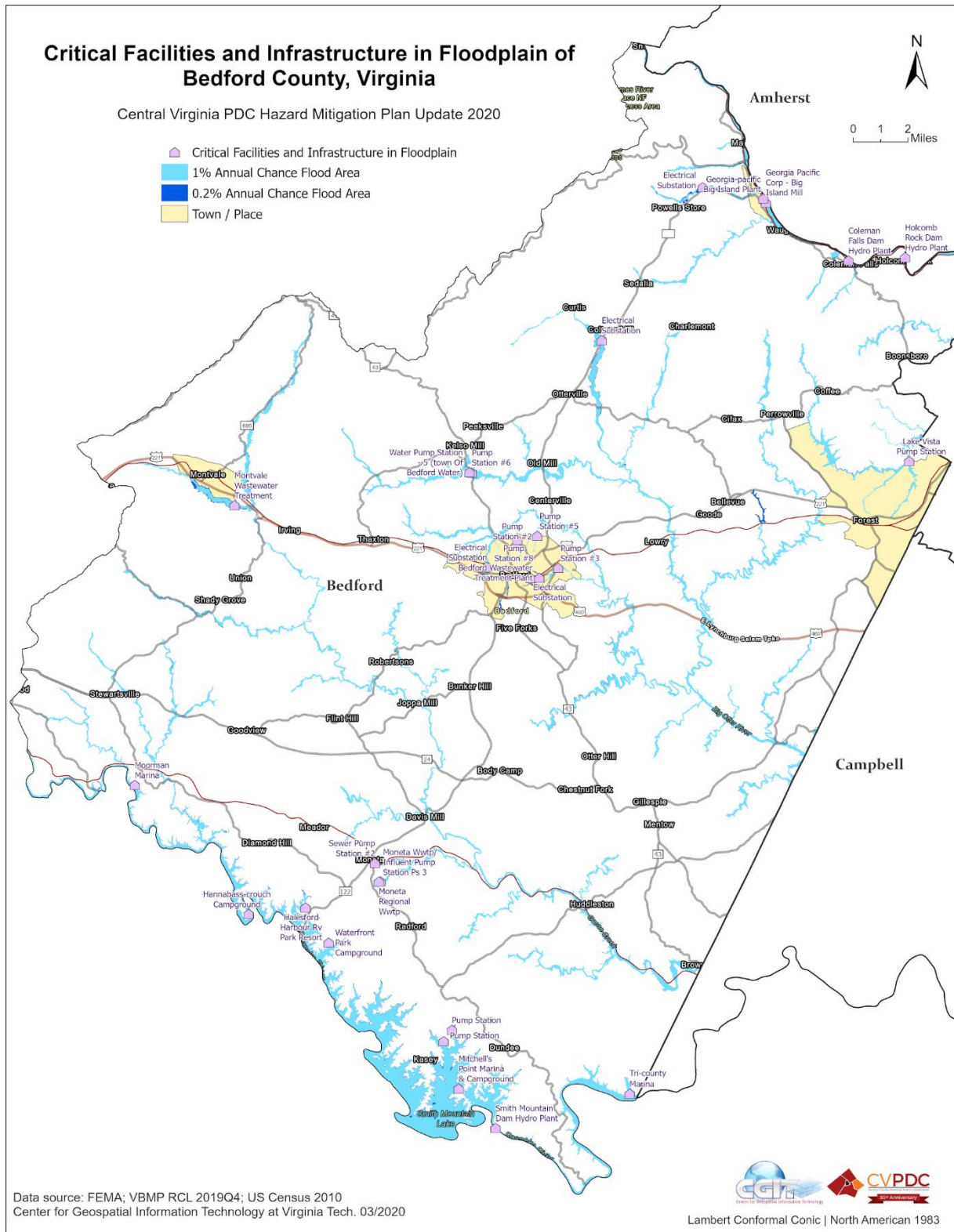


Figure 4-25 Critical facilities and infrastructure in floodplain of Bedford County, Virginia







# Hazard Identification and Risk Assessment

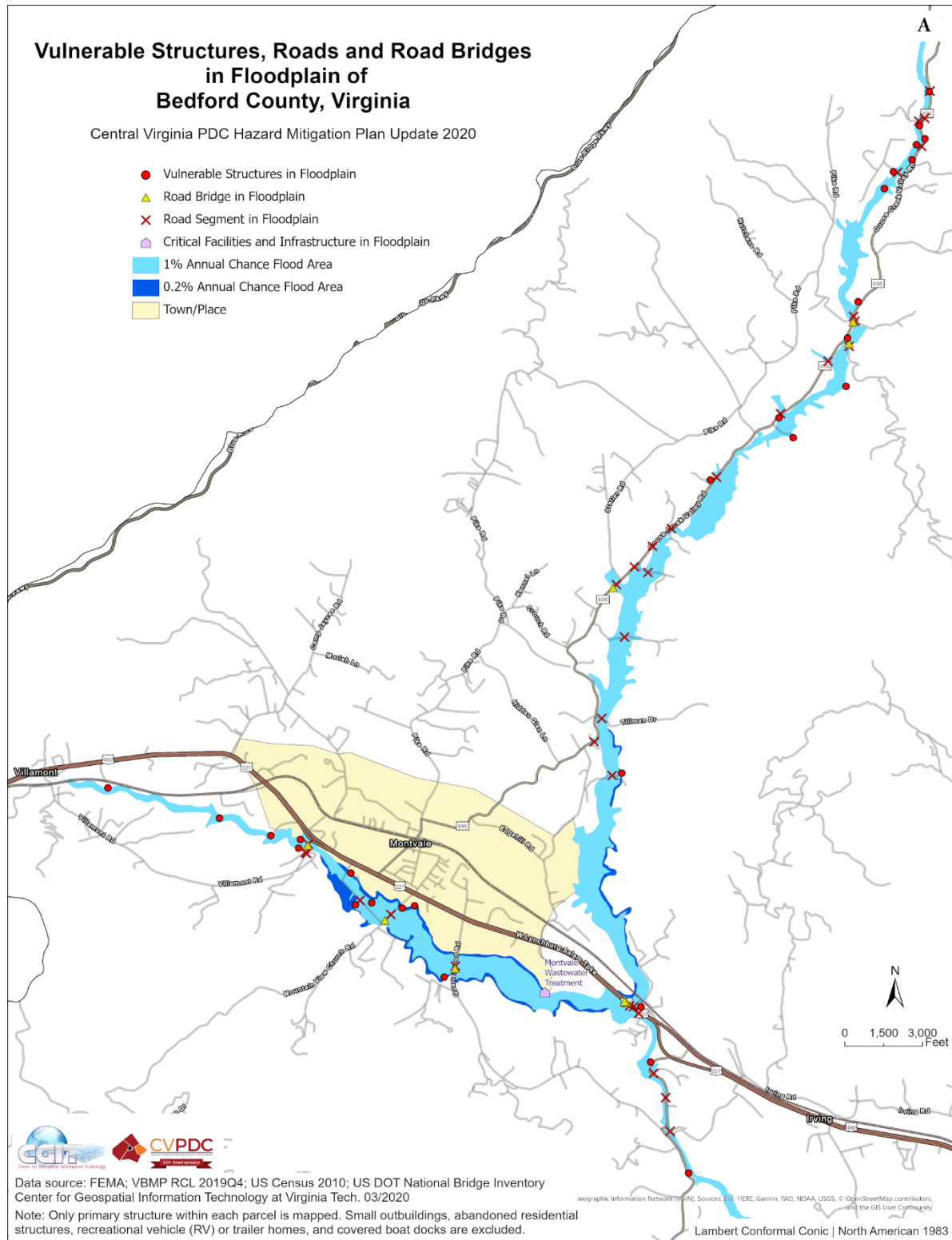


Figure 4-27 Vulnerable structures, roads and road bridges in floodplain of Town of Bedford, Virginia (Panel A)





# Hazard Identification and Risk Assessment

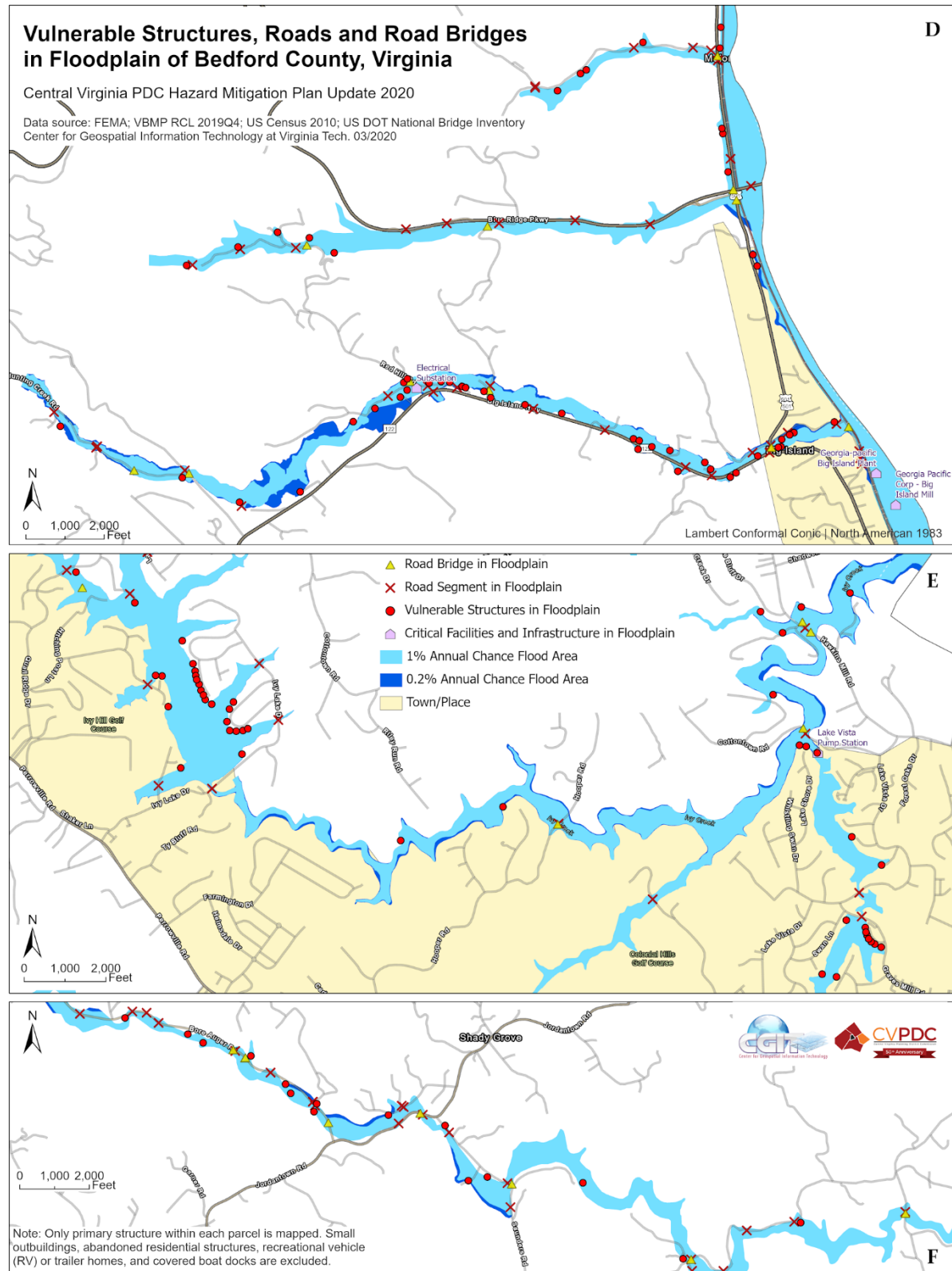


Figure 4-29 Vulnerable structures, roads and road bridges in floodplain of Bedford County and Town of Bedford, Virginia (Panel D, E, F)





# Hazard Identification and Risk Assessment

## Vulnerable Structures, Roads, and Road Bridges in Floodplain of Town of Bedford, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020



Note: Only primary structure within each parcel is mapped. Small outbuildings, abandoned residential structures, recreational vehicle (RV) or trailer homes, and covered boat docks are excluded.

Data source: FEMA; VBMP RCL 2019Q4; US Census 2010; US DOT National Bridge Inventory | Center for Geospatial Information Technology at Virginia Tech. 03/2020

Figure 4-30 Vulnerable structures, roads and road bridges in floodplain of Town of Bedford, Virginia





# Hazard Identification and Risk Assessment

## Community Growth Areas and Flood Areas within Bedford County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020

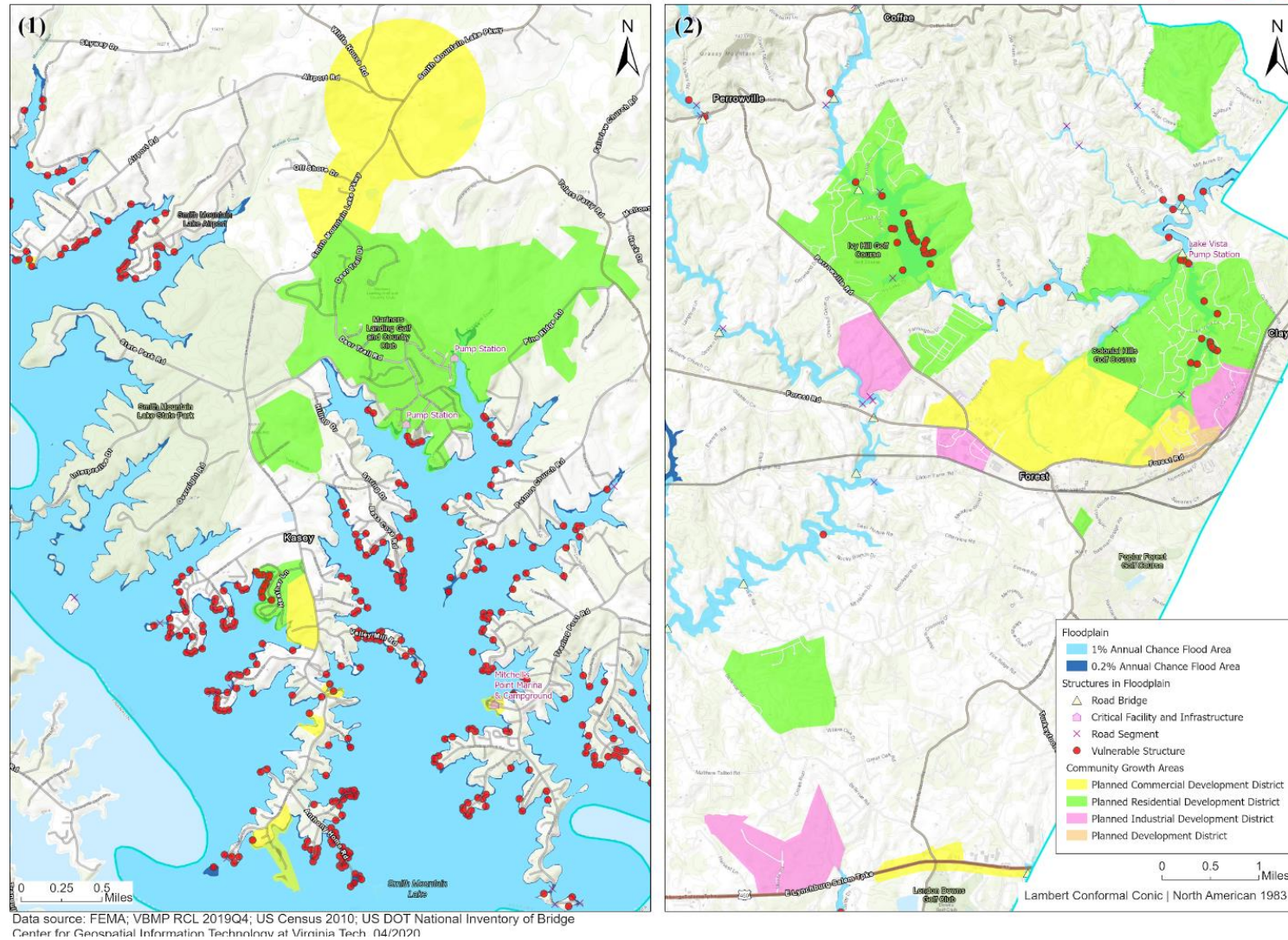


Figure 4-31 Community growth areas and floodplain within Bedford County, Virginia (Panel 1, 2)

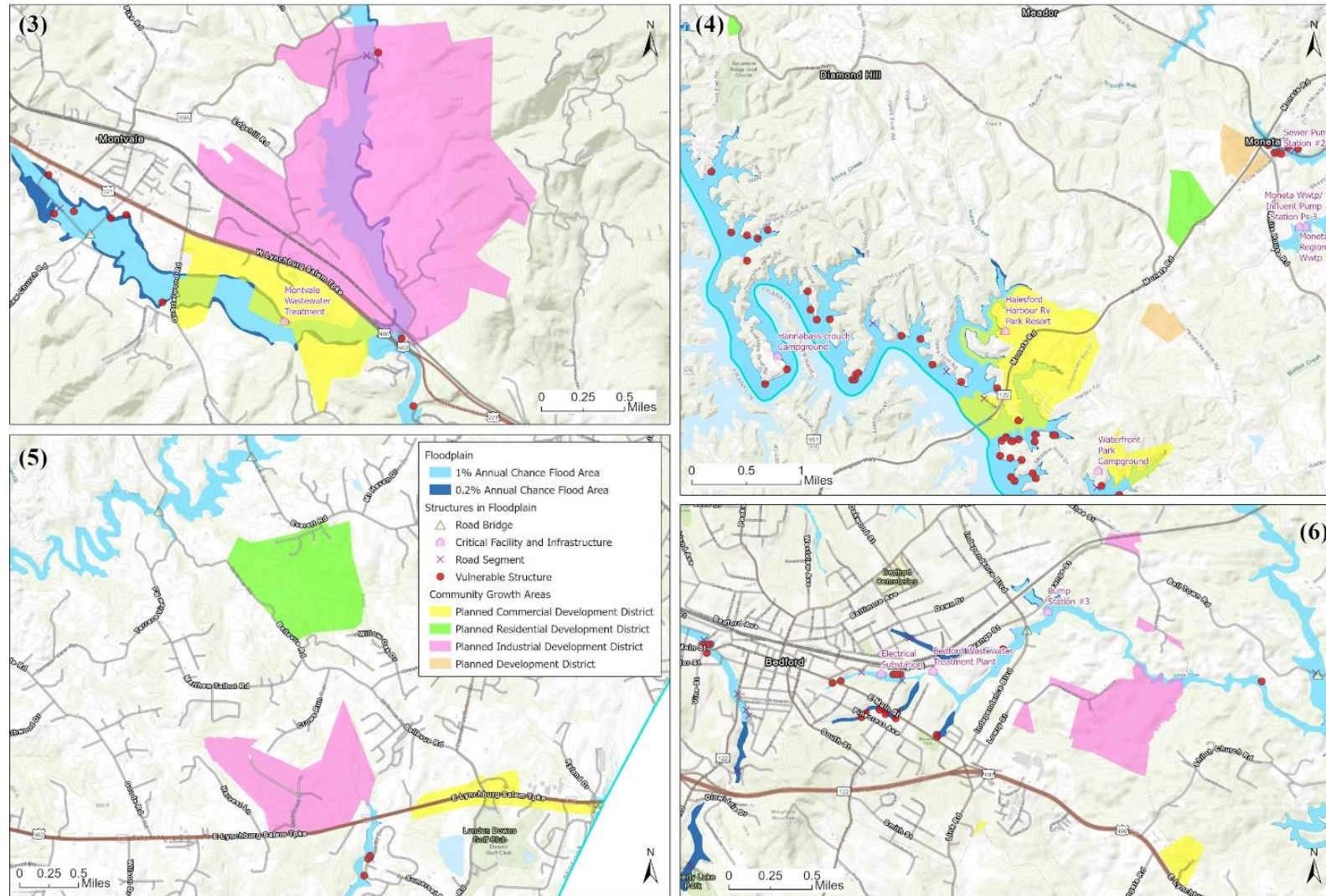




# Hazard Identification and Risk Assessment

## Community Growth Areas and Flood Areas within Bedford County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: FEMA; VBMP RCL 2019Q4; US Census 2010; US DOT National Inventory of Bridge | Center for Geospatial Information Technology at Virginia Tech. 04/2020

Lambert Conformal Conic | North American 1983

Figure 4-32 Community growth areas and floodplain within Bedford County, Virginia (Panel 3 to 6)



# Hazard Identification and Risk Assessment

#### **4.3.4.4 Campbell County, Town of Brookneal, and Town of Altavista**

Campbell County is located in the south-central Piedmont Region of Virginia, 115 miles west of Richmond, in the foothills of the Blue Ridge Mountains. From its beginnings in 1781 as a frontier settlement, to its emergence as a tobacco producer and then a center for industrial manufacturing, Campbell County has continually evolved and grown with national and world changes. The county is bordered on the north by the City of Lynchburg and James River and in the South by Roanoke (Staunton) River. According to the 2016 American Community Survey five year estimates, the population of Campbell County is 55,061—about 1% increase from the 2010 Census. The top five major employers in Campbell County in 2019 are BWXT Nuclear Operations Group Inc, BGF Industries Inc., Abbott Laboratories, Moore's Electrical and Mechanical, and WalMart.

The Town of Brookneal, near Phelps Creek and Falling River, has been a center for commerce for the surrounding counties of Campbell, Charlotte, and Halifax since its founding in 1802. The unincorporated Town of Rustburg serves as the county seat.

The Town of Altavista is a relatively new town in southern Campbell County, incorporated in 1912. Residential and industrial growth occurred within the town boundaries until around 1960, after which the concentration of new development took place outside the boundaries.

##### **4.3.4.4.1 Community Characteristics**

Campbell County entered into the NFIP on October 17, 1978, with emergency entry on December 27, 1973. The current effective date for the FIRMs is August 28, 2008. They are currently in good participating standing with the program. The county has 42 flood policies in force (31 policies within the unincorporated areas) with \$717,000 losses paid. Campbell County plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in Campbell County take 28.0 and 29.7 square miles, accounting for 5.5% and 5.8% total area of the entire county respectively.

Town of Altavista entered into the NFIP on August 1, 1978, with emergency entry on February 19, 1974. The current effective date for the FIRMs is August 28, 2008. They are currently in good participating standing with the program. The town has 12 flood policies in force with \$159,000 losses paid. Town of Altavista plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in the Town of Altavista take 1.0 and 1.1 square miles, accounting for respectively 20% and 21.6% total area of the town.

Town of Brookneal entered into the NFIP on March 1, 1978, with emergency entry on January 15, 1974. The current effective date for the FIRMs is August 28, 2008. They are currently in good participating standing with the program. The Town of Brookneal has 3 flood policies in force with \$0 losses paid. The Town of Brookneal plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in the Town of Brookneal take 0.3 and 0.3 square miles, accounting for respectively 8.7% and 9.4% total area of the town.



# Hazard Identification and Risk Assessment

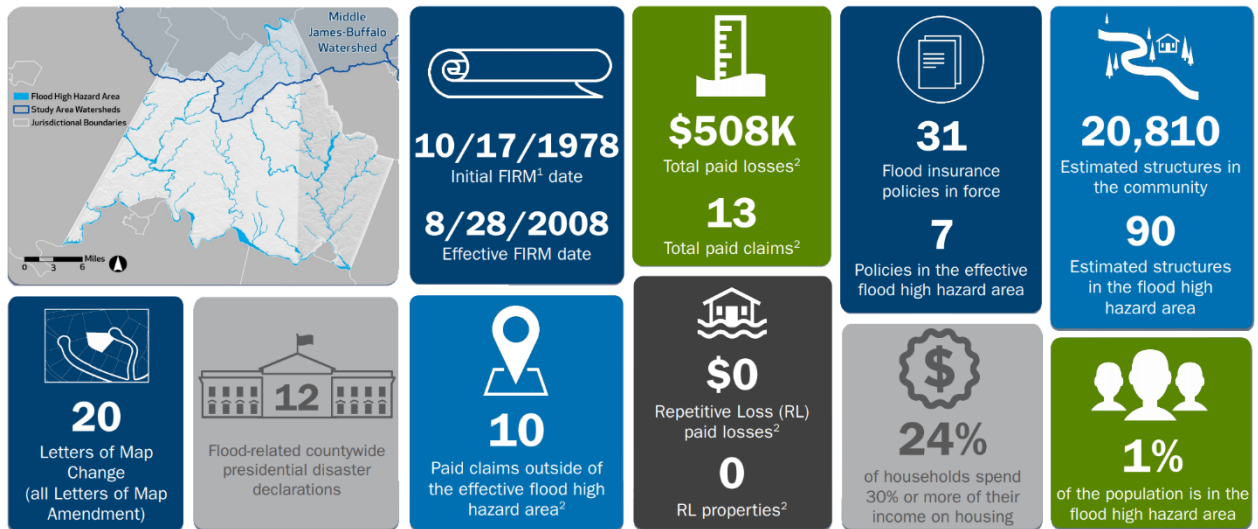


Figure 4-33 Community dashboard of Campbell County (Unincorporated Areas)

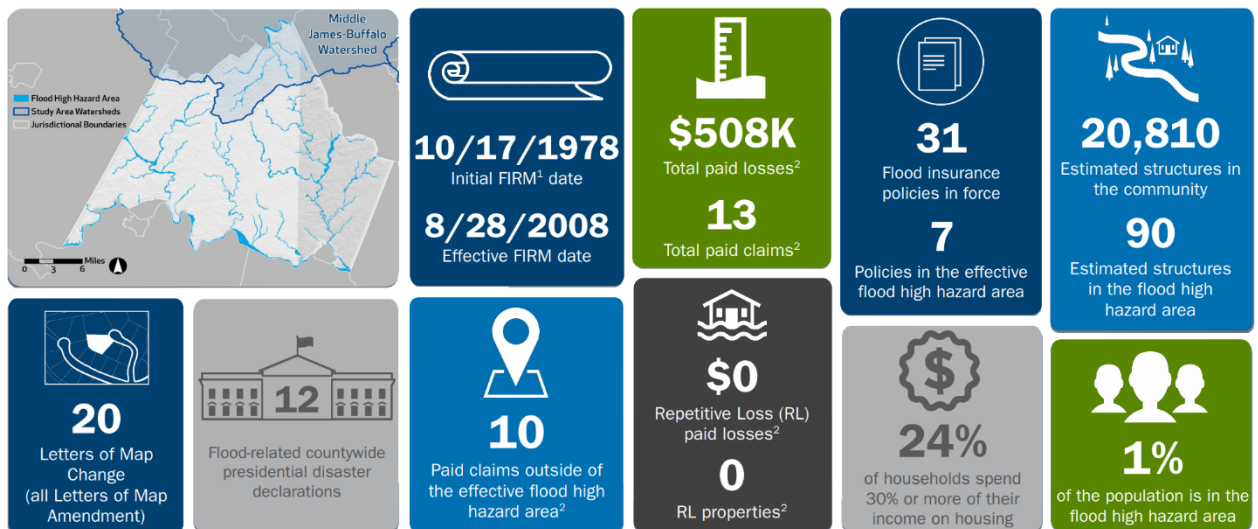


Figure 4-34 Community dashboard of Altavista





# Hazard Identification and Risk Assessment

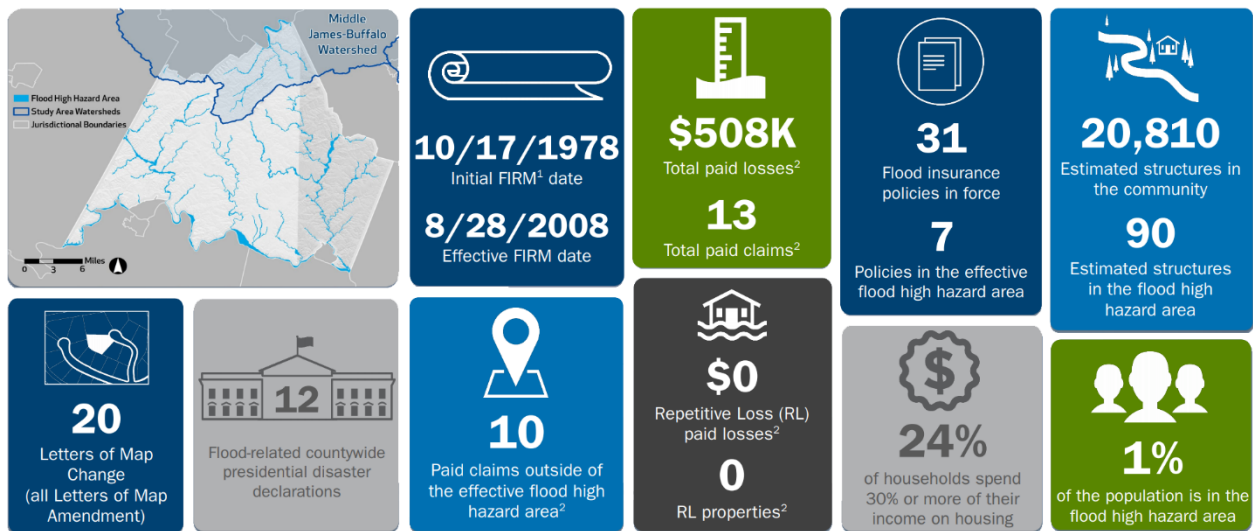


Figure 4-35 Community dashboard of Brookneal

## 4.3.4.4.2 Principal Flood Problems

This flood risk assessment identifies impacts to the people and property of Campbell County using the Flood Risk Discovery Report of Middle James-Buffalo Watershed (FEMA, 2019) developed under FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program and the detailed risk analysis developed for this Hazard Mitigation Plan, the following principal flood problems have been identified for Campbell County.

- Low-lying areas of Campbell County adjacent to streams studied by detailed methods are subject to periodic flooding.
- The most severe flooding is usually a result of heavy rains from tropical storms, while on the smaller creeks, the major floods are the result of local thunderstorms or frontal systems.
- Critical facilities located in the floodplain include: nuclear facility property (and major employer), Falling River Treatment Plant, Staunton River Treatment Plant, Campbell County Utility and Service Authority, and Flat Creek Pump Station.
- 8 high risk bridges in the floodplain.
- Natural gas line and fuel pipeline located in floodplain.
- One repetitive loss property and no severe repetitive loss properties.
- Older population located in the floodplain.

The nuclear facility identified in this HMP falls in the Nuclear Reactors, Materials, and Waste Sector classification (Cybersecurity & Infrastructure Security Agency). The subcategory of this critical infrastructure sector is the Nuclear Fuel Cycle Facility category. The hazards of a Nuclear Fuel Cycle Facility are very different than those found in a nuclear power reactor or a nuclear waste facility.

## 4.3.4.4.3 Vulnerable Population and Structures

The vulnerable population in or adjacent to floodplains within the incorporated area of Campbell County was profiled using demographic data with dasymetric mapping techniques at census block level. FEMA's



# Hazard Identification and Risk Assessment

Risk Map program identified 1% of the population is in the floodplain for the county. However, the county's up to 3.1% (or 4%) population have the potential to be impacted by flooding because of living in or close to 1-percent (or 0.2-percent) flood zones. Among those populations, 8% of them are at a low-income level (annual income < \$20K), 22.2% are young (age < 16), and 16.2% are seniors (age > 65). Whites make up the largest share (81.3%) of the total residents in Campbell County. Likewise, whites also predominate in or around the floodplain, representing 85.4% of the vulnerable population. Blacks are 11.8% of the vulnerable population, Hispanic or Latino are 1%, Asians are 0.1%, and Native Americans are 0.3%. Table 4-43 and Table 4-44 provide more demographics of the vulnerable population in Campbell County, in terms of ethnic group, income level, and age group.

*Table 4-43 Ethnic group in floodplains of Campbell County*

	Population	Households	White	Black	Hispanic	Asian	Native Am
Campbell	54842	22441	44595 (81.3%)	7737 (14.1%)	918 (1.7%)	543 (1.0%)	142 (0.3%)
1% Floodplain	1726 (3.1%)	683	1474 (85.4%)	204 (11.8%)	18 (1.0%)	1 (0.1%)	5 (0.3%)
0.2% Floodplain	2203 (4.0%)	891	1813 (82.3%)	319 (14.5%)	32 (1.5%)	3 (0.1%)	6 (0.3%)

*Table 4-44 Income level and age group in floodplains of Campbell County*

	Population	Households	Income <\$20k/Yr	Age <16	Age >65
Campbell	54842	22441	4844 (8.8%)	12044 (22.0%)	8685 (15.8%)
1% Floodplain	1726 (3.1%)	683	138 (8.0%)	383 (22.2%)	279 (16.2%)
0.2% Floodplain	2203 (4.0%)	891	175 (7.9%)	474 (21.5%)	378 (17.2%)

The unincorporated area of Campbell County has 69 (or 89) primary structures, 5 (or 6) critical facilities and infrastructures identified in the 1-percent (or 0.2-percent) floodplain. These are shown in Figure 4-36. Most of the structures and facilities are scattered within the county. There are a dozen homes concentrated near the East Brook / Kelly area in the north of the county. Table 4-45 lists critical facilities and infrastructures in the floodplain, including 1 energy facility, 1 nuclear facility, 1 hazmat facility, 2 historic sites, and 2 sewer pump stations (shown in Figure 4-37).

The Town of Altavista has 21 (or 23) primary structures identified in the 1-percent (or 0.2-percent) floodplain (shown in Figure 4-39). They are:

- Single family homes along Lynch Rd which parallels Lynch Creek.
- Single family homes or commercial buildings between Norfolk Southern Railroads and Roanoke River bank.

Five critical facilities and infrastructures, including Lane Home Furnishings, Altavista Area YMCA Family Center, Altavista Wastewater Plant, and BGF Industries Inc are in the floodplain. Among these facilities, the BGF Industries Inc is also one of the largest employers of Campbell County (ranks #4). The Altavista



# Hazard Identification and Risk Assessment

Water Plant and the Intake Pump Station are also in the floodplain. The Plant is in Pittsylvania County and the intake is in Campbell County.

The Town of Brookneal has 1 (or 2) primary structures in the 1-percent (or 0.2-percent) floodplain. There are 4 critical facilities and infrastructures in both 1-percent and 0.2 percent floodplains, including 1 communication facility, 1 historic site (Cat Rock Sluice), and 2 wastewater treatment plants (in Falling River and Staunton River). These are shown in Figure 4-40.

The floodplains overlaid with the community growth areas are shown in Figure 4-41 and Figure 4-42 for Campbell County, Altavista, and Brookneal.

*Table 4-45 Critical facility and infrastructure in floodplain of Campbell County, Altavista, and Brookneal*

Facility Name	Address	Facility Type	Coordinates	Flood Zone*
WODI - AM - The Rain Broadcasting, Inc. ***	1230 Radio Road Brookneal	Communication Facility	37.0384, -78.9420	1%; 0.2%
Leesville Hydro Plant	Rt. 754, Hurt	Energy Facility	37.0931, -79.4022	1%; 0.2%
BGF Industries **	401 Amherst Avenue, Altavista	HazMat Facility	37.1122, -79.2782	1%; 0.2%
Lane Home Furnishings **	701 5Th St, Altavista	HazMat Facility	37.1097, -79.2855	1%; 0.2%
Lynchburg Casting Industries	1132 Mt Athos Rd, Lynchburg	HazMat Facility	37.4027, -79.0595	1%
Cat Rock Sluice ***	General Location, Brookneal	Historic Site	37.0436, -78.9599	1%; 0.2%
Harpers Mill	3771 Hat Creek Rd, Brookneal	Historic Site	37.1397, -78.8988	1%; 0.2%
Six Mile Bridge	Mount Athos Rd & James River, Lynchburg	Historic Site	37.3932, -79.0612	1%; 0.2%
Altavista Area YMCA Family Center **	1000 Franklin Ave, Altavista	Large Population Venue	37.1140, -79.2889	1%; 0.2%
Campbell Co Util And Serv Auth/Sewer Pump Station	9625 Leesville Rd, Evington	Sewer Pump Station	0.0000, 0.0000	1%; 0.2%
Flat Creek Pump Station	13238 Wards Rd N, Lynchburg	Sewer Pump Station	37.3096, -79.1831	1%; 0.2%
Altavista Wastewater Plant **	Ln Access Rd, Altavista	Wastewater Treatment Plant	37.1123, -79.2740	1%; 0.2%
Brookneal Town - Falling River ***	Wickliffe Ave, Brookneal	Wastewater Treatment Plant	37.0522, -78.9340	1%; 0.2%
Brookneal Town - Staunton River ***	Radio Rd, Brookneal	Wastewater Treatment Plant	37.0376, -78.9391	1%; 0.2%

*Note: \* 1% (or 0.2%) indicates 1-percent (or 0.2-percent) annual chance flood zone. \*\* Located in the Town of Altavista. \*\*\* Located in the Town of Brookneal.*



# Hazard Identification and Risk Assessment

In the unincorporated areas of Campbell County, there are 104 flood-prone roads (including primary and secondary roads, and ramps) with a total of about 21 miles road segments in the floodplain (shown in Figure 4-38). The top 5 susceptible roads are Campbell Hwy, Mt Athos Rd, Halseys Bridge Rd, Richmond Hwy, and Johnson Creek Rd. All these roads have multiple flood-prone locations along their route. Norfolk Southern Railroad tracks along the south bank of James River may be impacted during flooding events. There are 7 road bridges identified as at high risk (scour critical) in the floodplain (Table 4-46).

Total of 14 roads in the Town of Altavista intersect with the floodplain. The top 5 most flood-prone roads are Lane Access Rd, Main St, Pittsylvania Ave, 3rd St, and Lynch Rd. Total road segments in the floodplain are about 3 miles. One road bridge on Clarion Road is identified as at high risk.

In the Town of Brookneal, total road segments in the floodplain are about 0.9 miles. These roads include Dog Creek Rd, Radio Rd, Wickliffe Ave, Lusardi Dr, and Juniper Cliff Rd. No high risk bridges are identified in the town.

*Table 4-46 Top 50 flood-prone roads in Campbell County (unincorporated area)*

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (mi)
1	Campbell Hwy	STR	9	1.47
2	Mt Athos Rd	SEC	2	1.43
3	Halseys Bridge Rd	SEC	4	1.26
4	Richmond Hwy	SEC	5	1.05
5	Johnson Creek Rd	SEC	9	0.95
6	Red Oak School Rd	SEC	2	0.79
7	Long Island Rd	STR	1	0.79
8	Bedford Hwy	STR	5	0.76
9	Leesville Rd	STR	2	0.56
10	Seneca Rd		2	0.49
11	Three Creeks Rd	SEC	2	0.42
12	U S Highway No 29	SEC	5	0.41
13	Red House Rd	STR	3	0.40
14	Lynch Rd	SEC	1	0.34
15	Railroad Ave	STR	2	0.31
16	Dearborn Rd	STR	4	0.30
17	Tardy Mountain Rd	STR	1	0.28
18	Riverbend Rd	STR	2	0.28
19	Beaver Creek Xing	STR	2	0.27
20	Taylor Pl	SEC	1	0.25
21	Wheeler Rd	STR	1	0.23
22	Colonial Hwy	SEC	2	0.23
23	Eastbrook Rd	SEC	2	0.23
24	Flat Creek Ln	UMS	2	0.21
25	Deer Haven Dr	SEC	3	0.20
26	Pigeon Run Rd	SEC	2	0.19
27	Stevens Rd	SEC	1	0.19





# Hazard Identification and Risk Assessment

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (mi)
28	Stage Rd	SEC	3	0.19
29	Gladys Rd	SEC	3	0.19
30	Trestle Rd	SEC	1	0.18
31	Lawyers Rd	UMS	2	0.18
32	Whitehall Rd	SEC	3	0.17
33	Richmond Hwy Ramp	SEC	1	0.17
34	Lynchburg Hwy	SEC	2	0.17
35	Camp Hydaway Rd	SEC	1	0.16
36	Lynbrook Rd	UMS	1	0.16
37	Morris Church Rd	SEC	1	0.15
38	Swinging Bridge Rd	SEC	2	0.15
39	Wards Rd	STR	3	0.15
40	Chellis Ford Rd	SEC	1	0.14
41	Shirlen Dr	SEC	1	0.14
42	English Tavern Rd	SEC	1	0.13
43	Masons Mill Rd	STR	2	0.13
44	Five Links Ln	SEC	1	0.12
45	Two Bid Rd	SEC	2	0.12
46	Bethany Rd	SEC	2	0.11
47	Bear Creek Rd	STR	2	0.11
48	East Ferry Rd	STR	2	0.11
49	Evington Rd	SEC	1	0.11
50	Hurt Rd	STR	2	0.11

Table 4-47 Flood-prone roads within Town of Altavista

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (feet)
1	Lane Access Rd	Secondary	2	3228
2	Main St	Primary	3	2795
3	Pittsylvania Ave	Primary	2	2283
4	3rd St	Secondary	1	2028
5	Lynch Rd	Secondary	1	1700
6	Clarion Rd	Primary	1	682
7	Broad St	Secondary	1	604
8	Lynch Mill Rd	Primary	1	503
9	7th St	Secondary	1	492
10	Riverbend Rd	Primary	1	391
11	West Rd	Secondary	1	341
12	U S Highway No 29	Primary	1	120
13	5th St	Secondary	1	78
14	Avoca Ln	Secondary	1	66



# Hazard Identification and Risk Assessment

Table 4-48 Flood-prone roads within Town of Brookneal

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (feet)
1	Dog Creek Rd	Primary	1	2130
2	Radio Rd	Secondary	1	1693
3	Wickliffe Ave	Primary	1	518
4	Lusardi Dr	Primary	1	365
5	Juniper Cliff Rd	Secondary	1	243

Table 4-49 Road bridges at high risk (scour critical) in floodplain in Campbell County

Name	Location	Crossing	Coordinate
Red House Road	1.6-Rt 643 / 1.00-Rt 648	Falling River	37.1953, -78.9495
Mitchell Mill Road	1.00-Rt 699/1.60-Rt 701	Big Seneca Creek	37.1570, -79.1205
Clarion Road	0.09-Rt.714/1.10-Rt.712	Stream	37.5611, -79.0638
Red House Road	2.50-Rt 736/0.40-Rt 834	Little Falling River	37.1918, -78.8777
Hurt Road	1.50-Rt 601/0.45-Rt 618	Little Falling River	37.1405, -78.9153
Three Creeks Road	0.90-Rt.652/0.60-Rt.708	Mollys Creek	37.1706, -78.9724
East Ferry Road	0.60 Rt 727 / 1.00 Rt 751	Seneca River	37.1925, -79.1250
Evington Road	0.60-Rt 934/2.10-Bedfo CL	Buffalo Creek	37.2473, -79.3052

Table 4-50 Road bridges in floodplain in Town of Altavista

Name	Location	Crossing	Coordinates	Floodplain
Route 29 Bus.	0.00-CmpbCo./0.00-PittCo.	Staunton River & Ns Pwy	37.1268, -79.2707	1%; 0.2%
Riverbend Road	0.05-Rt 875/0.20-Rt 29B	Otter River	37.1388, -79.2441	1%; 0.2%
Main Street	0.30-Rt 43/2.83 NCL Altav	Lynch Creek	37.1104, -79.2874	1%; 0.2%
Clarion Road *	0.09-Rt.714/1.10-Rt.712	Stream	37.1294, -79.2743	1%; 0.2%

Note: \* Identified as high risk (scour critical) road bridge.

Table 4-51 Road bridges in floodplain in Town of Brookneal

Name	Location	Crossing	Coordinates	Floodplain
Wickliffe Avenue	.06-E Brknl / 4.20-Cha Co	Falling River	37.0536, -78.9358	1%; 0.2%



# Hazard Identification and Risk Assessment

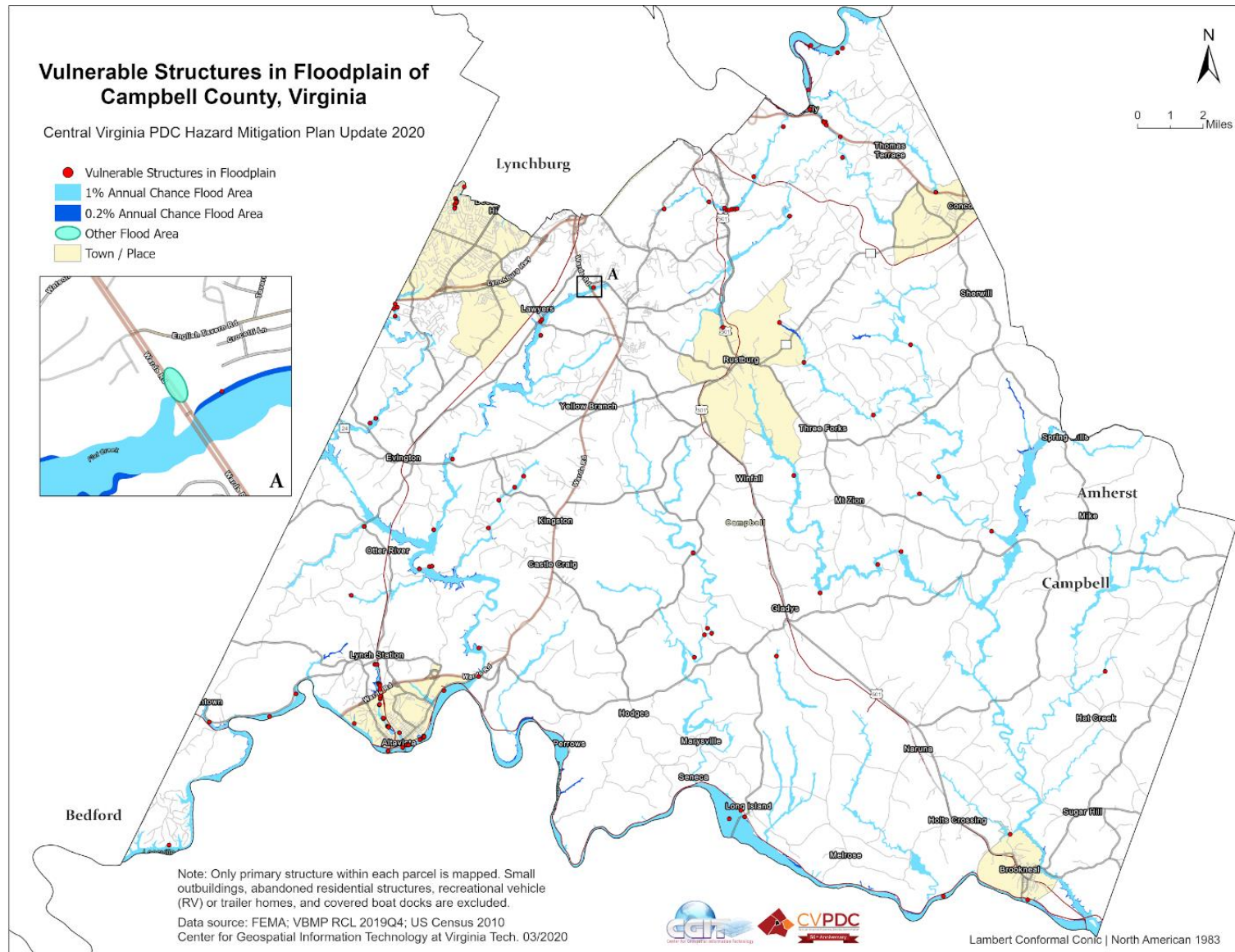


Figure 4-36 Vulnerable structures in floodplain of Campbell County, Virginia



# Hazard Identification and Risk Assessment

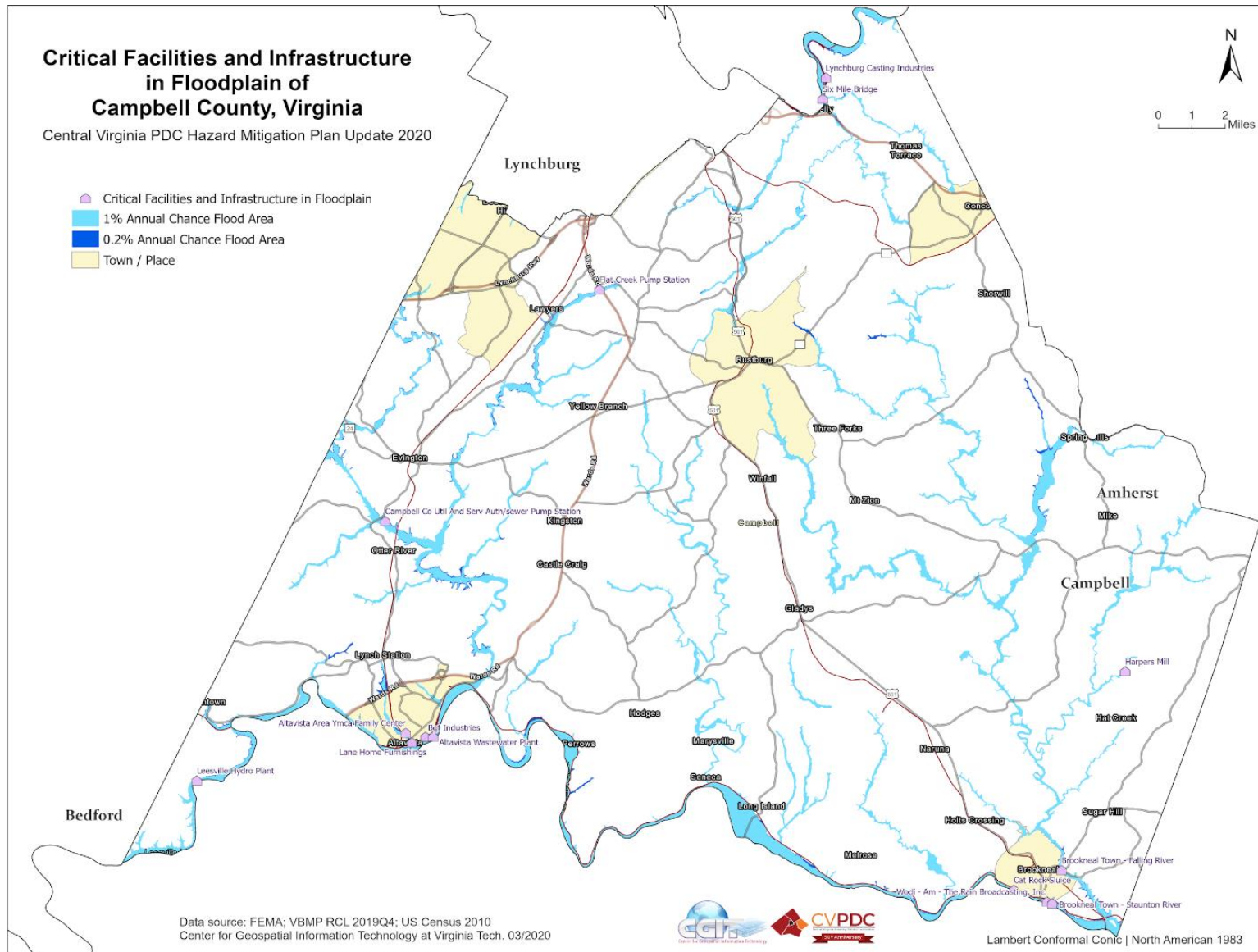


Figure 4-37 Critical facilities and infrastructure in floodplain of Campbell County, Virginia





# Hazard Identification and Risk Assessment

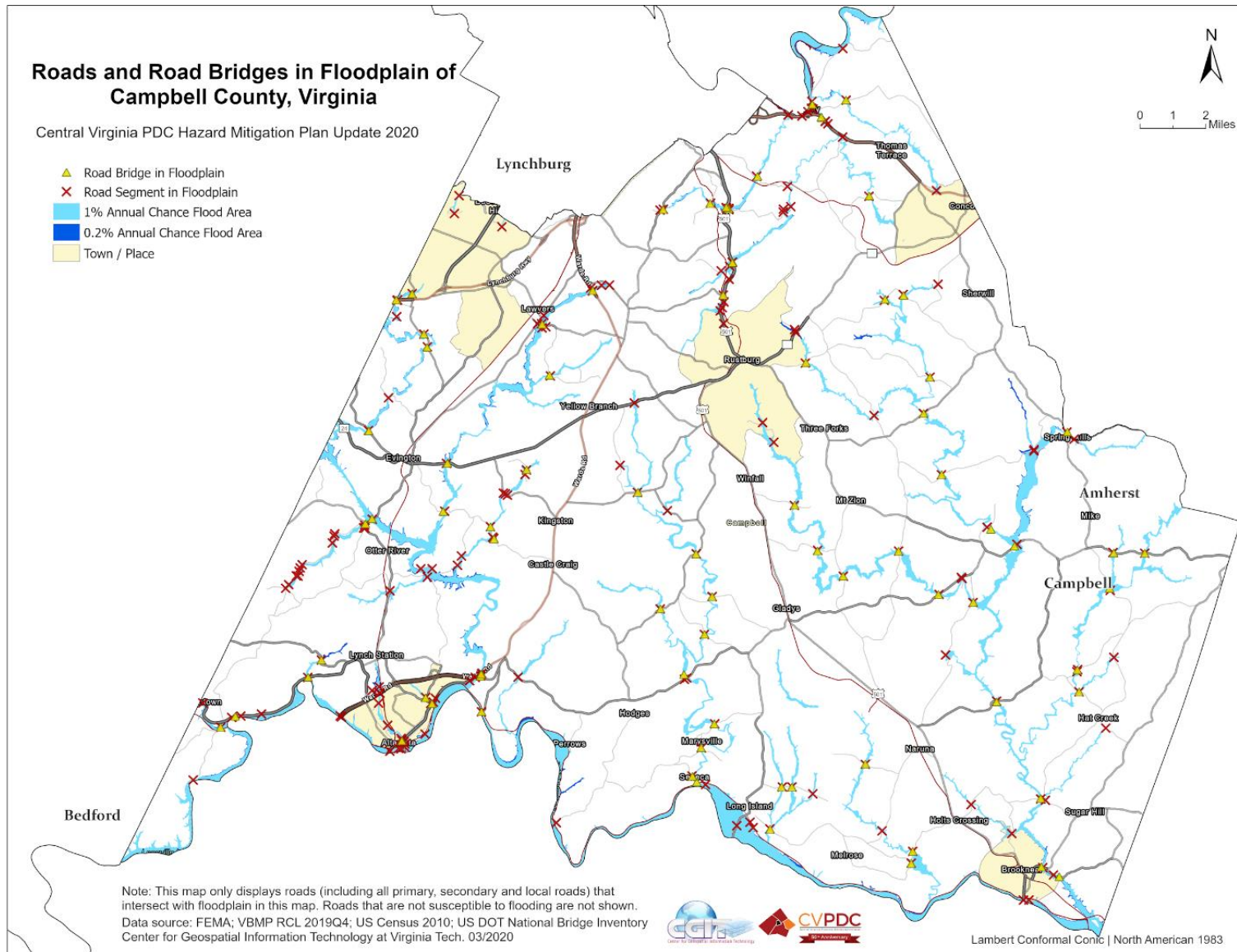


Figure 4-38 Roads and bridges in floodplain of Campbell County, Virginia



# Hazard Identification and Risk Assessment



Figure 4-39 Vulnerable structures in floodplain of Town of Altavista, Virginia



# Hazard Identification and Risk Assessment

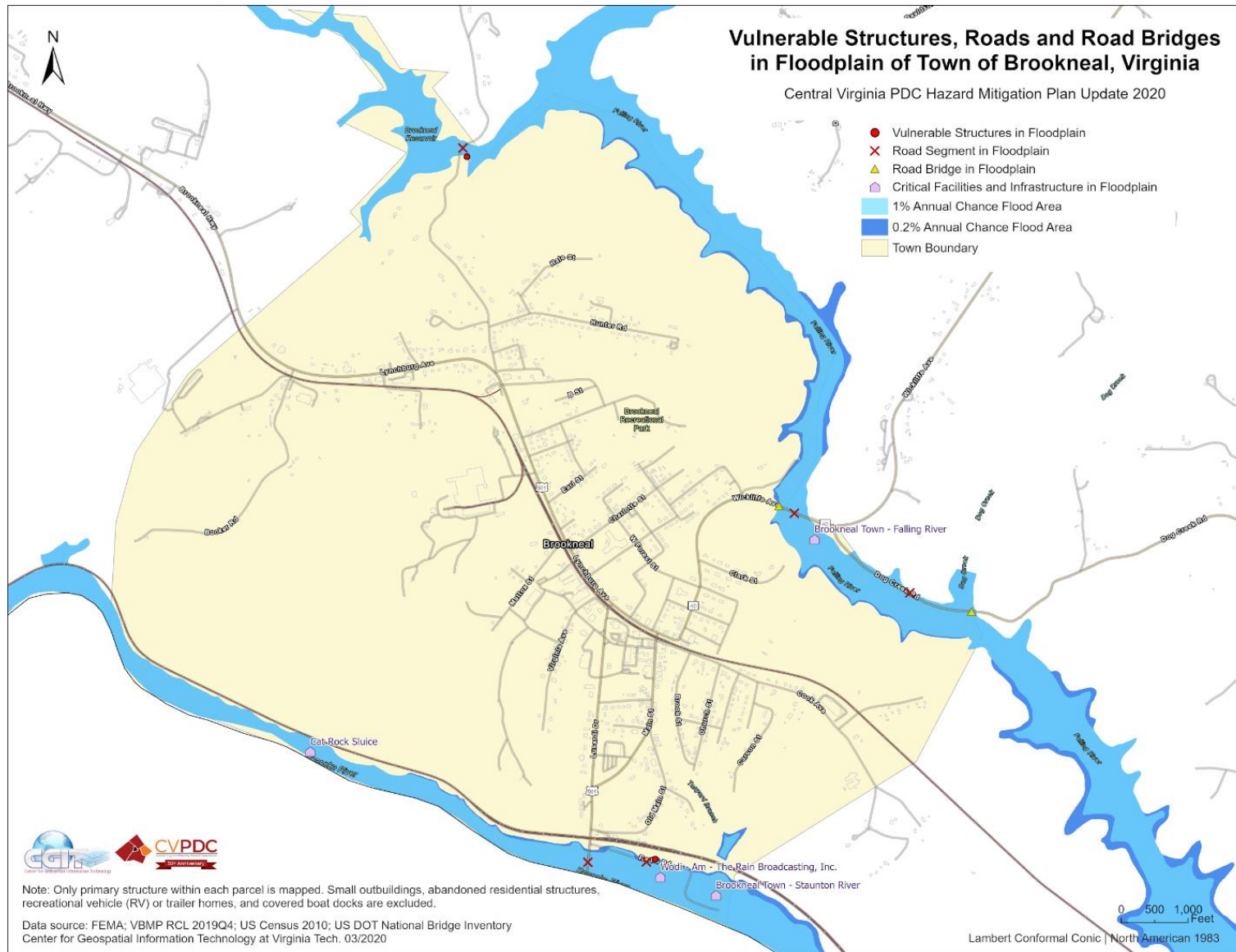


Figure 4-40 Vulnerable structures in floodplain of Town of Brookneal, Virginia









# Hazard Identification and Risk Assessment

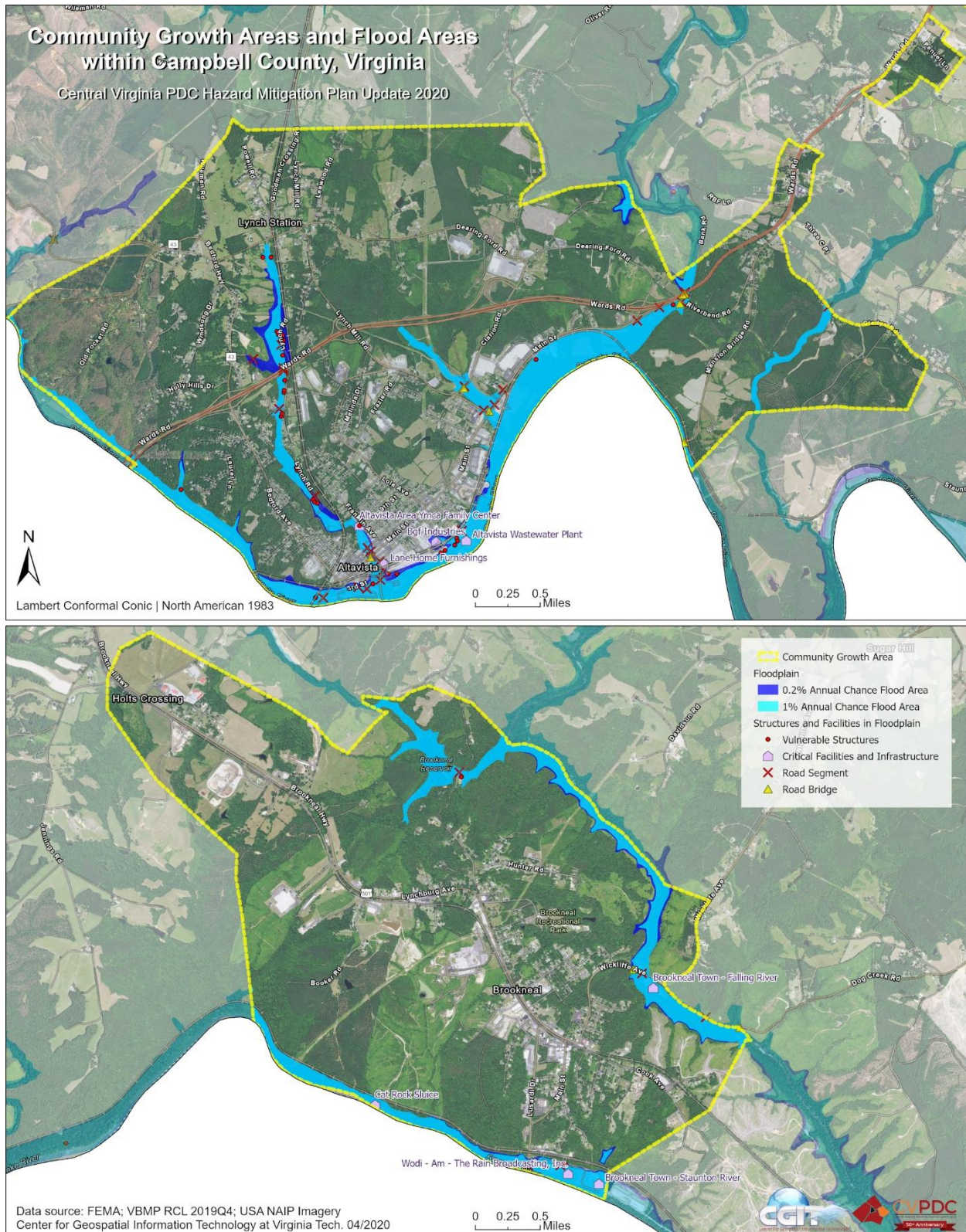


Figure 4-42 Community growth areas and floodplain within Campbell County, Virginia (map 2)



# Hazard Identification and Risk Assessment

## 4.3.4.5 City of Lynchburg

The City of Lynchburg is located near the geographic center of Virginia. In 1757, John Lynch established a ferry service on the James. The ferry service remained profitable for many years, and by the end of the American Revolution, the village at Lynch's Ferry had itself become an important center of trade. Lynch saw the possibilities of establishing a town on the hill overlooking the ferry site, and in late 1784 petitioned the General Assembly of Virginia for a town charter. In October, 1786, the charter was granted, founding the town of Lynchburg. Located on James River, the city has a land area of 48 square miles and is bordered on the west by the Blue Ridge Mountains and Bedford County, to the south by Campbell County, and to the North by Amherst County. According to the 2016 American Community Survey five year estimates, the City of Lynchburg has a population of 78,755, a 4.2% increase from the 2010 Census.

The city is a major highway and transportation hub that has contributed to its status as a broadly diversified manufacturing center. Lynchburg is 115 miles west of Richmond, the state capital; 52 miles east of Roanoke; 180 miles southwest of Washington, D.C.; and 200 miles west of the Port of Hampton Roads. Lynchburg is the central city of the Lynchburg Metropolitan Statistical Area (MSA), which—according to the 2016 Census American Community Survey—has a total population of 258,062. Liberty University, a private coeducational Christian university, was founded in 1971 and encompasses 4,400 acres located in the foothills of the Blue Ridge Mountains and south of James River. The U.S. Department of Education reports Liberty as the third largest university in the country with 80,494 total enrollment (Fall 2015). However, the majority of these students are enrolled in distance education, with roughly 15,000 living locally. The top five largest employers in Lynchburg in 2019 are Liberty University, Centra Health Inc, J. Crew Outfitters, Areva NP Inc, and University of Lynchburg.

### 4.3.4.5.1 Community Characteristics

Lynchburg City entered into the NFIP on September 1, 1978, with emergency entry on September 18, 1973. The current effective date for the FIRMs is June 6, 2010. They are currently in good participating standing with the program. The city has 97 flood policies in force with \$3.2 M losses paid (shown in the Figure 4-43 dashboard). Lynchburg City plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in Lynchburg City take 3 and 3.5 square miles, accounting for 6.2% and 7% total area of the entire city, respectively.





# Hazard Identification and Risk Assessment

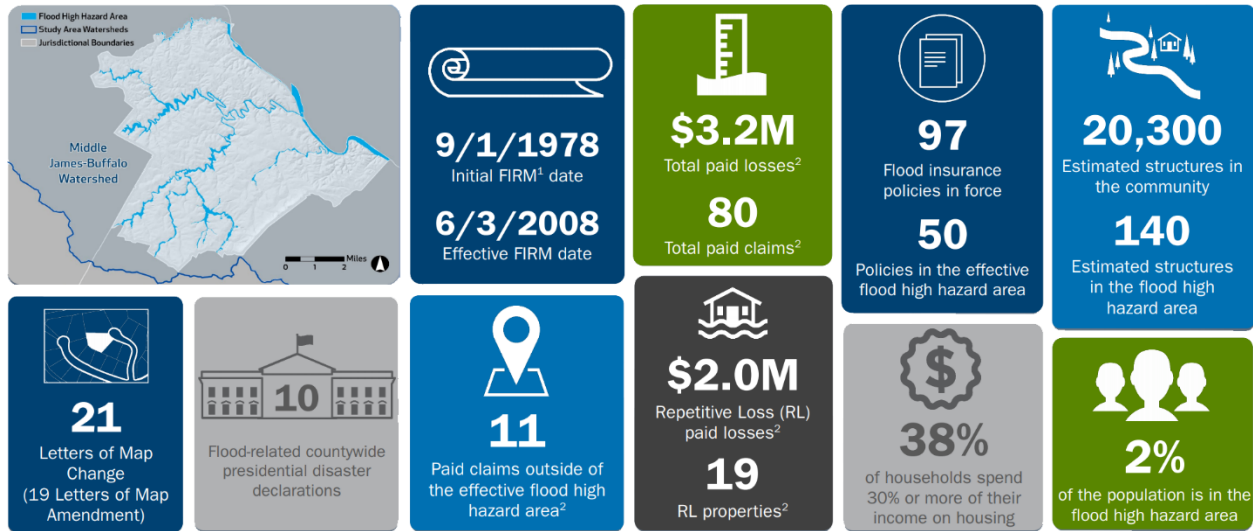


Figure 4-43 Community dashboard of City of Lynchburg

## 4.3.4.5.2 Principal Flood Problems

This flood risk assessment identifies impacts to the people and property of the City of Lynchburg. The floodplains of the James River near the city are intensely developed, containing numerous warehouses, factories, businesses, and the necessary rail, highway, and utility services for the city. Floodplain development for all other streams in the city is mainly residential, with some commercial and industrial sites adjacent to the floodplain areas. Using the Flood Risk Discovery Report of Middle James-Buffalo Watershed (FEMA, 2019) developed under FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program and the detailed risk analysis developed for this Hazard Mitigation Plan, the following principal flood problems have been identified for the City of Lynchburg:

- Critical facilities located in the floodplain including: wastewater treatment plant, energy facility, and hazmat facilities.
- 2 high risk bridges in the floodplain.
- Natural gas line and fuel pipeline located in floodplain.
- Several critical facilities sit outside of but very close to floodplain
- Downtown redevelopment area partially located in floodplain.
- Nineteen repetitive loss properties and seven severe repetitive loss properties.
- Older and lower income population located in the floodplain.

## 4.3.4.5.3 Vulnerable Population and Structures

The vulnerable population in or adjacent to floodplains within the City of Lynchburg was profiled using demographic data with dasymetric mapping techniques at census block level. FEMA's Risk Map program identified about 2% of the population is in the floodplain for the city. However, the city's up to 7.3% (or 14.5%) population have the potential to be impacted by flooding because of living in or close to 1-percent (or 0.2-percent) flood zones. Among those populations, 11.7% of them are at a low-income level (annual income < \$20 k), 23.1% are young (age < 16), and 15.2% are seniors (age > 65). Whites make up the largest share (63%) of the total residents in the City of Lynchburg. Likewise, whites also predominate in or around the floodplain, representing 64.8% of the vulnerable population. Blacks are 25.2% of the vulnerable



# Hazard Identification and Risk Assessment

population, Hispanic or Latino are 3.8%, Asians are 3.1%, and Native Americans are 0.4%. Table 4-52 and Table 4-53 provide more demographics of the vulnerable population in the city, in terms of ethnic group, income level, and age group.

*Table 4-52 Ethnic group in floodplains of City of Lynchburg*

	Population	Households	White	Black	Hispanic	Asian	Native Am
Lynchburg	75568	28476	47574 (63.0%)	21984 (29.1%)	2300 (3.0%)	1852 (2.5%)	200 (0.3%)
1% Floodplain	5544 (7.3%)	2479	3590 (64.8%)	1395 (25.2%)	209 (3.8%)	170 (3.1%)	20 (0.4%)
0.2% Floodplain	10964 (14.5%)	4920	7051 (64.3%)	2799 (25.5%)	438 (4.0%)	334 (3.0%)	27 (0.2%)

*Table 4-53 Income level and age group in floodplains of City of Lynchburg*

	Population	Households	Income <\$20k/Yr	Age <16	Age >65
Lynchburg	75568	28476	7559 (10.0%)	14774 (19.6%)	10556 (14.0%)
1% Floodplain	5544 (7.3%)	2479	651 (11.7%)	1281 (23.1%)	840 (15.2%)
0.2% Floodplain	10964 (14.5%)	4920	1328 (12.1%)	2435 (22.2%)	1807 (16.5%)

The City of Lynchburg has 160 (or 235) primary structures identified in the 1-percent (or 0.2-percent) floodplain shown in Figure 4-44. Most vulnerable structures are concentrated in the following areas:

- Southwest bank of James River. This area is the major floodplain of the city which consists of a strip of land averaging about 400 feet wide by 3 miles long. The area is highly developed with industrial establishments, warehouses, and commercial buildings. All of these are vulnerable to high water. A quarter of identified vulnerable structures throughout the city are located here. Five critical facilities, including Amazement Square Child Museum, U.S. Pipe (former Griffin Pipe Products Co, LLC), Lynchburg Foundry Co Lower Basin Plant <sup>19</sup>, Westrock Converting Company, and Lynchburg City Sewage Treatment are also in this floodplain (Table 4-54 and Figure 4-46, Panel A).

<sup>19</sup> The Lynchburg Foundry Co. Lower Basin Plant no longer exists. However, the site potentially releases toxic pollution during a flood. According to the EPA, numerous hazardous chemicals and petroleum products were historically used during the manufacturing process at this facility. See: <https://www.epa.gov/hwcorrectiveaction/hazardous-waste-cleanup-intermet-archer-creek-foundry-currently-virginia-casting>





# Hazard Identification and Risk Assessment

- Reusens area. Over 30 homes and train warehouses of CSX Railroad sit in this floodplain. Two facilities, the Reusens Dam Hydro Plant and an electrical substation, are located here (Figure 4-46, panel B).
- Forest Hill / Blue Ridge Farms area. Some homes and buildings of Peak View Park are in the floodplain (Figure 4-47, Panel C).
- Lynchburg Expressway (Route 460) / Timberlake Rd (Route 501) interchange. Several clusters of townhouses, single family houses, and duplexes are in the floodplain near this interchange along Burton Creek (Figure 4-48, Panel D).

It is worth mentioning that 2 facilities not in the floodplain still need attention. The electrical substation in Stonewall St is very close to the floodplain. Valley View Retirement Community (assisted care facility) has a corner of the property in a flood zone but the structure is not (Table 4-55). Walmart ranks #8 of the largest employers of the city. The Walmart Supercenter on Wards Rd near Liberty University sits partially in the floodplain. Most of its parking lot is within the flood zone.

*Table 4-54 Critical facility and infrastructure in floodplain of City of Lynchburg*

Facility Name	Address	Facility Type	Coordinates	Flood Zone*
Amazement Square Child Museum	27 9Th St, Lynchburg	Attractions	37.4162, -79.1403	1%; 0.2%
Electrical Substation		Electrical Substation	37.4622, -79.1872	1%; 0.2%
Reusens Dam Hydro Plant	4300 Hydro Street, Lynchburg	Energy Facility	37.4630, -79.1867	1%; 0.2%
U.S. Pipe (former Griffin Pipe Products Co LLC)	10 Adams Street, Lynchburg	HazMat Facility	37.4208, -79.1413	1%; 0.2%
Lynchburg Foundry Co Lower Basin Plant	Garnet Street And Concord Turnpike, Lynchburg	HazMat Facility	37.4071, -79.1318	1%; 0.2%
Westrock Converting Company	1801 Concord Turnpike, Lynchburg	HazMat Facility	37.4034, -79.1281	1%; 0.2%
Lynchburg City Sewage Treatment	2301 Concord Tpke, Lynchburg	Wastewater Treatment Plant	37.3968, -79.1141	1%; 0.2%

Note: 1% (or 0.2%) indicates 1-percent (or 0.2-percent) annual chance flood zone

*Table 4-55 Critical facility and infrastructure located outside of (but adjacent to) floodplain of City of Lynchburg*

Facility Name	Address	Facility Type	Coordinates	Note
Electrical Substation	127 Stonewall St, Lynchburg,	Electrical Substation	37.4194, -79.1446	Very close to floodplain
Valley View	1213 Long	Assisted Care	37.3717,	Property contains a



# Hazard Identification and Risk Assessment

Facility Name	Address	Facility Type	Coordinates	Note
Retirement Community	Meadows Drive, Lynchburg		-79.1993	floodplain but not the building.

In the City of Lynchburg, there are 77 flood-prone roads (including primary and secondary roads, and ramps/exits) with a total of about 12 miles road segments in the floodplain (Table 4-56 and Figure 4-45). The 5 most susceptible roads are Blackwater Creek Trl, Concord Tpke, Wards Rd, 5th St, and Hydro St. All these roads together with Lynchburg Expy, Evergreen Rd, and Graves Mill Rd all have multiple flood-prone locations along their route. CSX Railroad tracks along the bank of James River may be impacted during flooding events. Among the 23 road bridges in the floodplain, 2 scour critical bridges across Blackwater Creek and Fishing Creek are identified as at high risk (Table 4-57).

*Table 4-56 Top 50 flood-prone roads in City of Lynchburg*

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (mi)
1	Blackwater Creek Trl	SEC	15	2.28
2	Concord Tpke	SEC	2	1.66
3	Wards Rd	SEC	8	1.10
4	5th St	STR	2	0.56
5	Hydro St	SEC	2	0.55
6	Cornerstone Trl	SEC	3	0.53
7	Exit 9	SEC	3	0.50
8	Jefferson St	STR	1	0.38
9	Evergreen Rd	SEC	3	0.37
10	Lynchburg Expy	SEC	8	0.37
11	Rte 29 Byp	STR	2	0.22
12	29 Exs Expw	SEC	1	0.19
13	Wards Ferry Rd	STR	2	0.19
14	Fort Ave	SEC	2	0.15
15	Greenwood Dr	URB	1	0.12
16	Enterprise Dr	SEC	2	0.11
17	7th St	SEC	1	0.11
18	Mill Stream Ln	RMP	1	0.10
19	Graves Mill Rd	SEC	3	0.10
20	Robin Dr	SEC	1	0.10
21	501 Exn Expw	SEC	1	0.09
22	Coffee Rd	SEC	1	0.09
23	Trents Ferry Rd	SEC	1	0.09
24	Garnet St	SEC	1	0.08
25	Timberlake Rd	SEC	2	0.07
26	501 Ex	STR	1	0.06
27	Link Rd	STR	1	0.06
28	Rivermont Ave	URB	2	0.06
29	Adams St	SEC	1	0.06



# Hazard Identification and Risk Assessment

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (mi)
30	Creekside Dr	SEC	1	0.06
31	On Ramp	UMS	3	0.06
32	Mcconville Rd	STR	1	0.05
33	Fenwick Dr	SEC	1	0.05
34	Washington St	SEC	1	0.05
35	Wade Ln	SEC	1	0.05
36	Atlanta Ave	URB	1	0.04
37	Indian Hill Rd	SEC	1	0.04
38	Buckingham Dr	SEC	1	0.04
39	Jefferson Ridge Pkwy	SEC	1	0.04
40	Simons Run	SEC	4	0.04
41	Windsor Hills Dr	STR	1	0.04
42	Exit 11	SEC	1	0.03
43	Badcock Pl	STR	1	0.03
44	Rhonda Rd	SEC	1	0.03
45	Ivy Dr	SEC	1	0.03
46	Wiggington Rd	STR	1	0.03
47	Horseford Rd	SEC	1	0.03
48	Cranehill Dr		1	0.03
49	Carroll Ave	SEC	2	0.03
50	Cvcc Campus Dr	SEC	1	0.03

*Table 4-57 Road bridges at high risk (scour critical) in floodplain in City of Lynchburg*

Name	Location	Crossing	Coordinate
Hollins Mill Road	.89 RT 501 / .84 RT 29 B	Blackwater Creek	37.4253, -79.1595
501 Business	0118128 000829	Fishing Creek	37.3982, -79.1503



# Hazard Identification and Risk Assessment

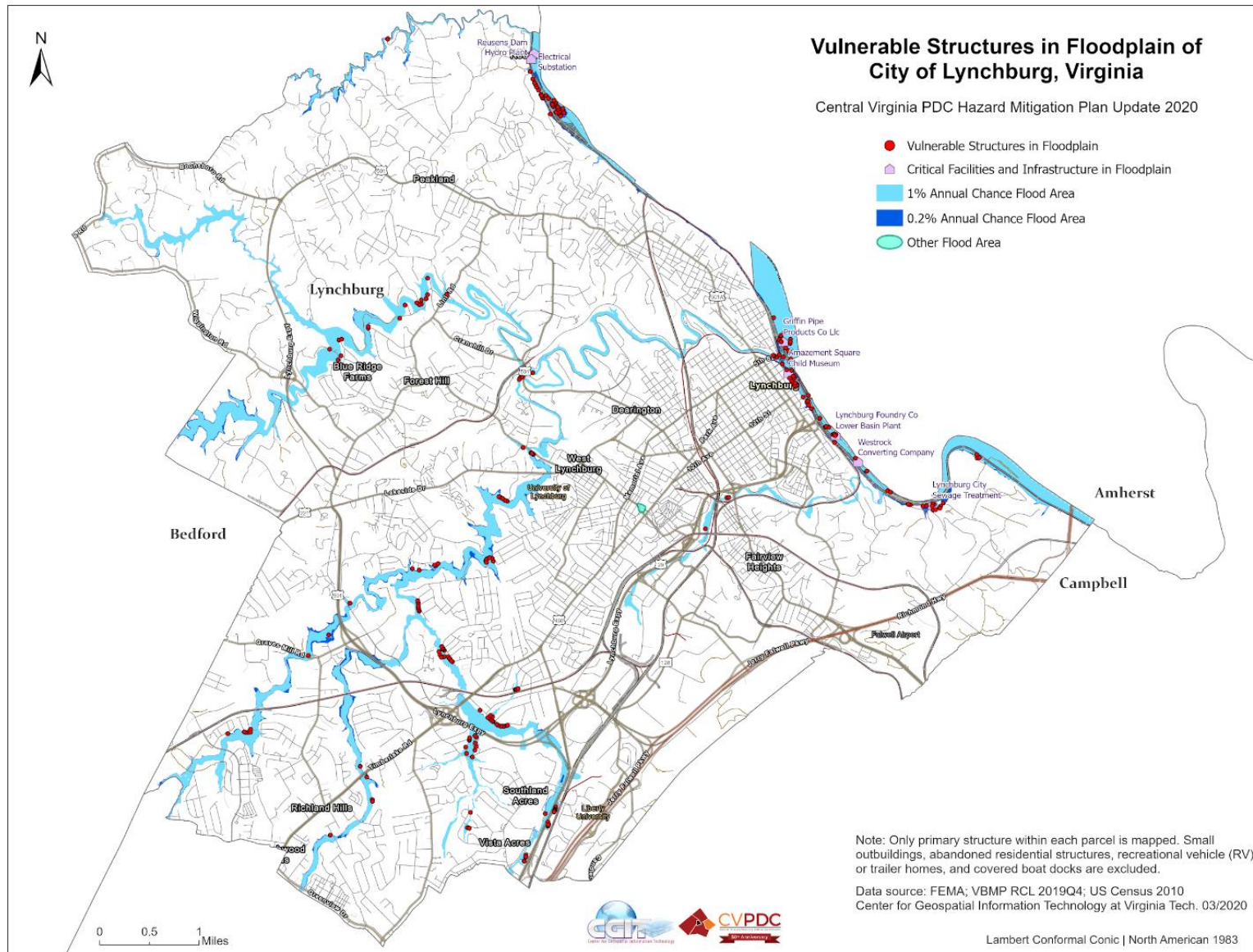


Figure 4-44 Vulnerable structures in floodplain of City of Lynchburg





# Hazard Identification and Risk Assessment

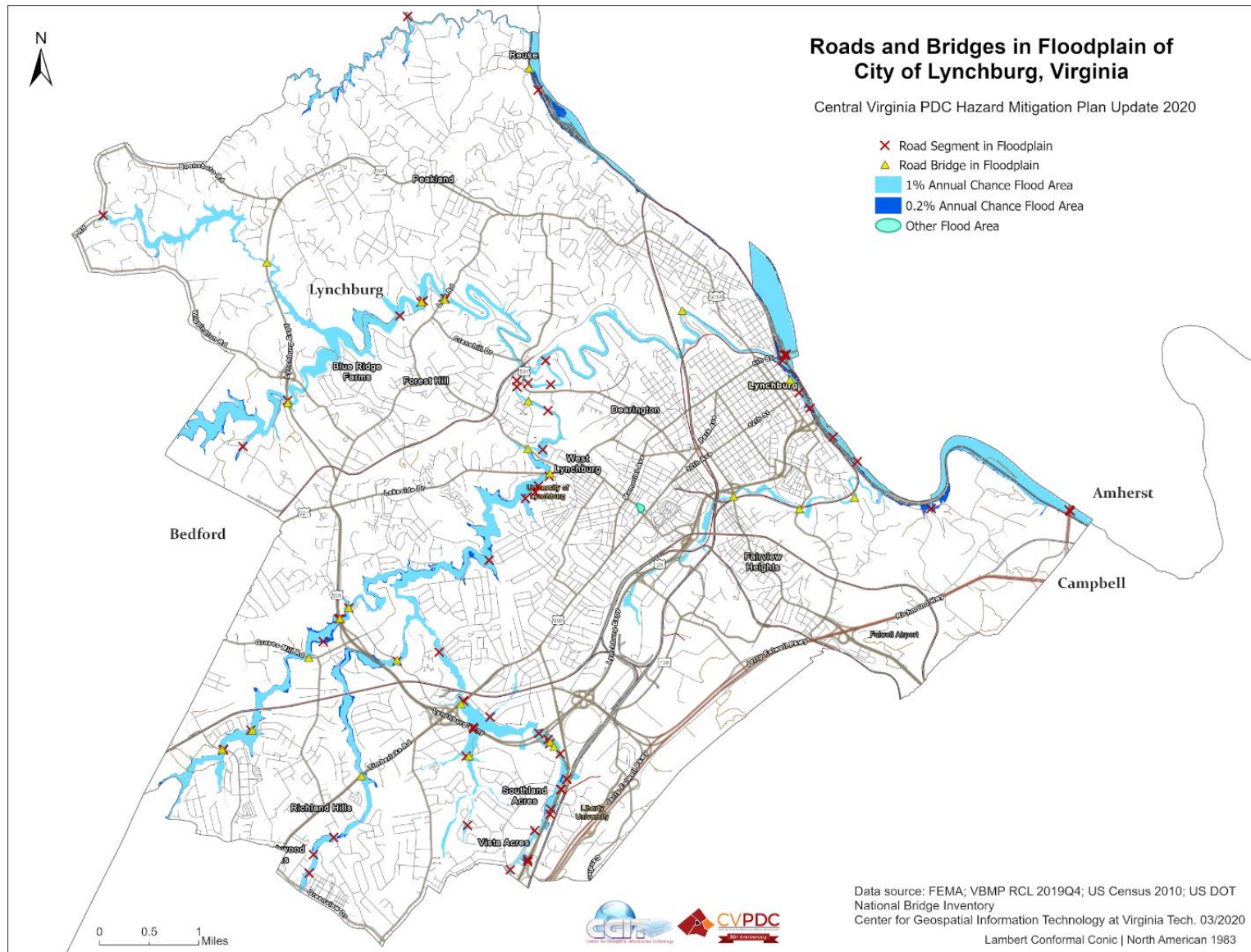


Figure 4-45 Roads and bridges in floodplain of City of Lynchburg



# Hazard Identification and Risk Assessment

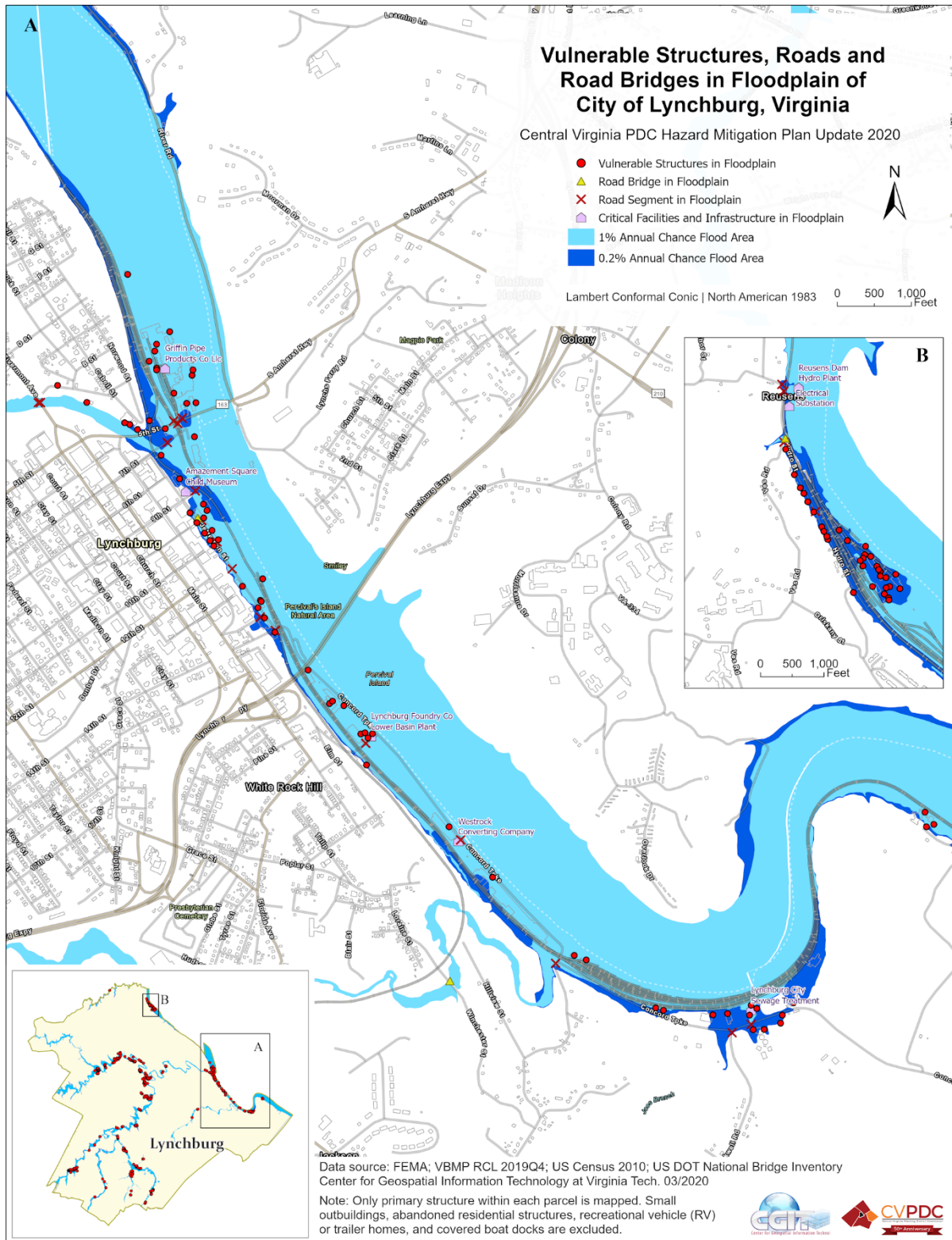


Figure 4-46 Vulnerable structures, roads and road bridges in floodplain of City of Lynchburg, Virginia (Panel A, B)





# Hazard Identification and Risk Assessment

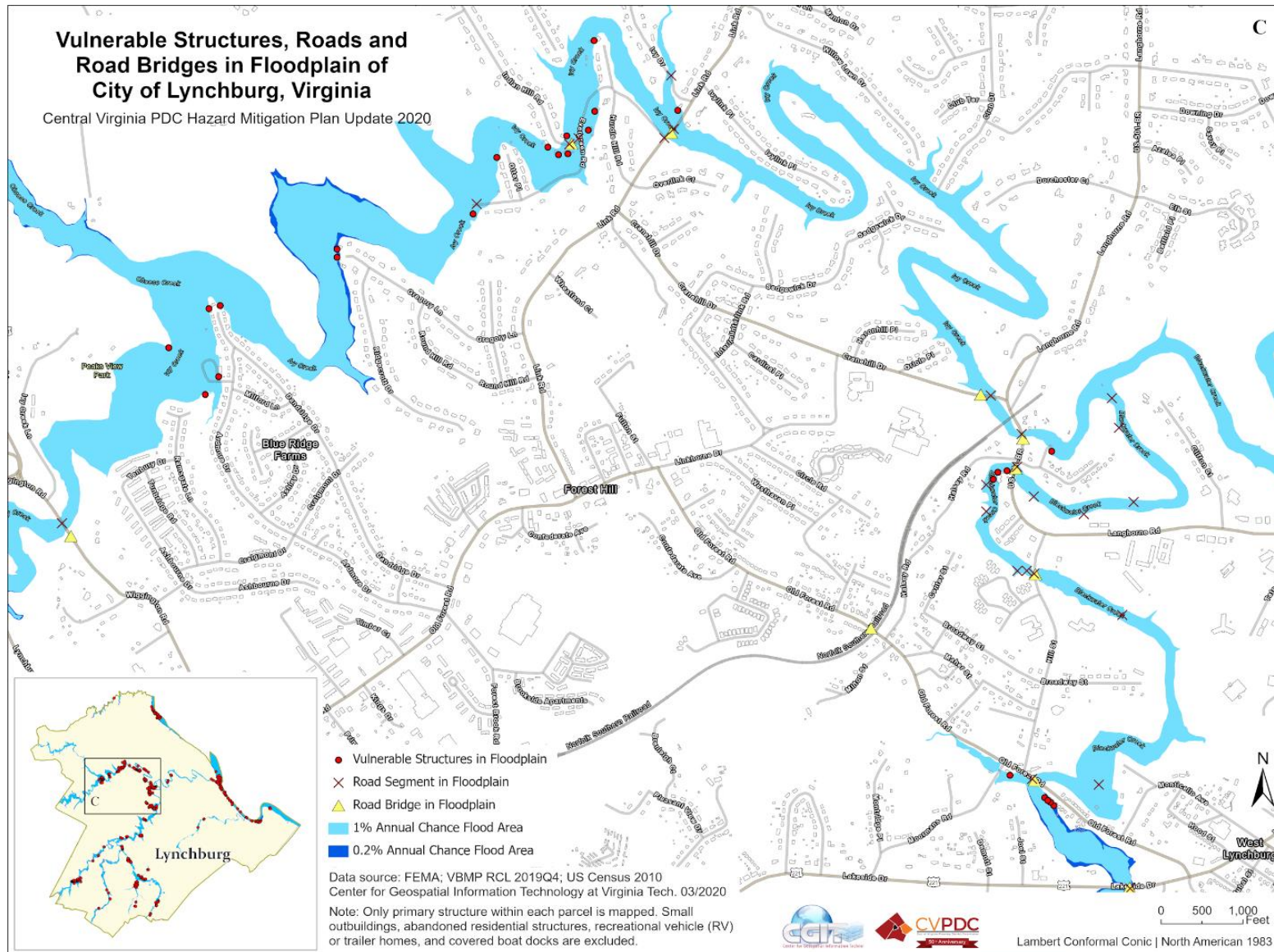


Figure 4-47 Vulnerable structures, roads and road bridges in floodplain of City of Lynchburg, Virginia (Panel C)



# Hazard Identification and Risk Assessment

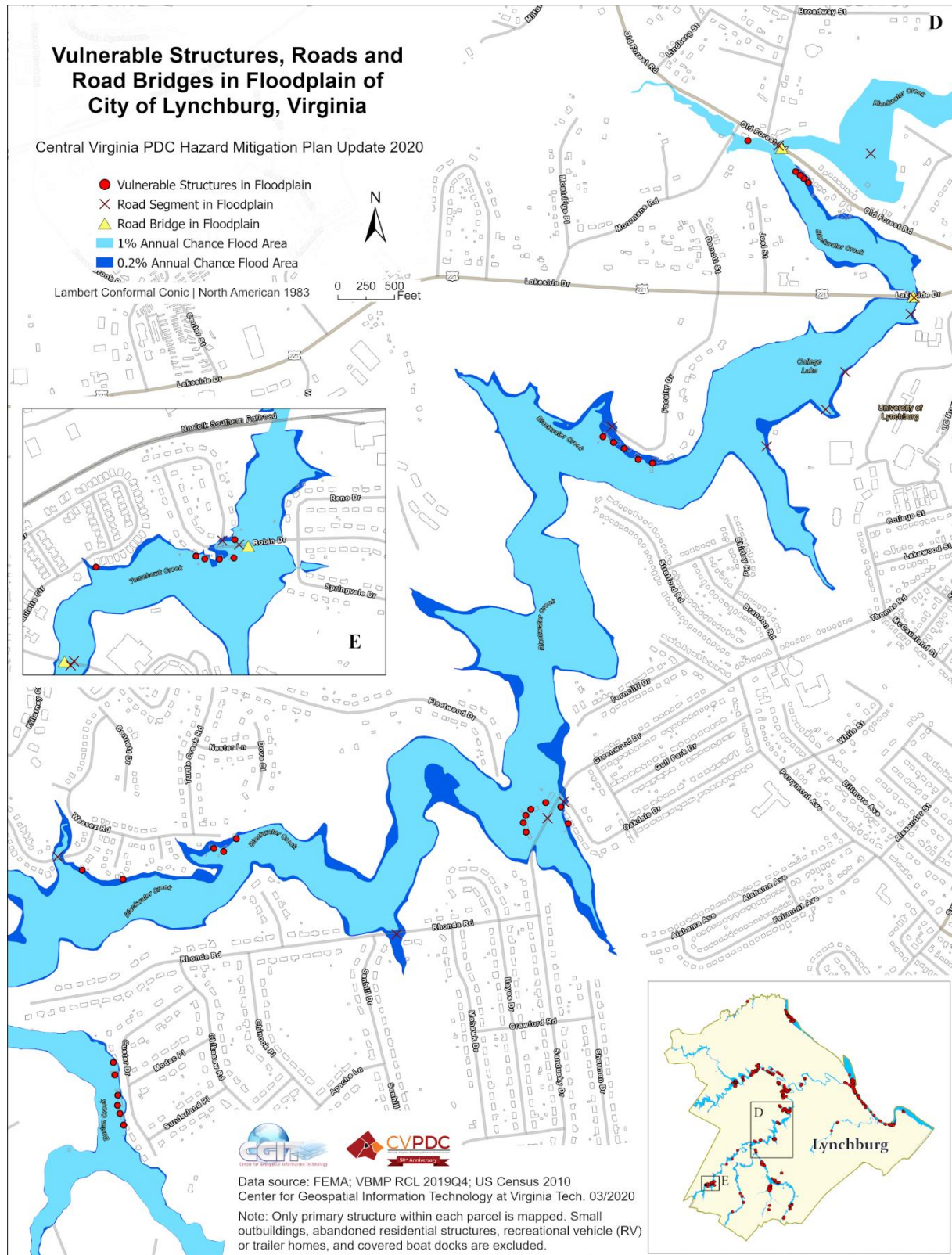


Figure 4-48 Vulnerable structures, roads and road bridges in floodplain of City of Lynchburg, Virginia (Panel D)







# Hazard Identification and Risk Assessment

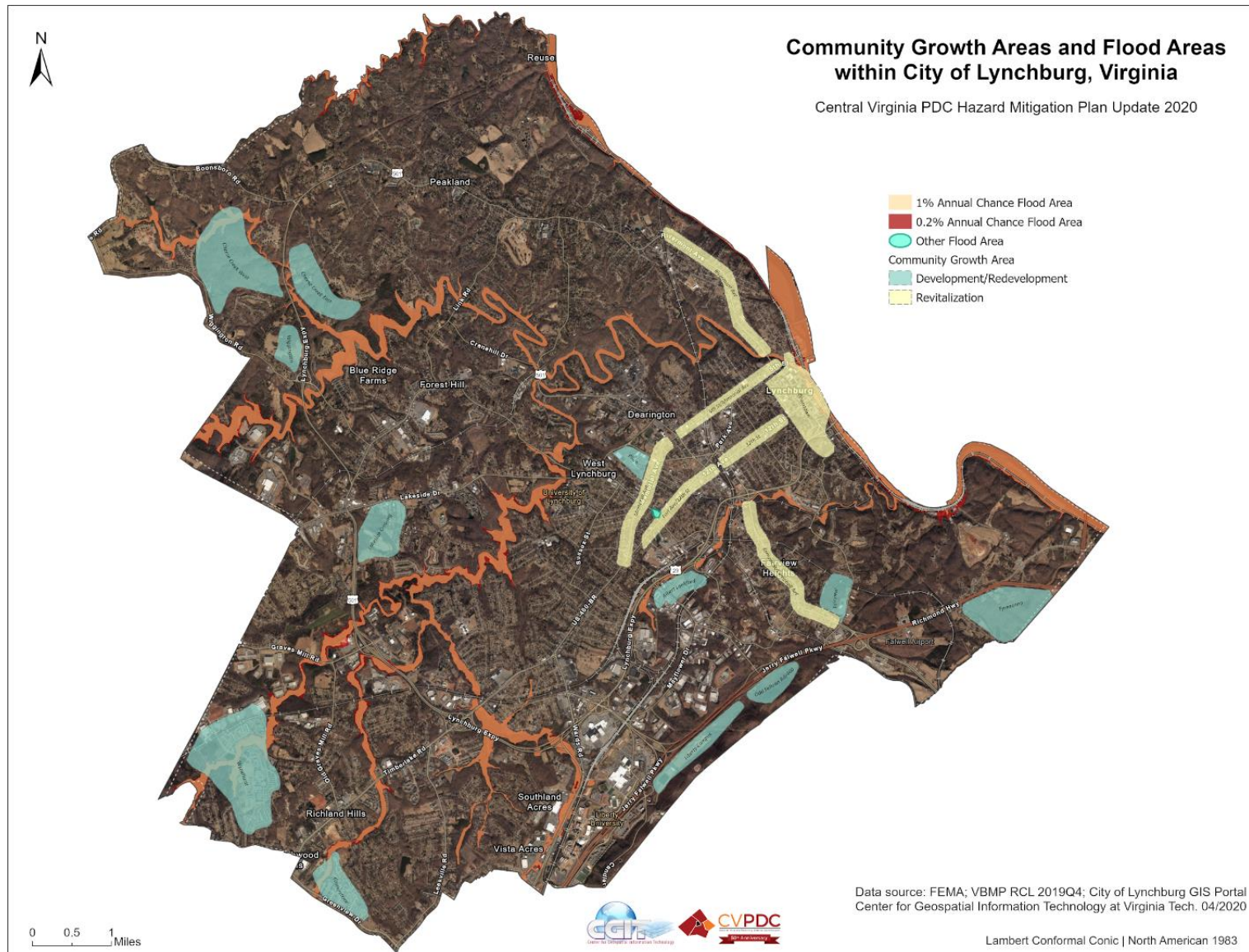


Figure 4-50 Community growth areas and floodplain within City of Lynchburg, Virginia





# Hazard Identification and Risk Assessment

## 4.3.5 Probability of Future Occurrences

Based on recorded historical occurrences over the past 23 years (1996–2019), a flood event is a highly likely occurrence for the CVPDC.

## 4.3.6 References

- U.S. Government Publishing Office. Title 44 of the Code of Federal Regulation (44 CFR), Chapter 1, Subchapter B. Section 59.1 Definitions [https://www.ecfr.gov/cgi-bin/text-idx?SID=b4bb956de1cd97fcde4e45957579e523&mc=true&node=pt44.1.59&rgn=div5#se44.1.59\\_11](https://www.ecfr.gov/cgi-bin/text-idx?SID=b4bb956de1cd97fcde4e45957579e523&mc=true&node=pt44.1.59&rgn=div5#se44.1.59_11). (Accessed on July 19, 2019)
- National Weather Service, [https://www.weather.gov/mrx/flood\\_and\\_flash](https://www.weather.gov/mrx/flood_and_flash)
- FEMA. Definitions of FEMA Flood Zone Designations. <https://snmapmod.snco.us/fmm/document/fema-flood-zone-definitions.pdf>
- FEMA. Hazus Flood Model FEMA Standard Operating Procedure for Hazus Flood Level 2 Analysis. June 2018. [https://www.fema.gov/media-library-data/1530821743439-e16c13c1f6266bbe374dc00a00ac9910/Hazus\\_Flood\\_Model\\_SOP\\_level2analysis.pdf](https://www.fema.gov/media-library-data/1530821743439-e16c13c1f6266bbe374dc00a00ac9910/Hazus_Flood_Model_SOP_level2analysis.pdf)
- FEMA. *Travel Trailers In the A-zone or V-zone: The Basics*. <http://www.laseagrant.org/wp-content/uploads/FEMA-Travel-Trailers.pdf>
- Moftakhari, Hamed R., Amir AghaKouchak, Brett F. Sanders, Maura Allaire, and Richard A. Matthew. *What Is Nuisance Flooding? Defining and Monitoring an Emerging Challenge*. Water Resources Research 54, no. 7 (July 2018): 4218–27. <https://doi.org/10.1029/2018WR022828>.
- FEMA. Flood Insurance Study: Bedford County, Virginia and Incorporated Areas. September 2010.
- FEMA. Middle James-Buffalo Watershed Discovery Report. in Flood Risk Discovery Report series. January 2019. <https://www.bedfordcountyva.gov/home/showdocument?id=5882>
- FEMA. Appomattox Watershed Discovery Report. in Flood Risk Discovery Report series. November 2018.
- Amherst County. Amherst County Comprehensive Plan, 2007-2027. <https://www.countyofamherst.com/egov/apps/document/center.egov?view=item;id=3773>
- Appomattox County. Appomattox County Comprehensive Plan. <http://www.appomattoxcountyva.gov/home/showdocument?id=1576>
- Bedford County. Bedford County 2030 Comprehensive Plan. <https://www.bedfordcountyva.gov/home/showdocument?id=3948>
- Campbell County. Campbell County Comprehensive Plan 2014-2029. <https://www.co.campbell.va.us/166/Comprehensive-Plan>
- City of Lynchburg. Comprehensive Plan: Planning for the Future 2013-2030. <http://www.lynchburgva.gov/comprehensive-plan>
- Town of Amherst. 2017 Comprehensive Plan. <http://amherstva.gov/wp-content/uploads/town-code/2017-Comprehensive-Plan-Approved-170412-.pdf>



# Hazard Identification and Risk Assessment

## 4.4 Dam Failure

### 4.4.1 Hazard Profile

Dam failure is a collapse or breach in a dam. In recent years, aging infrastructure and population growth in floodplain areas downstream from dams and near levees have resulted in an increased emphasis on safety, operation, and maintenance of dams. While most dams have storage volumes small enough that failures have little or no repercussions, dams with large storage volumes can cause significant downstream flooding in the event of a breach.

Various types of dams exist to serve a multitude of functions within the CVPDC area. These include farm use, recreation, hydroelectric power generation, flood and storm-water control, water supply and fish or wildlife ponds. In some cases, a single dam structure serves multiple functions, such as generating hydroelectric power and providing recreational opportunities to boaters and fishermen.

#### 4.4.1.1 *Geographic Location/ Extent*

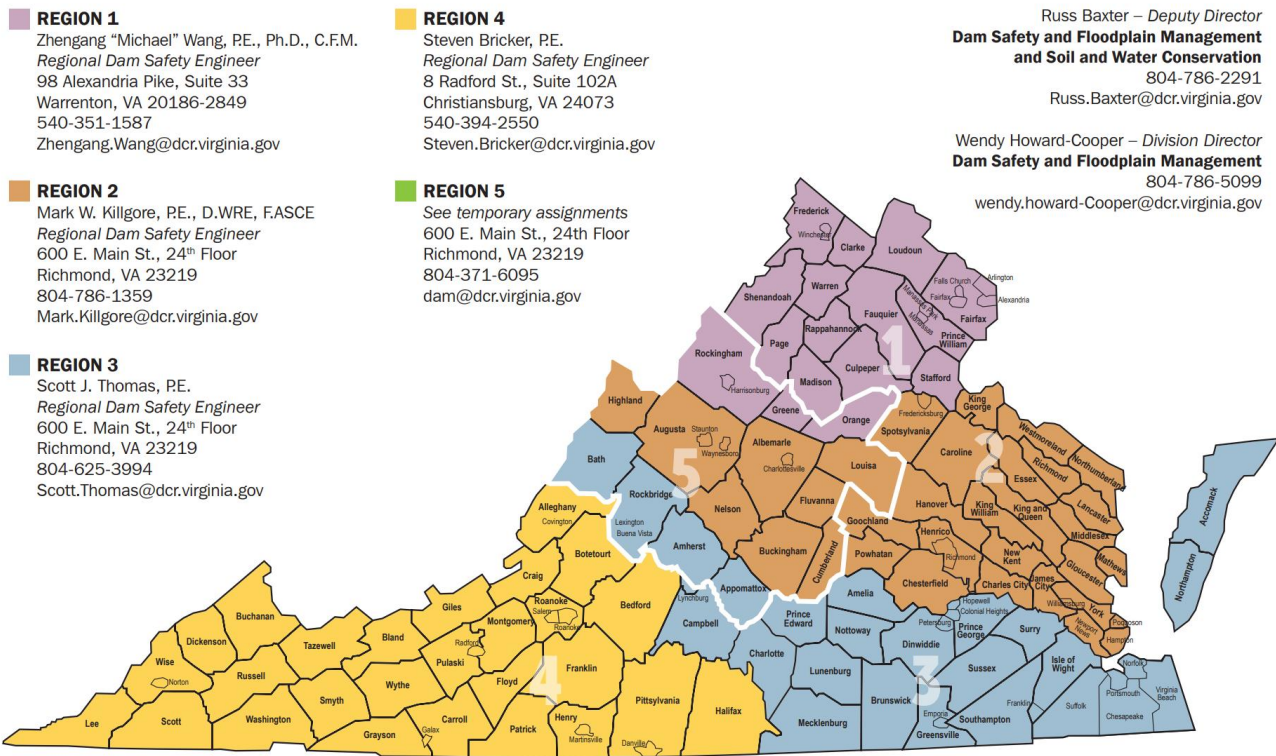
The federal and most state governments regulate certain impounding structure (dam) planning, construction, operation, maintenance, and repair. On the state level, the Virginia Dam Safety Act of 1982 (and as amended effective December 22, 2010) serves as the guiding legislation. In Virginia, the Virginia Soil and Water Conservation Board has statutory authority to administer the Virginia Dam Safety Program. The Virginia Department of Conservation and Recreation (DCR), Division of Dam Safety and Floodplain Management, aids the Virginia Soil and Water Conservation Board in the administration of the Virginia Dam Safety Program. DCR oversees a dam safety and floodplain management program to ensure that dams are properly and safely designed, built, operated, and maintained. There are a total of 255 dams (impounding structures) located across the CVPDC area, managed by three of the assigned DCR dam safety regions (III, IV and V. Figure 4-51). 113 of those dams are listed as regulated, 20 are non-regulated, and 122 dams in the region are listed as “undetermined”. This is important, since dam owners bear the responsibility of their upkeep and they are responsible when dams fail and cause environmental, economic, and personal damage. DCR’s past program to locate and identify these dams was known as dam DRAGNET. Currently the initiative to determine the status of those impounding structures which have “Undetermined” regulatory status is called the Preliminary Regulatory Determination/Unknown Dam Initiative (PRD-UDI). Eight of the CVPDC area dams are found along Virginia’s longest river, James River, and six of these are currently producing hydroelectricity.





# Hazard Identification and Risk Assessment

## Dam Safety Regions and Contacts



Virginia Department of Conservation and Recreation  
600 E. Main St., 24<sup>th</sup> Floor  
Richmond, VA 23219



3/4/2020

Figure 4-51 Virginia Department of Conservation and Recreation Dam Safety Regions and Contacts Map

(Source: DCR. March 2020)<sup>20</sup>

Virginia Dam Safety Inventory System (DSIS) provides records on over 3,500 dams in Virginia that DCR tracks.<sup>21</sup> Table 4-58 shows the number of dams (impounding structures) per jurisdiction within the CVPDC service area from DSIS. Table 4-59 shows a breakdown of how they are regulated.

Table 4-58 Number of dams per jurisdiction in DSIS within CVPDC area

Jurisdiction	Number of Dams
Amherst County	46
Appomattox County	17
Bedford County	152
Campbell County	34
Lynchburg City	6

<sup>20</sup> <https://www.dcr.virginia.gov/dam-safety-and-floodplains/document/dsterrscrlr.pdf>

<sup>21</sup> Virginia Dam Safety Inventory System (DSIS). <https://www.dcr.virginia.gov/dam-safety-and-floodplains/ds-dsis>



# Hazard Identification and Risk Assessment

Table 4-59 Number of dams under each regulation in DSIS within CVPDC area

Regulation	Number of Dams
DCR state regulated	94
Exempt Federal	10
Exempt, Other	1
Exempt, Agriculture	7
Exempt, Size	20
Undetermined	123

## 4.4.1.2 State Regulated Dams

Unless otherwise exempted (agriculture, mining, etc.), the Virginia Dam Safety Act and the Virginia Impounding Structure Regulations stipulate that a regulated impounding structure is one that is 25 feet or greater in height and creates a maximum impounding capacity of 15 acre-feet or greater; or alternatively, is six (6) feet or greater in height and creates a maximum impounding capacity of 50 acre-feet or greater. Definitions of some of the terms used are as follows:

- *"Height"* means the hydraulic height of an impounding structure, which is the vertical distance from the natural bed of the stream or watercourse measured at the downstream toe of the impounding structure to the top of the impounding structure (*i.e.* dam crest).
- *"Maximum impounding capacity"* means the volume of water or other materials in acre-feet that is capable of being impounded at the top of the impounding structure (*i.e.* dam crest).
- *"Top of the impounding structure"* means the lowest point of the non-overflow section of the impounding structure.

Certain impounding structures may demonstrate qualification and eligibility for an agricultural exemption, thus not needing an operation and maintenance certificate or general permit coverage. Procedure to claim agricultural exemption is in accordance with §10.1-604 of the Code of Virginia, Section 4VAC50-20-165 of the Virginia Impounding Structure Regulations, and DCR guidance document DCR-VSWCB-022. In general, to demonstrate qualification and eligibility for an agricultural exemption the following is necessary:

- The dam must be less than 25 feet in height or it must create a maximum impounding capacity at the top of the impounding structure (*i.e.* dam crest) less than 100 acre-feet;
- The dam must be operated primarily for agricultural purposes. Examples of agricultural purpose use include irrigation for crops or use for livestock purposes;
- Must exhibit compliance with the provisions of DCR guidance document DCR-VSWCB-022 (*Agricultural Exemption Requirements*); and
- Must use/submit DCR Form 199-106 (*Agricultural Exemption Report for Impounding Structures*) for review and approval.

### ***What does the term "unknown / undetermined" mean in hazard potential classification of dams?***

*According to Virginia DCR, it was the general definition provided: "Based on the workshop training materials we have defined, at this time, the unknown classification (regulated or non-regulated) as "requires study to be performed by dam owner/engineer and submitted, reviewed, and approved (confirmed) by DCR prior to assignment of final hazard potential classification."*



# Hazard Identification and Risk Assessment

Other information about the dam safety program in the Commonwealth of Virginia can be found on the DCR website.

## 4.4.1.3 Magnitude/Severity

The hazard potential classification of dams in Virginia are high, significant, or low. The classification is based on a determination of the effects that a dam failure would likely have on people and property in the downstream area, or inundation zone. Hazard potential classifications descend in order from high to low, high having the greatest potential for adverse downstream impacts in the event of failure. Classification is unrelated to the physical condition of the dam or the probability of its failure. The hazard potential classifications are described by the DCR as follows (Table 4-60):

Table 4-60 Virginia Hazard Potential Classification of Dams <sup>22</sup>

Potential	Description	Inspection
HIGH	Dams that upon failure would cause probable loss of life or serious economic damage	Annual, with inspection by a Virginia-licensed professional engineer every 2 years.
SIGNIFICANT	Dams that upon failure would cause probable loss of life or serious economic damage	Annual, with inspection by a Virginia-licensed professional engineer every 3 years.
LOW	Dams that upon failure would lead to no expected loss of life or significant economic damage. Special criteria: This classification includes dams that upon failure would cause damage only to property of the dam owner.	Annual, with inspection by a professional engineer every 6 years.

(Source: Dam Safety and Floodplains Department, Virginia Department of Conservation and Recreation)

Dams are classified with a hazard potential classification depending on the downstream losses estimated in the event of failure. The recent regulatory revisions, 2008 DCR Dam Safety Impounding Structure Regulations (4VAC50-20-40), bring Virginia's classification system into alignment with the system already used in the National Inventory of Dams maintained by the U.S. Army Corps of Engineers. Hazard potential classification is not related to the structural integrity of a dam, but strictly to the potential for adverse downstream effects if the dam were to fail. Regulatory requirements, such as the frequency of dam inspection, the standards for spillway design, and the extent of emergency operations plans, are dependent upon the dam classification. In accordance with the DCR impounding structure regulations, High Hazard Potential Classification is defined as the following:

*"High Hazard Potential is defined where an impounding structure failure will cause probable loss of life or serious economic damage. 'Probable loss of life' means that impacts will occur that are likely to cause a loss of human life, including but not limited to impacts to residences, businesses, other occupied structures, or major roadways. Economic damage may occur to, but not be limited to, building(s), industrial or commercial facilities, public utilities, major roadways, railroads, personal property, and agricultural interests. 'Major roadways' include, but are not limited to, interstates, primary highways, high-volume urban streets, or other high-volume roadways."*

<sup>22</sup> <https://www.dcr.virginia.gov/dam-safety-and-floodplains/dam-safety-index>



# Hazard Identification and Risk Assessment

Figure 4-52 illustrates the locations of dams in all hazard potential classifications in the DSIS system within the region. A large percentage of the dams in the CVPDC region have been rated as Low or Significant hazard potential classification. The dam inventory also provides information on the downstream hazard potential, or inundation zone, from a dam failure.

As shown in Table 4-61, of the total dams in DSIS within CVPDC, 23 (9%) dams are considered “High hazard”, 17 (7%) are considered “Significant hazard”, 28 (11%) are considered “Low hazard”, and 187 (73%) are considered “Unknown”.

*Table 4-61 Number of Dams in each Hazard potential category in CVPDC area*

Hazard Class	Description	Number of Dams
HIGH, SPECIAL	Virginia-licensed Professional Engineer inspection once a year	1
HIGH	Virginia-licensed Professional Engineer inspection every 2 years	22
SIGNIFICANT	Virginia-licensed Professional Engineer inspection every 3 years	17
LOW	Virginia-licensed Professional Engineer inspection every 3 years	22
LOW, SPECIAL	No future inspection required	6
UNKNOWN	This is common for regulatory status (regulated by DCR) and hazard class. For both hazard class and regulatory status there may be hundreds to thousands of dams that are unknown.	187

(Source: DCR)<sup>23</sup>

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<sup>23</sup> <https://www.dcr.virginia.gov/dam-safety-and-floodplains/document/dsis-u-guide.pdf>

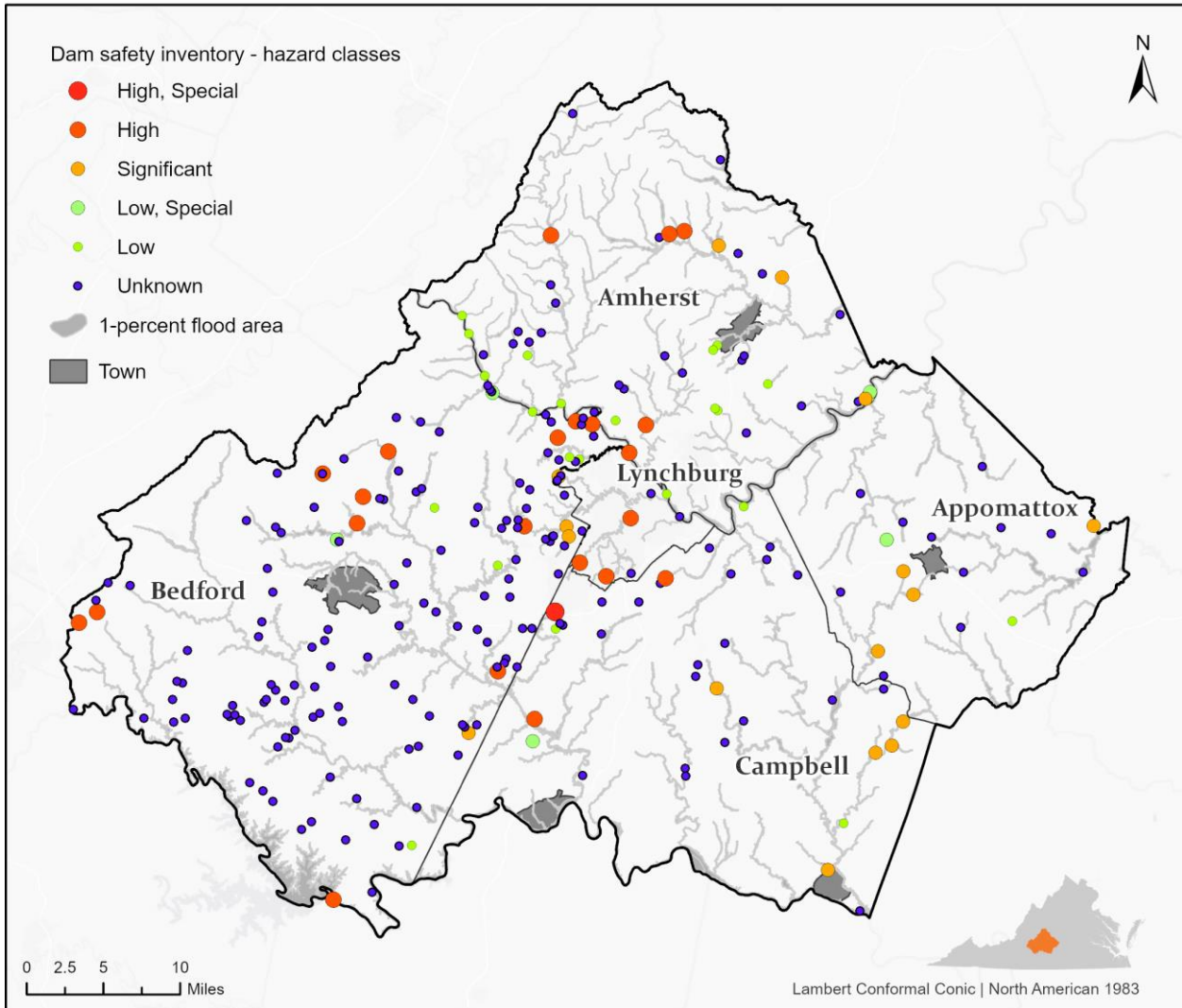




# Hazard Identification and Risk Assessment

## Dams in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: Virginia Dam Safety Inventory System, as of 02/07/2020  
Center for Geospatial Information Technology at Virginia Tech. 02/2020



Figure 4-52 Dams in CVPDC. (Source: Virginia Dam Safety Inventory System)



# Hazard Identification and Risk Assessment

Safety standards become increasingly more stringent as the potential for adverse impact increases. For example, a high hazard potential classification dam -- that is, one whose failure would cause probable loss of human life -- is required to meet higher standards than a dam whose failure would not be as likely to result in such severe adverse consequences. Classification, however, is not static. Downstream conditions, including land use, can and often do change. Although a dam itself may remain relatively stable, it is subject to reclassification if it becomes apparent that a change has occurred in the downstream inundation zone. For example, if new homes or roadways are somehow built in the downstream inundation zone of a Significant hazard potential classification dam, the dam could be reclassified to High hazard potential classification.

A change in hazard potential classification can create a dilemma because, if a dam is reclassified, it usually does not meet the higher standards of the new hazard classification. To meet the required higher standards, the owner of the dam is often required to make modifications or improvements. Any dam that does not meet the most extreme standards of a high hazard dam could become deficient in the future if land use in the downstream inundation zone changes.

To avoid the need for some of these modifications or improvements, all affected parties -- dam owners, engineers, downstream land owners, and local governments -- need to work together. People should be aware of the impacts development downstream can have on the required standards of a dam. It is better and cheaper to address this potential problem beforehand rather than wait and deal with modifications later.

The Virginia Impounding Structure Regulations require the owner of each regulated high, significant, or low hazard potential classification dam to apply for an Operation and Maintenance Certificate. The application must include an assessment of the dam by a professional engineer licensed to practice in Virginia, an emergency plan (EAP - emergency action plan or EPP - emergency preparedness plan), and the appropriate fee(s) and forms, submitted separately. An executed copy of the emergency plan (EAP or EPP) must be filed with the appropriate local emergency official and the Virginia Department of Emergency Management (VDEM).

## ***What is the difference between floodplain maps and dam failure flood inundation maps?***

*Floodplain maps show the area expected to be inundated by floodwaters due to runoff from a rainfall event of a particular frequency from a riverine source. For example, Flood Insurance Rate Maps (FIRMs) published by the Federal Emergency Management Agency (FEMA) typically show the 1-percent-annual-chance (100-year) floodplain and sometimes a 0.2-percent-annual-chance (500-year) floodplain. The 1-percent-annual-chance floodplain is the area inundated by a flood having a 1-percent chance of being equaled or exceeded in a given year. FIRMs are utilized by communities who are participants in the National Flood Insurance Program to guide and regulate development. They are also utilized to determine flood insurance purchase requirements and rates.*

*Dam failure flood inundation maps show the estimated area expected to be flooded due to a failure or an uncontrolled release from a dam. These maps may consider different failure scenarios such as a non-rainfall-induced failure, also known as a sunny day or fair weather failure, or failure during a rainfall event. Dam failure flood inundation areas can be much larger than the 1-percent-annual-chance floodplain. The flood is more like a wave than a steady current and can have great power and force. Dam failure flood inundation maps, and associated emergency plans (EAP's or EPP's) are utilized by dam owners, engineers, regulators, and emergency managers to determine warning and evacuation areas downstream of a dam. It is important to note that dam failure flood inundation maps do not reflect the safety or integrity of a dam. Dams that meet safety regulations and are operated and maintained well may still have a dam failure flood inundation map.*

<https://damsafety.org/media/faq>



# Hazard Identification and Risk Assessment

A Regular Operation and Maintenance Certificate for a state regulated impounding structure provides coverage for a period of six years. If a dam has an outstanding issue or deficiency but does not pose imminent danger, a Conditional Operation and Maintenance Certificate can be issued, during which time the dam owner is required to correct the outstanding issue or deficiency. Annual inspection reports by a Virginia-licensed professional engineer or the dam owner (see Table 4-61), must be submitted per the required frequency based on the assigned hazard potential classification to DCR Dam Safety for review and approval.

#### **4.4.1.4 Previous Occurrences**

There are no comprehensive databases of historical dam failures or flooding following a dam failure in the CVPDC area. Most failures occur due to lack of maintenance of dam facilities in combination with major precipitation events, such as hurricanes and thunderstorms.

The 1985 Election Day floods occurred in November 1985, when the James River crested at 42.15ft at Holcomb Rock station; 15 James River gauging stations reported new records. The Appalachian Power Co. hydroelectric plant at Reusens Dam was swamped and facilities like the U.S. Pipe and Lynchburg foundry were damaged.<sup>24</sup> After this disaster, the system of James River dams was improved with tributary “wing dams” and gauges upriver to provide more advance notice of onrushing disaster. Another major event in the CVPDC area took place on June 22 and 23, 1995, when the Timberlake Dam in Campbell County failed. Extremely heavy rainfall over the Timberlake basin caused the dam to fail and resulted in two fatalities. Virginia Tech and local National Weather Service office provided a hydrometeorological assessment of this dam failure and the associated flash flood event in “The Timber Lake Dam failure: A hydrometeorological assessment” report. Most recently, there was an overtopping and evacuation event associated with College Lake Dam, City of Lynchburg (Inventory No. 680002) in August of 2018. It was a highly publicized event. A localized precipitation event of 4 to 6 inches within the 21 square mile watershed to the dam/lake resulted in water from high lake levels and adjacent road approach drainage to overtop the top of dam crest 12-18 inches deep and the EAP became activated to Stage Two and then Stage Three. Stage Three required evacuation of approximately 125 people in the downstream impact zone. The dam did not fail. Damage from the overtopping event was repaired along with other minor improvements authorized under an emergency authorization for repair activities. Coverage under a current conditional operation and maintenance certificate requires the dam owner to modify, improve, upgrade, or remove (decommission) the dam accordingly to comply with Virginia Dam Safety program requirements.

#### **4.4.1.5 Relationship to Other Hazards**

Figure 4-53 shows the interrelationship (causation, concurrence, etc.) between this hazard and other hazards discussed in this plan update.

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<sup>24</sup> [https://www.newsadvance.com/news/local/from-the-archives-the-flood-of/collection\\_cb701b48-6861-11e5-a5a0-c783bf39af3e.html#1](https://www.newsadvance.com/news/local/from-the-archives-the-flood-of/collection_cb701b48-6861-11e5-a5a0-c783bf39af3e.html#1)



# Hazard Identification and Risk Assessment

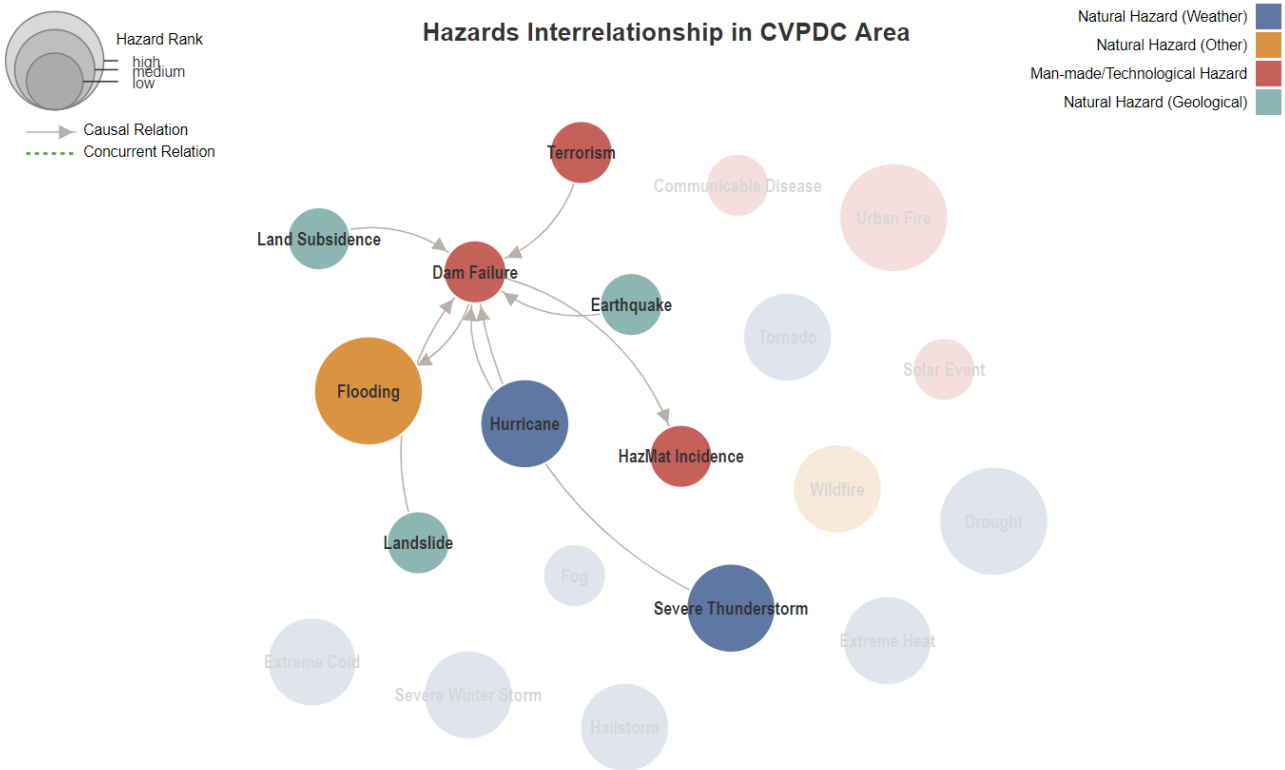


Figure 4-53 Hazards interrelationship

## 4.4.1.6 Dam failure and other hazards

Dam failures are most likely to happen for one of five reasons: overtopping, foundation defects, cracking, inadequate maintenance and upkeep, and piping.<sup>25</sup> Flood or overtopping is one of the most common causes of dam failure and occurs when the dam's spillway is inadequate for dealing with excess water. During flood events, too much water to be properly handled by the spillway may rush to the dam site and flow over the top of the dam. Improper building construction, including using easily eroded construction materials, also frequently leads to the slow structural failure of dams. This failure can be compounded by underlying geological factors such as porous bedrock that loses structural integrity when saturated. Figure 4-54 and Figure 4-55 summarize the most common causes of dam failure between 2010 and 2017.

<sup>25</sup> Association of State Dam Safety Officials (ASDSO). Dam Failures and Incidents. <https://www.damsafety.org/dam-failures>





# Hazard Identification and Risk Assessment

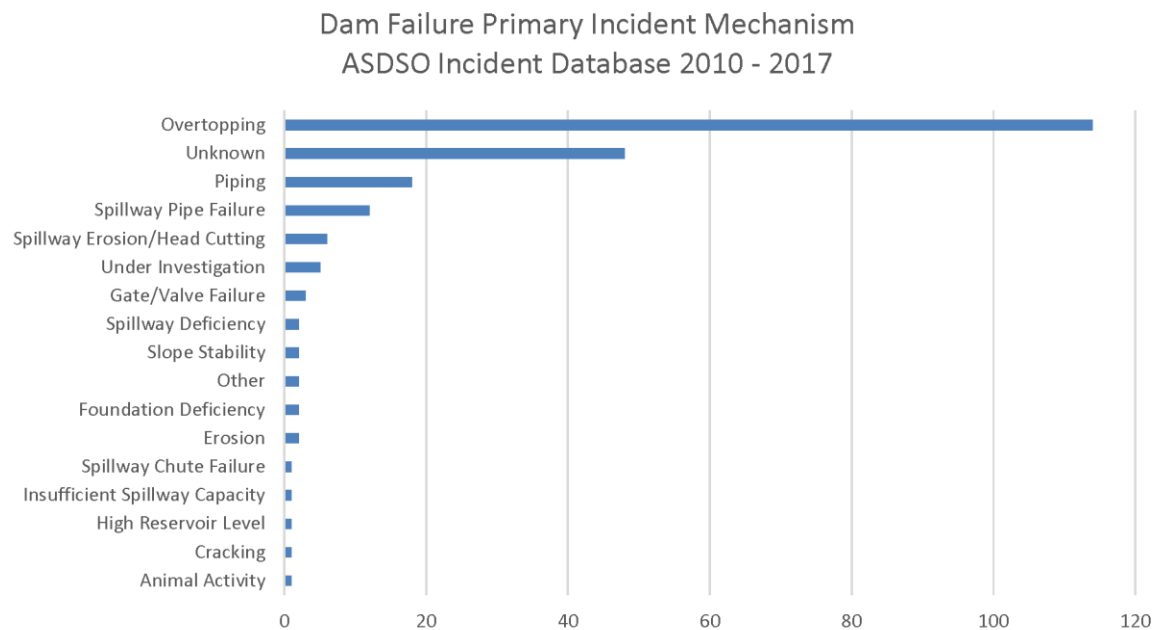


Figure 4-54 Dam failure primary incident mechanism (Source: ASDSO Incident Database, 2010 - 2017)<sup>26</sup>

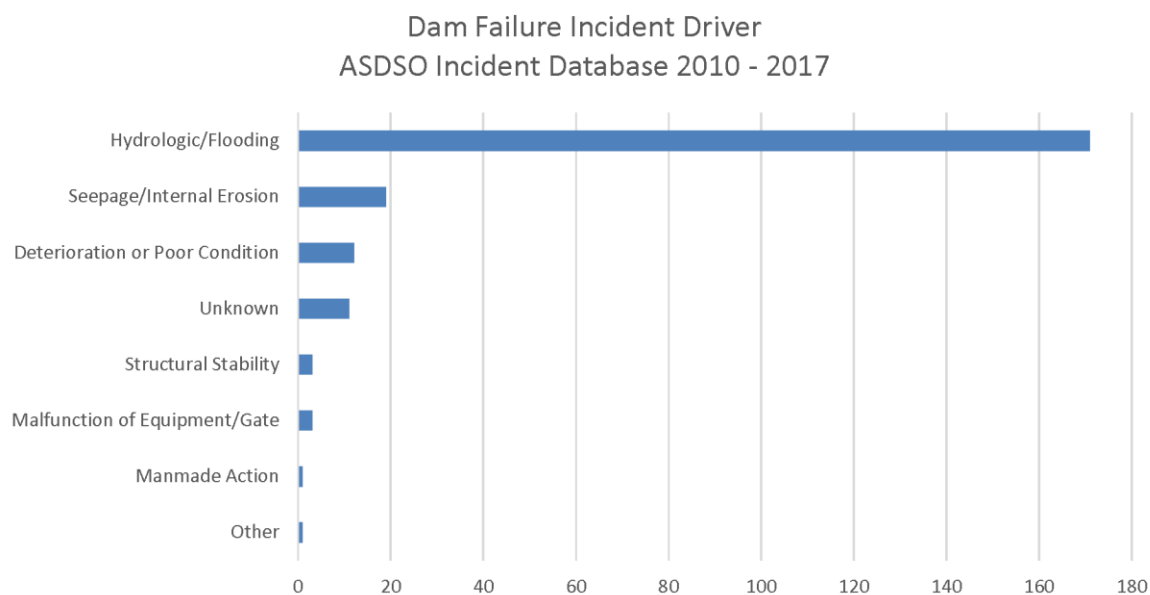


Figure 4-55 Dam failure incident driver (Source: ASDSO Incident Database, 2010 – 2017)

<sup>26</sup> The dam failure incident data derive from the ASDSO Dam Incident Database, dam failure incidents for the years 2010 through 2017. Incident data mostly obtained from the state dam safety programs and/or media reports. The incident data is not inclusive of all dam safety incidents.



# Hazard Identification and Risk Assessment

The many causes of dam failures are commonly summarized using five types of failure modes: hydrologic, geologic, structural, seismic, and human-influenced (refer to Table 4-62).

Table 4-62 Typical Dam Failure Modes

Failure Mode	Examples of dam failures
Hydrologic	Overtopping due to: <ul style="list-style-type: none"><li>• Inadequate spillway design</li><li>• Blocked spillway</li><li>• Loss of freeboard* due to embankment settlement or erosion</li><li>• Structural overstressing of dam components</li></ul>
	Surface erosion due to: <ul style="list-style-type: none"><li>• High velocity water</li><li>• Wave action</li></ul>
Geologic	Piping and internal erosion caused by: <ul style="list-style-type: none"><li>• Internal cracking, hydraulic fracture, or differential settlement</li><li>• Inadequate filters</li><li>• Outlet pipeline failure</li><li>• Pipes through the embankment formed by roots or animal/insect burrows</li></ul>
	Slope instability and hydraulic fracturing: <ul style="list-style-type: none"><li>• Load exceeds sliding resistance at base or at joints of structure</li></ul>
Structural	Concrete dam: Failure of critical structural components Embankment dam: Failure of the upstream or downstream face
Seismic	Earthquakes/ground movement; also liquefiable foundations or embankment materials
Human influenced or caused	Misoperation: <ul style="list-style-type: none"><li>• Sudden rise in reservoir level causes flow through transverse cracks in embankment</li><li>• Incidents including gate failures, power interruption etc.</li></ul>
	Terrorist activities: <ul style="list-style-type: none"><li>• Purposeful misoperation of the dam</li><li>• Impact of object that removes part of the dam crest</li></ul>

\*Freeboard = Vertical distance between a specified stillwater (or other) reservoir surface elevation and the top of the dam, without camber (FEMA, 2004a) <sup>27</sup>

Extreme rainfall or snowmelt events that can lead to natural floods of variable magnitude could induce landslides. Landslides pose two threats to dams, both upstream from the dam and at the dam site itself. At the dam site, a landslide could completely wipe out the dam from its foundation. A landslide upstream has the potential to send a wave of water surging towards the dam, quite possibly causing an overtopping event. Terrorist attacks are also another concern for dam safety. The terrorist activities can range from purposeful misoperation of the dam to physical attacks on the structure itself.

Earthquakes are also a major threat to dams, though it is very rare that a dam will be completely destroyed by an earthquake. In the event of total failure, the most common cause is the liquefaction of fill along the dam

<sup>27</sup> <https://damsafety.org/sites/default/files/FEMA%20Federal%20Guidelines%20InundatnMap%20P946.pdf> p4-3.



# Hazard Identification and Risk Assessment

wall. Almost all of the high hazard dams in the CVPDC area are located between the Central Virginia seismic zone (CVSZ) and the Giles County seismic zone (GCSZ), an area of normally low seismic activity.

No matter what the cause of dam failure, the aftermath of such an event can range from moderate to severe. It is likely that the failure of major dams will cause widespread loss of life downstream to humans and animals, as well as extreme environmental stress along the flood path. Water supplies upstream could be left completely dry, while water supplies downstream are overrun or contaminated with debris from the ensuing flood.

## 4.4.2 Impact and Vulnerability

Dam failure has the potential to cause direct or indirect economic impacts, significant and long-term social effects, and negative environmental impacts. Impounded water upstream of a dam when released uncontrollably, may threaten lives in the flow path downstream or cause damage to homes, roads, bridges, and any other infrastructure in its way. Direct economic impacts appear immediately following a dam failure and typically include the need to repair and rebuild structures and infrastructure and reopen businesses. Indirect economic impacts may include unemployment leading to population shifts, difficulty in attracting new business to the area, lower local property tax revenues, etc. Social impacts may include changes in quality of life in the affected community, loss in the public's confidence in public officials, difficulty delivering resources and services to the community, etc. Environmental impacts of dam failure may include the pollution of surface or groundwater, air, and soil; the release of hazardous materials; or the destruction of environmentally sensitive areas.<sup>28</sup>

The American Society of Civil Engineers' 2017 Infrastructure Report Card detailed the importance of public safety and proper maintenance:

*"In order to improve public safety and resilience, the risk and consequences of dam failure must be lowered. Progress requires better planning for mitigating the effects of failures; increased regulatory oversight of the safety of dams; improving coordination and communication across governing agencies; and the development of tools, training, and technology. Dam failures not only risk public safety, they also can cost our economy millions of dollars in damages. Failure is not just limited to damage to the dam itself. It can result in the impairment of many other infrastructure systems, such as roads, bridges, and water systems. When a dam fails, resources must be devoted to the prevention and treatment of public health risks as well as the resulting structural consequences."*

## 4.4.3 Risk Assessment and Jurisdictional Analysis for High Hazard Dams

### 4.4.3.1 Amherst County and Town of Amherst

According to DCR DSIS inventory, there are a total of 46 dams within Amherst County. Of those dams, 5 (11%) are classified as high hazard potential dams, and 23 dams have unknown/undetermined status (Figure 4-56, Table 4-63). Although there are no high hazard (or other) dams in the Town of Amherst, there may be impacts if a high hazard dam fails.

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<sup>28</sup>

<https://damsafety.org/sites/default/files/files/FEMA%20TM%20AssessingtheConsequencesofDamFailure%20March2012.pdf>



# Hazard Identification and Risk Assessment

## 4.4.3.1.1 Principal Dam Breach Problems

The following issues have been identified for dam failure scenarios in Amherst County (also see Table 4-64):

- Pump station at Route 718 / Buffalo River
- Henry L. Lanum Water Treatment Plant
- Norfolk Southern Railroad impacts
- Several road, bridge, and culvert impacts
- Several residences and businesses in the maximum inundation area
- Inundation areas not all readily available in a Geographic Information System (GIS) format for high hazard dams

*Table 4-63 Number of Dams in each Hazard Potential Category within Amherst County, Virginia.*

Hazard Potential	Number of Dams
HIGH	5
HIGH, SPECIAL	0
SIGNIFICANT	4
LOW	12
LOW, SPECIAL	2
UNKNOWN	23

*Table 4-64 Critical facility and infrastructure in dam failure inundation zone within Amherst County*

Facility Name	Facility Type	Address	Coordinates	Floodplain	Inundation Zone
Electrical Substation	Electrical Substation	127 Stonewall St, Lynchburg	37.4622, -79.1872	1%, 0.2%	Reusens Dam
Lanum Water Filtration Plant	Wastewater Treatment Plant	1355 Elon Rd, Madison Heights	37.4846, -79.1664	1%, 0.2%	Graham Creek Reservoir Dam
Sewer Pump Station	Sewer Pump Station	Route 718 / Buffalo River	37.6091, -79.0384	1%, 0.2%	Thrasher Dam and Stonehouse Dam

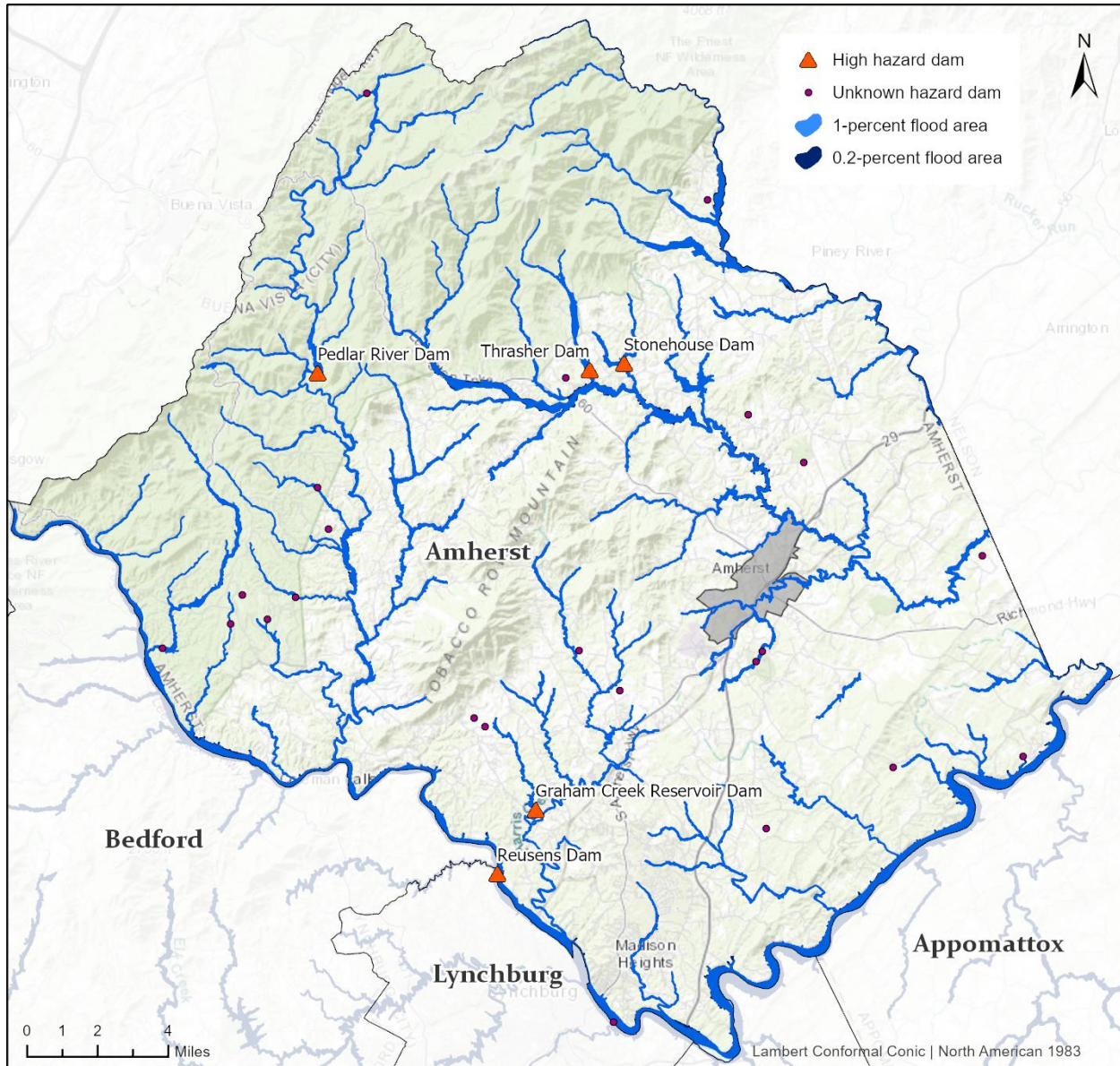




# Hazard Identification and Risk Assessment

## High and Unknown Hazard Dams in Amherst County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: Virginia Dam Safety Inventory System, as of 02/07/2020  
Center for Geospatial Information Technology at Virginia Tech. 02/2020



Figure 4-56 Location of high and unknown hazard dams in Amherst County and Town of Amherst, Virginia.



# Hazard Identification and Risk Assessment

## 4.4.3.1.2 Risk Analysis of Individual Dam

### ***Thrasher Dam***

#### General information

The Thrasher Dam (aka. Buffalo River Dam #2) is operated by the Public Works Department in Amherst County. The dam is a 74.5 foot tall impounding structure, located on Thrasher Creek, a tributary to Buffalo River, in Amherst County, Virginia, approximately 8 miles northwest of Amherst, VA. From the dam, Thrasher Creek flows south approximately 0.5 miles before joining Buffalo River. Buffalo River continues southeastward joining Tye River, and then James River after approximately 30 miles.

The site is located at the end of Thrashers Lake Road (Route 829), Amherst Virginia 24521. The dam is classified as a High Hazard Dam as determined by the hazard classifications performed by Hurt and Proffitt. It creates a 36-acre impoundment used for recreation and flood control. The drainage area is approximately 4,352 acres, or 6.8 square miles. The reservoir flood capacity storage is 2,562 acre-feet at the emergency spillway crest, at elevation 748.5 feet.

The United States Department of Agriculture (USDA) Soil Conservation Service designed and funded construction of the dam. The dam was built by E.W. Yeatts, Inc. in 1977. The inundation maps were developed on April 19, 2013 by Hurt & Proffitt.

#### Dam break inundation zone

"Dam break inundation zone (DBIZ)" means the area downstream of a dam that would be inundated or otherwise directly affected by the failure of a dam (DCR, 2016).<sup>29</sup> According to DCR-VSWCB-038, §10.1-606.2, Mapping of Dam Break Inundation Zones: An owner of an impounding structure shall prepare a map of the dam break inundation zone for the impounding structure in accordance with criteria set out in the Virginia Impounding Structure Regulations (4VAC50-20)

Figure 4-57 is an overview of the inundation zone map for the Probable Maximum Flood (PMF) of Thrasher Dam. The upstream inundation zone caused by the dam is primarily farmland and wooded areas. No occupied structures are in the upstream inundation area. There are multiple roads that parallel or cross the river downstream of the dam and will be affected by a Probable Maximum Flood (PMF) event and a subsequent failure of the dam. The PMF is defined as the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in a particular drainage area. Downstream of the dam, Thrashers Creek flows through agricultural lands. The creek passes through a culvert under Sandidges Road and continues on to Buffalo River. In addition, there are multiple residences and business structures downstream of the dam that would be inundated by a PMF storm. During a dam failure or flood event, bridges and culverts may be adversely impacted. The roads should be closed off to ensure that no one is harmed during a culvert/bridge failure. Prior to reopening the road, Virginia Department of Transportation (VDOT) should be contacted to inspect the bridges and roads. No unauthorized personnel should be allowed on site.

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<sup>29</sup> <https://www.dcr.virginia.gov/form/dcr-vswcb-038.pdf>





# Hazard Identification and Risk Assessment

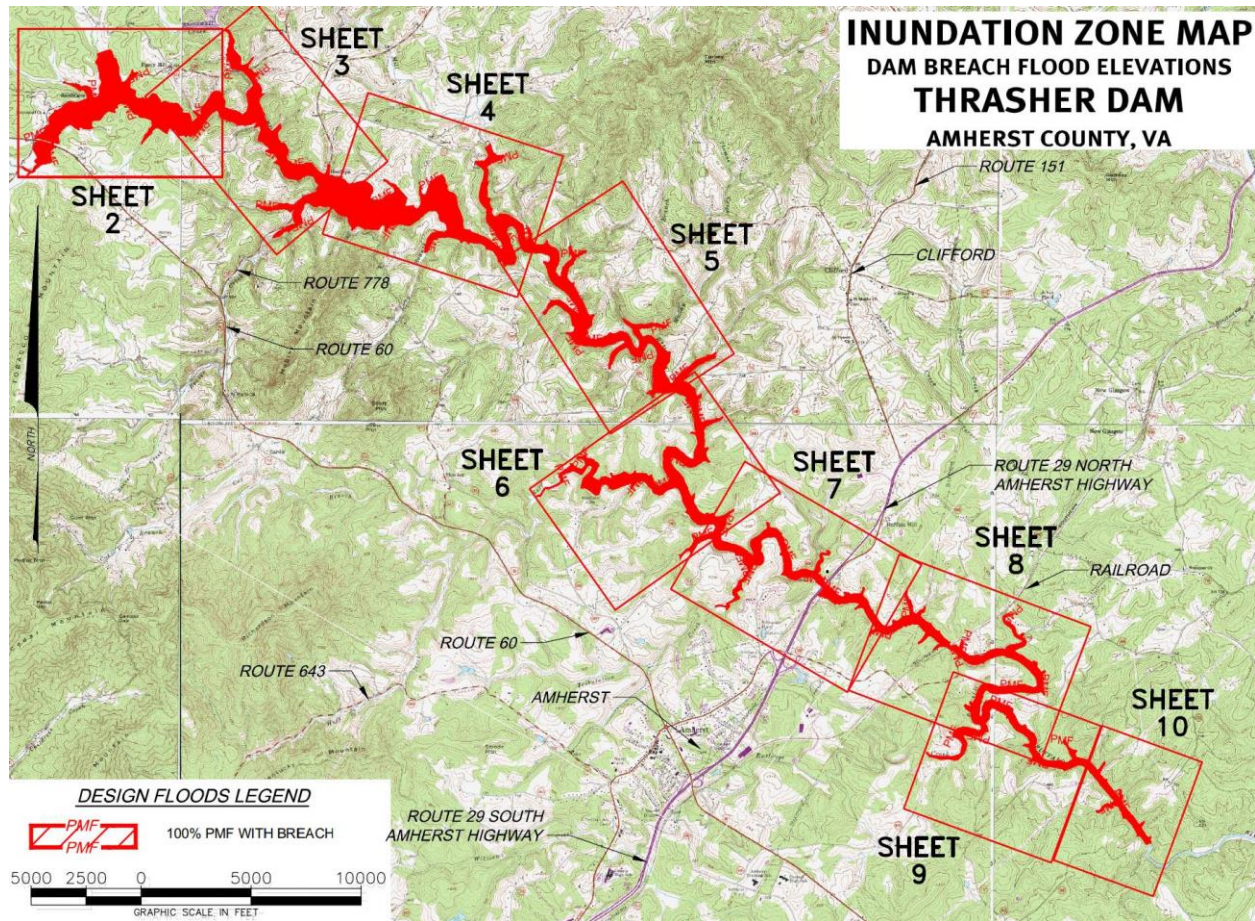


Figure 4-57 Inundation zone map of Thrasher Dam. (Source: Virginia DCR)

## Vulnerable structures

The following road bridges may be impacted during a dam breach scenario (Table 4-65). One sewer pump station at Route 718 / Buffalo River is inside the common inundation areas of both Thrasher Dam and Stonehouse Dam. One sewer pump station is located in the dam breach inundation zone (Table 4-66).

Table 4-65 Vulnerable road bridges in dam breach zone of Thrasher Dam

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Lowesville Road	Buffalo River	0.00-Rt 617N/0.20-Rt 617S	-79.10312	37.65442	1%, 0.2%
Amherst Highway	Buffalo River	0.00-Rt.608 / 0.60-Rt.739'	-79.02645	37.60525	1%, 0.2%
Campbells Mill Rd.	Branch of Buffalo River	0.15-Rt. 29 / 2.35-Rt.736	-79.02740	37.60700	1%, 0.2%
Turkey Mtn Rd	Mill Creek	2.99-Rt.738 / 0.60-Rt.645	-79.07860	37.65650	1%, 0.2%
Sandidges Road	Stonewall Creek	.40-Rt 625 / .10-Rt 617	-79.11534	37.66772	1%, 0.2%
Sandidges Road	Thrashers Creek	0.50-Rt.617/0.60-Rt.632	-79.13497	37.66575	1%, 0.2%



# Hazard Identification and Risk Assessment

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Poor House Farm Rd	Beaver Creek	.02-Rt 778 / 2.28-Rt 692	-79.10488	37.65224	1%, 0.2%
Boxwood Farm Road	Turner Creek	.70 Rt 658 / 1.06 Rt 822	-78.99573	37.59901	1%, 0.2%
Boxwood Farm Road	Buffalo River	.64 Rt 822 / 1.18 Rt 658	-79.00480	37.59684	1%, 0.2%
Lexington Tpke.	Stream	7.47 Amh WCL/0.00 Rt 610	-79.14728	37.65913	0.2%
Lexington Turnpike	Buffalo River	7.27-WCL Amh/.15-Rt.610	-79.14483	37.65870	1%, 0.2%
NBL Route 29	Buffalo River	0.85-RT 608 0.62-RT 29 B	-79.02603	37.60531	1%, 0.2%

Table 4-66 Vulnerable facilities and infrastructures in dam breach zone of Thrasher Dam

Name	Facility Type	Location	Locality	Lon	Lat	In flood zone
Sewer Pump Station	Sewer Pump Station	Route 718 / Buffalo River	Amherst	-79.0384	37.6091	1%, 0.2%

## Stonehouse Dam

### General information

The Stonehouse Dam (aka. Buffalo River Dam #3) is a 63.6 foot tall impounding structure, designed primarily for flood control in 1978 by the USDA Soil Conservation Service. It is located on Stonehouse Creek, a tributary to Buffalo River, in Amherst County approximately 8 miles northwest of the Town of Amherst. From the dam, Stonehouse Creek flows south approximately 0.8 miles joining Buffalo River. Buffalo River continues southeastward approximately 15 miles to James River.

### Dam break inundation zone

Figure 4-58 is an overview of the inundation zone map for the PMF of Stonehouse Dam. The upstream inundation zone caused by the dam is primarily farmland and wooded areas. No occupied structures are in the upstream inundation area. There are multiple streets and residences in the study area, downstream of the dam, that are subject to inundation for the dam breach scenario.





# Hazard Identification and Risk Assessment

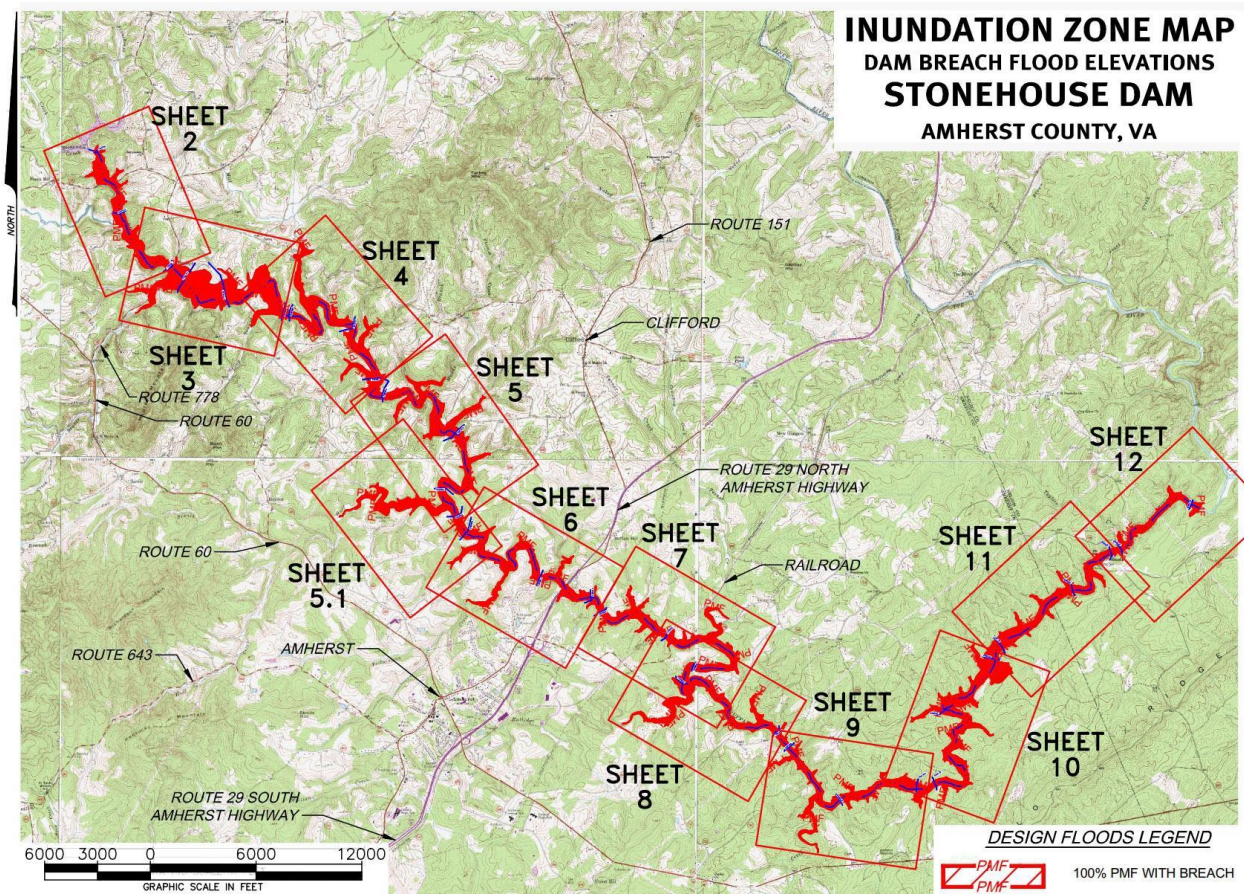


Figure 4-58 Inundation zone map of Stonehouse Dam. (Source: Virginia DCR)

## Vulnerable structures

During the dam breach event, several roads and structures downstream of the dam may be impacted. These include Sandidges Road (Route 610), Fancy Hill Road (Route 617), Lowesville Road (Route 778), Poor House Farm Road (Route 617), Winton Road (Route 736), Campbell's Mill Road (Route 608), North Amherst Highway (Route 29), South Amherst Highway (Route 29), Boxwood Farm Road (Route 739), Lexington Turnpike (Route 60), and Tye River Road (Route 657) as well as Norfolk Southern Railroad tracks (79.00705°W 37.59809°N ) in the affected area.

The following road bridges may be impacted during a dam breach scenario (Table 4-67).

Table 4-67 Vulnerable road bridges and tunnels in dam breach zone of Stonehouse Dam

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Lowesville Road	Buffalo River	0.00-Rt 617N/0.20-Rt 617S	-79.1031	37.65442	1%, 0.2%
Amherst Highway	Buffalo River	0.00-Rt.608 / 0.60-Rt.739	-79.0264	37.60525	1%, 0.2%
Campbells Mill Rd.	Branch of Buffalo River	0.15-Rt. 29 / 2.35-Rt.736	-79.0274	37.607	1%, 0.2%
Turkey Mtn Rd	Mill Creek	2.99-Rt.738 / 0.60-Rt.645	-79.0786	37.6565	1%, 0.2%
Sandidges Road	Stonewall Creek	.40-Rt 625 / .10-Rt 617	-79.1153	37.66772	1%, 0.2%



# Hazard Identification and Risk Assessment

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Poor House Farm Rd	Beaver Creek	.02-Rt 778 / 2.28-Rt 692	-79.1049	37.65224	1%, 0.2%
Boxwood Farm Road	Turner Creek	.70 Rt 658 / 1.06 Rt 822	-78.9957	37.59901	1%, 0.2%
Boxwood Farm Road	Buffalo River	.64 Rt 822 / 1.18 Rt 658	-79.0048	37.59684	1%, 0.2%
NBL Route 29	Buffalo River	0.85-RT 608 0.62-RT 29 B	-79.026	37.60531	1%, 0.2%

## ***Graham Creek Reservoir Dam***

### General information

Graham Creek Reservoir Dam is located on Graham Creek in Amherst County, which is a tributary to Harris Creek, which flows into James River approximately 7 miles below the dam near the City of Lynchburg, Virginia. The location is north of Elon Road (Route 130) and west of the Henry L. Lanum Jr. Water Filtration Plant, in Madison Heights, Virginia 24502. The dam was built in 1967 as a water supply storage reservoir and is operated by Amherst County Service Authority. The normal pool elevation was raised by 6 feet in 2003 to increase storage capacity. Downstream of the dam, Graham Creek flows through agricultural and residential areas.

### Dam break inundation zone

Inundation maps were developed as part of the Incremental Damage Assessment for Amherst County Graham Creek Reservoir Dam prepared on April 22, 2013 by Hurt & Proffitt. Figure 4-59 is an overview of the maps for the PMF event. During PMF storm events, the dam is overtopped by 9.6 feet and structures downstream of the dam will be impacted.





# Hazard Identification and Risk Assessment

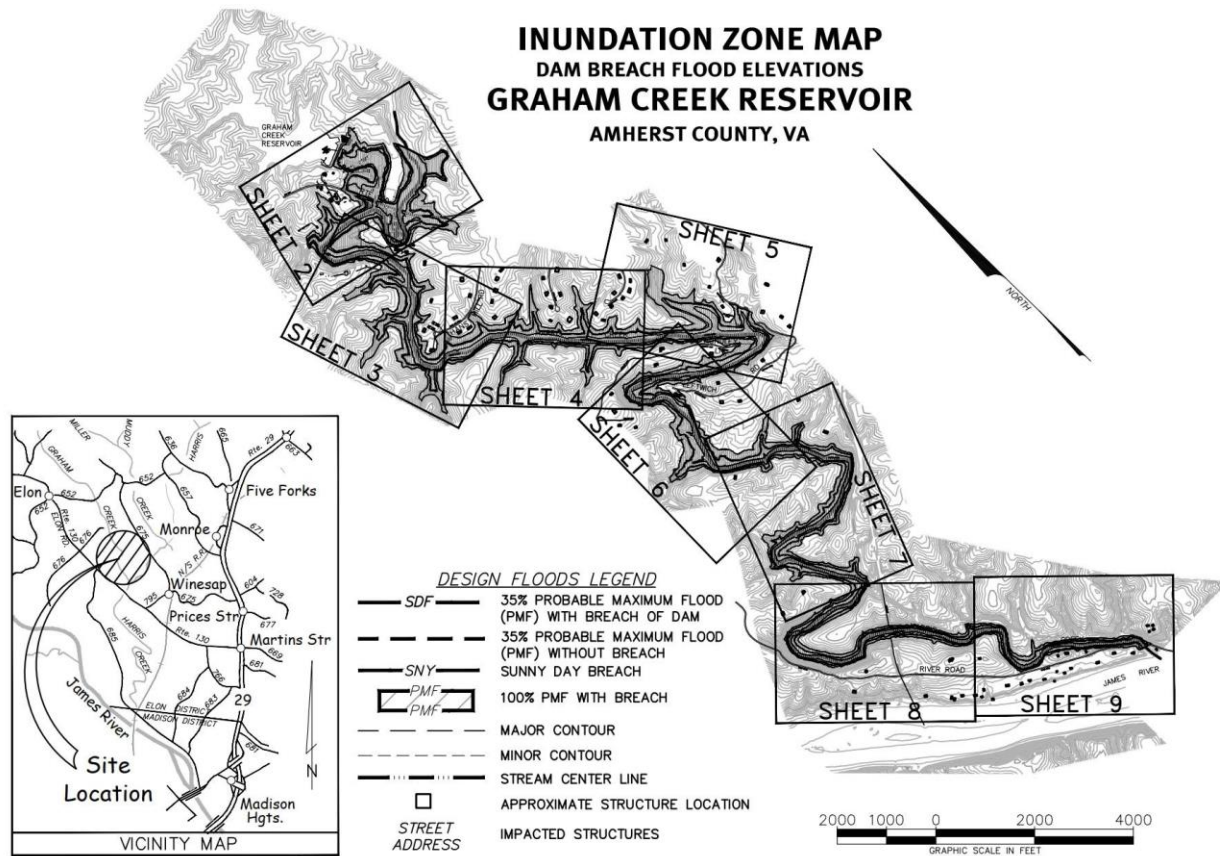


Figure 4-59 Inundation zone map of Graham Creek Reservoir Dam. (Source: Virginia DCR)

## Vulnerable structures

The dam hazard classification study indicates some structures may be impacted in the unlikely event of failure of the Graham Creek Reservoir Dam, as a dam break or flooding caused by large runoff. The Henry L. Lanum Water Treatment Plant, Hundley Lane, Route 130, and Norfolk Southern Railroad tracks (79.16244°W 37.44904°N) will be inundated during a PMF event (

Table 4-69). The following road bridges may be impacted (Table 4-68).

Table 4-68 Vulnerable road bridges and tunnels in dam breach zone of Graham Creek Reservoir Dam

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Elon Road	Harris Creek	0.45-Rt.795 / 0.80-Rt 704	-79.16532	37.48489	No
Elon Road	Graham Creek	0.65 Rt 704/0.60 Rt 795	-79.16612	37.48628	1%, 0.2%
River Road	Harris Creek	0.30-Rt 684/4.99-Rt 130	-79.15073	37.43892	1%, 0.2%

Table 4-69 Vulnerable facilities and infrastructures in dam breach zone of Graham Creek Reservoir Dam

Name	Facility Type	Location	Locality	Lon	Lat	In flood zone
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# Hazard Identification and Risk Assessment

Lanum Water Filtration Plant	Water Treatment Plant	1355 Elon Rd	Madison Heights	-79.1664	37.4846	1%, 0.2%
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## ***Pedlar River Dam***

### General information

Pedlar River Dam in Amherst County was initially constructed in 1904. It is a primary water source for the residents of Lynchburg and is operated and maintained by the City of Lynchburg. The spillway was raised in 1926 and the entire dam was raised in 1931 and again in 1964. Flow over the spillway discharges to Pedlar River. It is regulated by the Virginia Department of Conservation and Recreation Dam Safety Division.

### Dam break inundation zone

Figure 4-60 provides an overview of the inundation zone of Pedlar River Dam from the dam breach inundation study completed by Black & Veatch in February 2008.





# Hazard Identification and Risk Assessment

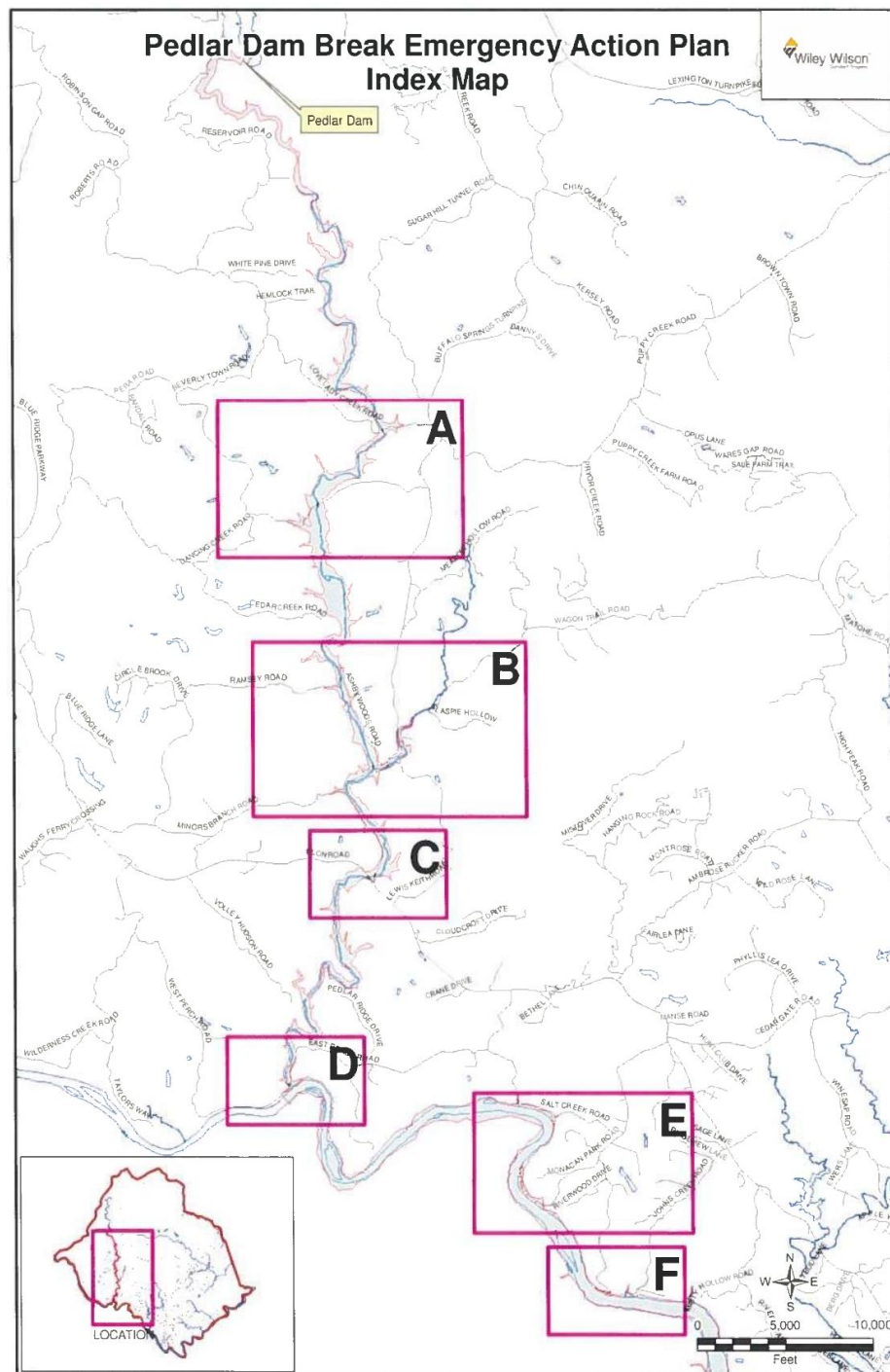


Figure 4-60 Inundation zone map of Pedlar River Dam. (Source: Virginia DCR)

## Vulnerable structures

Some roads and road bridges downstream of Pedlar River Dam may be impacted during a dam breach event. Ashby Woods Road (Route 643), Salt Creek Road along James River (Route 787), Monacan Parkway along James River (Route 652), and Reservoir Road are within the inundation zone. Norfolk Southern Railroad tracks along



# Hazard Identification and Risk Assessment

the south bank of James River may be inundated during a PMF event. Part of Route C, Reservoir Road (Forest Service Road 39), passes through the Pedlar River valley upstream of the reservoir and may be flooded during storms. Table 4-70 and Table 4-71 list several road bridges and two power plants that may be impacted.

*Table 4-70 Vulnerable road bridges and tunnels in dam breach zone of Pedlar River Dam*

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Dancing Creek Road	Pedlar River	1.40-Rt 635 / 1.00-Rt 641	-79.26391	37.60045	1%, 0.2%
Buffalo Springs Tpke	Pedlar River	0.08-Rt 130/0.01-Rt 702	-79.25239	37.54261	1%, 0.2%
Buffalo Springs Road	Pedlar River	0.40-Rt 647/0.06- Rt.643	-79.25299	37.55951	1%, 0.2%
Love Lady Creek Road	Pedlar River	0.58-Rt 635/ 2.14-Rt 607	-79.25131	37.61209	No
Ramsey Road	Pedlar River	0.00-Rt 643/3.70-Rt 647	-79.25922	37.57339	1%, 0.2%
East Perch Road	Pedlar River	1.10-Rt.691/3.90-Rt.695	-79.26881	37.50983	1%, 0.2%
Wagon Trail Road	Horsleys Creek	.10 - Rt 651/.10 - Rt 635	-79.24792	37.56421	1%, 0.2%

*Table 4-71 Vulnerable facilities and infrastructures in dam breach zone of Pedlar River Dam*

Name	Facility Type	Location	Locality	Lon	Lat	In flood zone
Holcomb Rock Dam Hydro Plant	Energy Facility	4839 Holcomb Rock Road	Bedford	-79.2628	37.5036	1%, 0.2%
Coleman Falls Dam Hydro Plant	Energy Facility	6007 Lee Jackson Hwy.	Bedford	-79.3006	37.5021	1%, 0.2%

## ***Reusens Dam (Judith Dam)***

### General information

Reusens Dam originally was called Judith Dam when it was built in 1851 by the James River and Kanawha Company. It is located on James River at River Mile 260 near the northern limits of the City of Lynchburg, Virginia. It was modified in 1924 and was operated by the Appalachian Power Company between 1924 and 2017. It is now owned and operated by Eagle Creek Renewable Energy.<sup>30</sup> The dam is an exempt federal dam.

The reservoir formed by Reusens Dam has a surface area of 500 acres and gross storage capacity of 6,869 acre-feet. The drainage area to the reservoir is approximately 3,275 square miles (about one-third of the drainage basin for the entire James River). Drainage to Reusens Reservoir begins at the headwaters in the Allegheny Mountains and passes through the Valley and Ridge and Blue Ridge Provinces. Reusens Dam lies just east of the Blue Ridge Province within the Piedmont Upland section. Immediately surrounding Reusens Reservoir, the drainage area has approximately 1,200 feet of relief and is indicative of the eastern portion of the Blue Ridge Province. Runoff for the most part emanates from forested and agricultural areas.

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<sup>30</sup> Appalachian Power completes sale of hydroelectric plant near Lynchburg. April 13, 2017. The Roanoke Times. [https://www.roanoke.com/business/news/bedford\\_county/appalachian-power-completes-sale-of-hydroelectric-plant-near-lynchburg/article\\_1274e09c-7f33-5ffa-8d2f-99be62c7f98a.html](https://www.roanoke.com/business/news/bedford_county/appalachian-power-completes-sale-of-hydroelectric-plant-near-lynchburg/article_1274e09c-7f33-5ffa-8d2f-99be62c7f98a.html)



# Hazard Identification and Risk Assessment

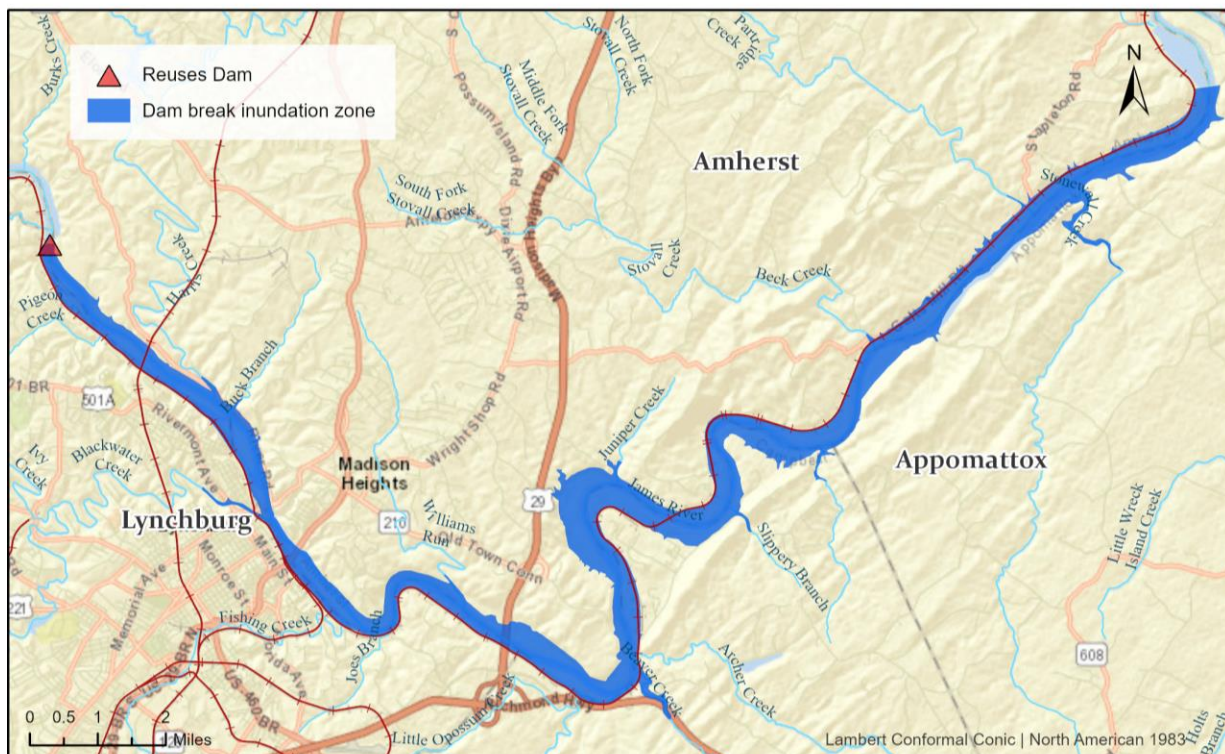
## Dam break inundation zone

The dam-break flood inundation zone of Reusens Dam was developed by Black & Veatch based upon a simulated failure of the dam during the 1985 flood-of-record. Figure 4-61 is an overview of the inundation zone map for the PMF of the dam. The digital format of the inundation zone boundary was provided by the City of Lynchburg GIS Portal.<sup>31</sup>

Reusens Dam sits downstream of the U.S. Army Corps of Engineers' Gathright Dam and several smaller reservoirs. There are no dams located downstream of this structure which could be operated to store flood flows. Downstream of the dam and powerhouses, runoff from urban areas becomes more predominant due to the proximity of the City of Lynchburg. Forest land accounts for approximately 70% of the land use in the drainage basin, with forest cover being primarily of the oak-chestnut type. Other land uses include cropland (13%), pasture (11%), urban (4%), and other miscellaneous uses (2%).

## **Dam Break Inundation Zone of Reusens Dam in Amherst County, Virginia**

Central Virginia PDC Hazard Mitigation Plan Update 2020



Dam Inundation areas from the City of Lynchburg's Emergency Action Plan showing extents of potential flooding within the City of Lynchburg downstream of local dams. Various flood scenarios with and without dam breaks are depicted. Dam inundation studies were conducted by various Engineering firms for the Dam owners.

Data source: City of Lynchburg GIS Portal, as of 3/14/2018  
Center for Geospatial Information Technology at Virginia Tech. 02/2020



*Figure 4-61 Inundation zone map of Reusens Dam. (Source: City of Lynchburg GIS Division)*

<sup>31</sup> Know My Zone! Flood and Dam Inundation Zone Look Up - Map.  
<https://www.arcgis.com/home/item.html?id=aea88b27b83943caa6a86b5411c475c5>



# Hazard Identification and Risk Assessment

## Vulnerable structures

Some road bridges in the downstream of Reusens Dam may be impacted during a dam breach scenario (Table 4-72). Roads including South Amherst Highway (Route 29), Monacan Parkway (Route 652), and Richmond Highway (Route 60) along James River may be impacted during a PMF event. Atlantic, Mississippi, and Ohio Railroad (AM&O) Jefferson Street Tunnel and Norfolk Southern Railroad tracks along James River may be inundated. The Amazement Square Child Museum, 4 electric substations, several hazmat or energy facilities near the south bank of James River, Six Mile Bridge (historic site) in Campbell County are also within (or partially in) the inundation zone (Table 4-73).

*Table 4-72 Vulnerable road bridges and tunnels in dam breach zone of Reusens Dam*

Road Name	Crossing	Bridge / Tunnel Location	Lon	Lat	In flood zone
460 EBL	Beaver Creek	0.50-Rt.726/0.85-Rt.662	-79.05480	37.38518	1%, 0.2%
Cottontown Rd./621	Ivy Creek	.40-RTE 1240;.25-RTE 884	-79.26179	37.39696	1%, 0.2%
Cranehill Drive	Ivy Creek	0.35LINKHORN/0.01LANG HORN	-79.19012	37.41823	No
Galts Mill Road	Beck Creek	2.58-Rt 664 / 0.00-Rt 648	-79.01101	37.44757	1%, 0.2%
Galts Mill Road	Partridge Creek	2.30-Rt.648/0.01-Rt.624	-78.97794	37.46973	1%, 0.2%
Hawkins Mill Road	IVY CREEK	1.55-RTE 659;0.70-RTE 621	-79.26113	37.40342	1%, 0.2%
Hawkins Mill Rd 659	Howards Mill Creek	1.00 Lynchburg; 0.50 Rt 660	-79.26183	37.4041	1%, 0.2%
Hill Street	Blackwater Creek	0025BDWAY ST 0009LGHE RD	-79.18784	37.41218	1%, 0.2%
Hollins Mill Road	Blackwater Creek	.89 RT 501 / .84 RT 29 B	-79.15955	37.42533	1%, 0.2%
Hooper Road 662	Ivy Creek	0.40 Rt 1280; 0.70 Rt 621	-79.28248	37.39055	1%, 0.2%
Indian Hill Road	Ivy Creek	0.01-Indian H R-0.04-Gren	-79.20731	37.42672	1%, 0.2%
Lakeside Drive	Blackwater Creek	0019291 0084WCL LYNC	-79.18393	37.40163	0.2%
Langhorne Road	Ivy Creek	0.1-Crnhill Dr./0.1-Halsy	-79.18835	37.41675	No
Langhorne Road	Blackwater Creek	.0-Halsey/.14-Kulman	-79.18866	37.41574	No
Link Road	Ivy Creek	0104501 0104291	-79.20311	37.42707	1%, 0.2%
Mount Athos Road	Beaver Creek	0.05-Rt 609/2.03-ESMaint	-79.05978	37.39074	1%, 0.2%
Ninth Street	Kanawha	0003JEFF ST 0001DEAD END	-79.14003	37.41608	No
Old Forest Road	Blackwater Creek	0047221 0125LINKHYDR	-79.18791	37.40524	1%, 0.2%
River Road	Harris Creek	0.30-Rt 684/4.99-Rt 130	-79.15073	37.43892	1%, 0.2%
River Road	Buck Branch	.40-Rt 683/.10-Rt 684	-79.14648	37.43556	1%, 0.2%
Robin Drive	Tomahawk Creek	0.04 LCR - 0.56 OGMR	-79.23853	37.36427	1%, 0.2%
Route 29 Business	James R NS CSX R/R C Tpk	.00 Amherst / .00 Lynch.	-79.13471	37.40968	1%, 0.2%
Route 460 WBL	Beaver Creek	.40-Rt726 / 5.21-Rt24	-79.05461	37.38479	1%, 0.2%
Rt. 501	Ivy Creek	0112RTE221	-79.23184	37.41205	0.2%





# Hazard Identification and Risk Assessment

Road Name	Crossing	Bridge / Tunnel Location	Lon	Lat	In flood zone
		0243RTE501BU			
Stage Road	Beaver Creek	0.10-Rt.726 /0.81-Rt.659	-79.05981	37.38895	No
AM&O - Jefferson Street Tunnel	-	Jefferson Street	-79.13979	37.41519	1%, 0.2%

*Table 4-73 Vulnerable facilities and infrastructures in dam breach zone of Reusens Dam*

Name	Facility Type	Location	Locality	Lon	Lat	In flood zone
Six Mile Bridge	Historic Site	Mount Athos Rd & James River	Campbell	-79.0612	37.3932	1%, 0.2%
Westrock Converting Company	HazMat Facility	1801 Concord Turnpike	Lynchburg	-79.1277	37.4032	1%, 0.2%
Lynchburg Foundry Co Lower Basin Plant	HazMat Facility	Garnet Street And Concord Turnpike	Lynchburg	-79.1318	37.4071	1%, 0.2%
Lynchburg Casting Industries	HazMat Facility	1132 Mt Athos Rd	Campbell	-79.0595	37.4027	0.2%
Reusens Dam Hydro Plant	Energy Facility	4300 Hydro Street	Lynchburg	-79.1867	37.4630	1%, 0.2%
Electrical Substation	Electrical Substation	127 Stonewall St	Lynchburg	-79.1447	37.4194	No
Electrical Substation	Electrical Substation	4370 Hydro St	Amherst	-79.1872	37.4622	1%, 0.2%
Amazement Square Child Museum	Attractions	27 9Th St	Lynchburg	-79.1403	37.4162	0.2%

## 4.4.3.2 Appomattox County and Town of Appomattox

According to DCR's DSIS inventory, there are 17 dams within Appomattox County and no dams in the Town of Appomattox. Of those dams, 11 are unknown/undetermined. There are no high hazard dams within the jurisdiction (Figure 4-62, Table 4-74).

The following issues have been identified for dam breach scenarios in Appomattox County:

- Caldwell Lake Dam (East Fork Falling River #15), a significant hazard dam, has had issues in the past, causing flooding.
- Potential bridge and culvert impacts



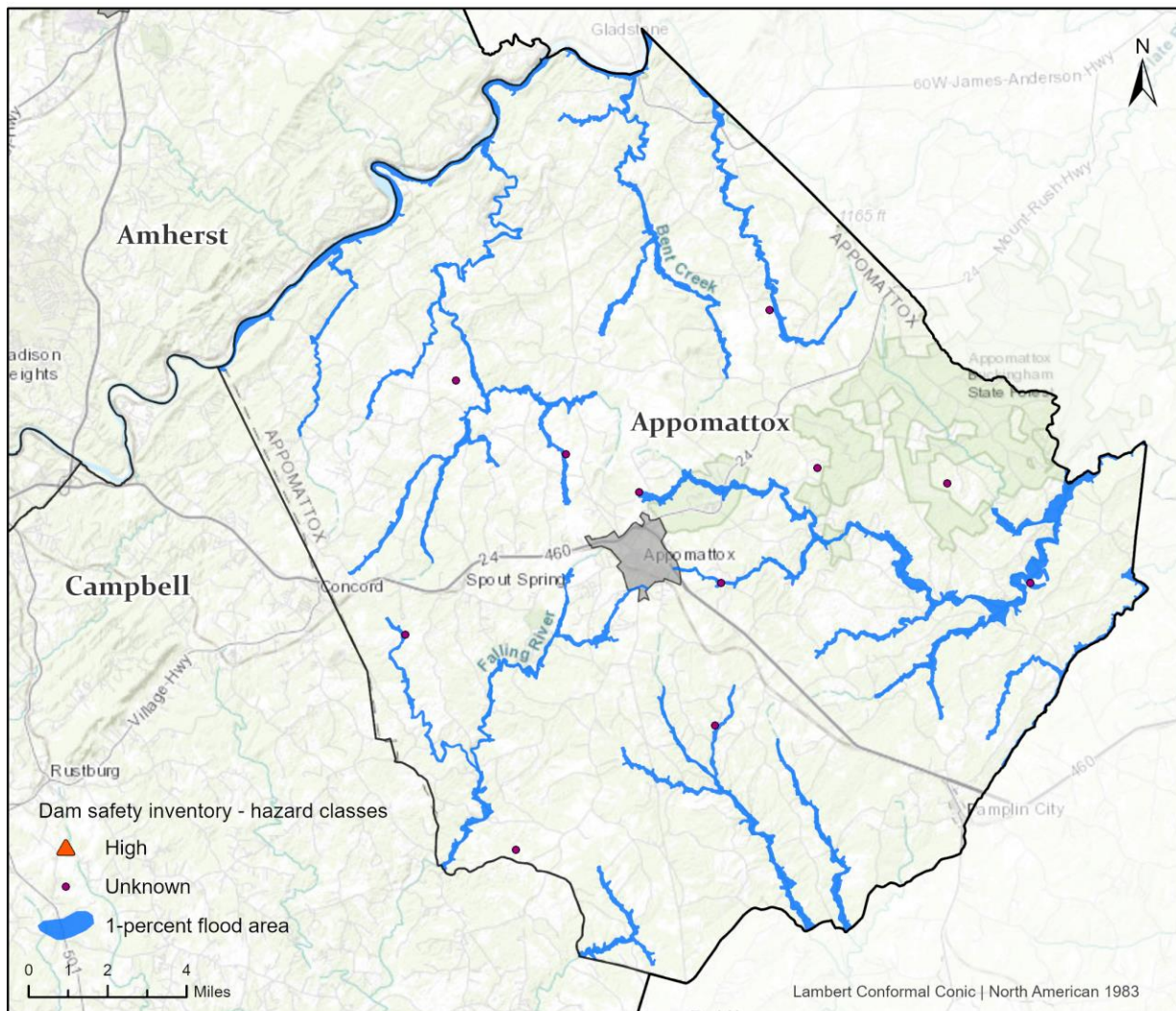
# Hazard Identification and Risk Assessment

Table 4-74 Number of Dams in each Hazard Potential Category within Appomattox County, Virginia.

Hazard Potential	Number of Dams
HIGH	0
HIGH, SPECIAL	0
SIGNIFICANT	4
LOW	1
LOW, SPECIAL	1
UNKNOWN	11

## High and Unknown Hazard Dams in Appomattox County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: Virginia Dam Safety Inventory System, as of 02/07/2020  
Center for Geospatial Information Technology at Virginia Tech. 02/2020



Figure 4-62 Location of High and Unknown hazard dams in Appomattox County, Virginia.



# Hazard Identification and Risk Assessment

## 4.4.3.3 Bedford County and Town of Bedford

There are a total of 152 dams within Bedford County recorded in DCR's DSIS inventory and no dams within the Town of Bedford. Of the dams in Bedford County, 129 dams are of unknown/undetermined category and 12 (8%) dams are classified as high hazard potential (Figure 4-63, Table 4-75).

### 4.4.3.3.1 Principal Dam Breach Problems

The following issues have been identified for dam breach scenarios in Bedford County (also see Table 4-76):

- Electrical substation impacts
- Two pump stations and two water storage facilities
- CSX Railroad and Norfolk Southern Railroad impacts
- Big Island Highway (Route 122), Forest Road (Route 221), Lee Jackson Highway, Stewartsville Road (Route 24), and Jordantown Road impacts
- Several bridge and culvert impacts
- Several residences and businesses in the maximum inundation area
- Inundation areas not all readily available in a GIS format for high hazard dams

Table 4-75 Number of Dams in each Hazard Potential Category within Bedford County, Virginia.

Hazard Potential	Number of Dams
High	12
High, Special	0
Significant	4
Low	5
Low, Special	2
Unknown	129

Table 4-76 Critical facility and infrastructure in dam break inundation area within Bedford County

Facility Name	Facility Type	Address	Coordinates	Floodplain	Inundation Zone
Tri-County Marina	Campground	1261 Sunrise Loop, Lynch Station	37.0595, -79.4468	1%, 0.2%	Smith Mountain Dam
Tuck-A-Way Campground	Campground	1312 Sunrise Loop, Lynch Station	37.0605, -79.4484	No	Smith Mountain Dam
Electrical Substation	Electrical Substation	Big Island Hwy / North Otter Creek	37.4599, -79.4651	1%, 0.2%	Bedford Lake Dam
Smith Mountain Dam Hydro Plant	Energy Facility	Route 1, Penhook	37.0413, -79.5356	1%, 0.2%	Smith Mountain Dam
Coleman Falls Dam Hydro Plant	Energy Facility	6007 Lee Jackson Hwy, Coleman Falls	37.5021, -79.3006	1%, 0.2%	Pedlar River Dam
Holcomb Rock Dam Hydro Plant	Energy Facility	4839 Holcomb Rock Road	37.5036, -79.2628	1%, 0.2%	Pedlar River Dam
Mineral Springs Christian School	Schools	1030 Bible Ln, Vinton	37.2865, -79.8352	No	Falling Creek Reservoir Dam



# Hazard Identification and Risk Assessment

Facility Name	Facility Type	Address	Coordinates	Floodplain	Inundation Zone
Pump Station #6	Sewer Pump Station	Peaks Rd / Woods Rd, Bedford	37.3894, -79.5516	1%, 0.2%	Stoney Creek Reservoir Dam
Lake Vista Pump Station	Sewer Pump Station	2474 Cottontown Rd, Forest	37.3953, -79.2606	1%, 0.2%	Ivy Lake Dam
Farmington Pump Station	Sewer Pump Station	1715 Helmsdale Dr, Forest	37.3845, -79.3008	No	Ivy Lake Dam
Water Pump Station - 5 (Town Of Bedford Water)	Water Booster Pump Station	4690 Peaks Rd, Bedford	37.3897, -79.5531	1%, 0.2%	Stoney Creek Reservoir Dam
Well Lot Ridgeview Sc 1	Water Storage Facility	Ridgeview Dr, Lynchburg	37.3976, -79.2588	No	Ivy Lake Dam

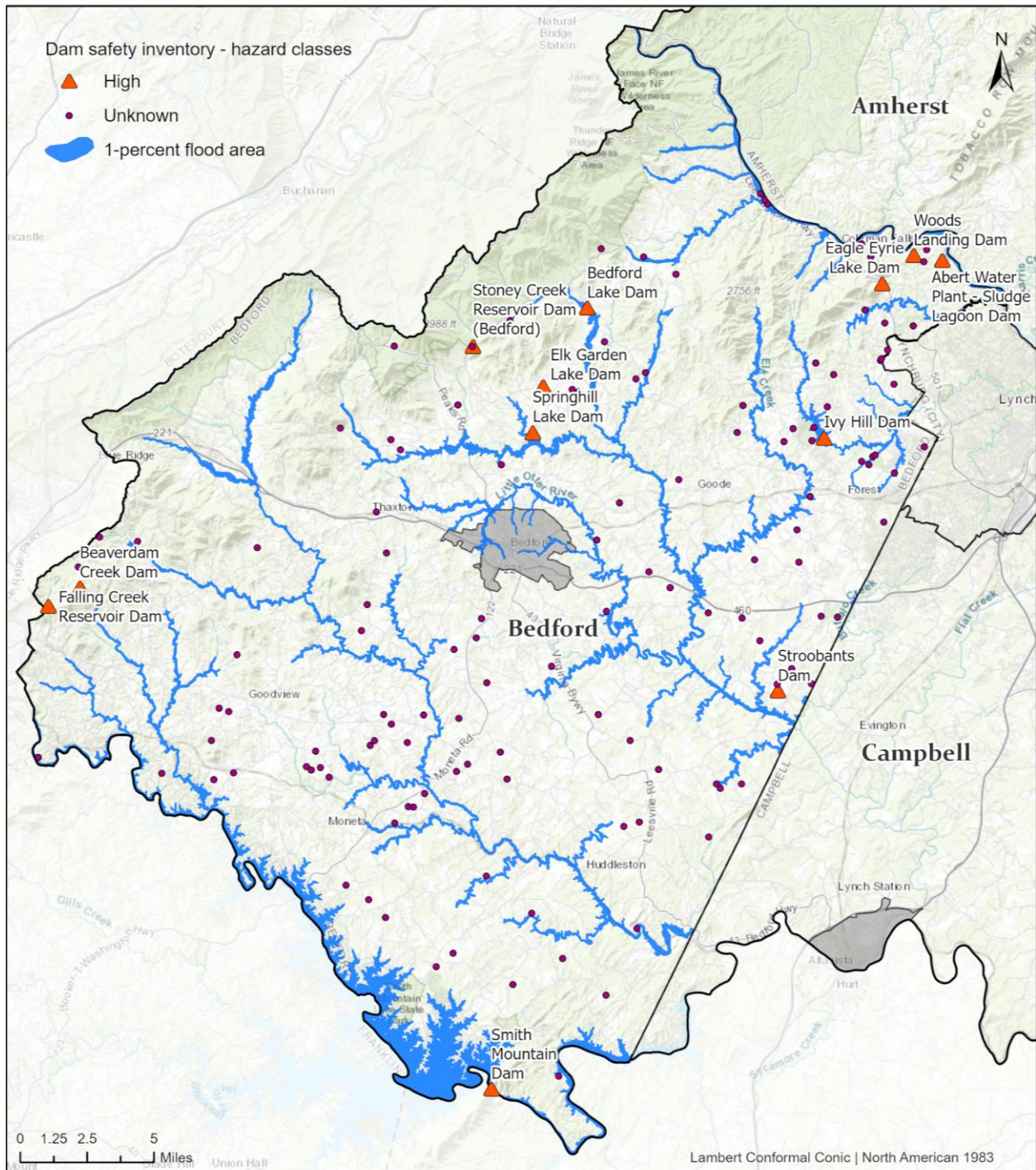




# Hazard Identification and Risk Assessment

## High and Unknown Hazard Dams in Bedford County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: Virginia Dam Safety Inventory System, as of 02/07/2020  
Center for Geospatial Information Technology at Virginia Tech. 02/2020



Figure 4-63 Location of High and Unknown hazard dams in Bedford County, Virginia.



# Hazard Identification and Risk Assessment

## 4.4.3.3.2 Risk Analysis of Individual Dam

### ***Abert Water Plant - Sludge Lagoon Dam***

#### General information

The Abert Water Plant - Sludge Lagoon Dam was initially constructed in 1994. It is owned by the City of Lynchburg and is operated by the City's Water Resources Department. Because the lagoon is designed as a wastewater treatment facility, its perimeter is surrounded by channels designed to divert surface runoff. Wastewater normally flows through the lagoon and into the concrete outlet structure through an 8-inch diameter, gated orifice which is the primary spillway, and then into the 24-inch diameter outlet structure drain. In the event flow exceeds the primary spillway capacity, the grated open top of the outlet structure serves as the emergency spillway. The impoundment is capable of storing the 90% probable maximum precipitation (PMP) (with the emergency spillway completely obstructed) without overtopping the dam. The PMP is theoretically, the greatest depth of precipitation for a given duration that is physically possible over a given storm area at a particular geographical location at a certain time of the year. Flow from the spillway discharges to an unnamed tributary leading 2,000 feet to James River.

#### Dam break inundation zone

Figure 14 is an overview of the inundation zone map completed by Wiley & Wilson in January 2010 for the PMF of Abert Water Plant. The inundation zone is confined to property owned by the City of Lynchburg, except at the CSX Transportation right-of-way and railroad track along the river. The land is steep, densely wooded, undeveloped, and inaccessible by road. A PMF dam break would cause the James River water surface level to increase less than 1-foot. No action is required for properties affected by less than a 1-foot increase.





# Hazard Identification and Risk Assessment

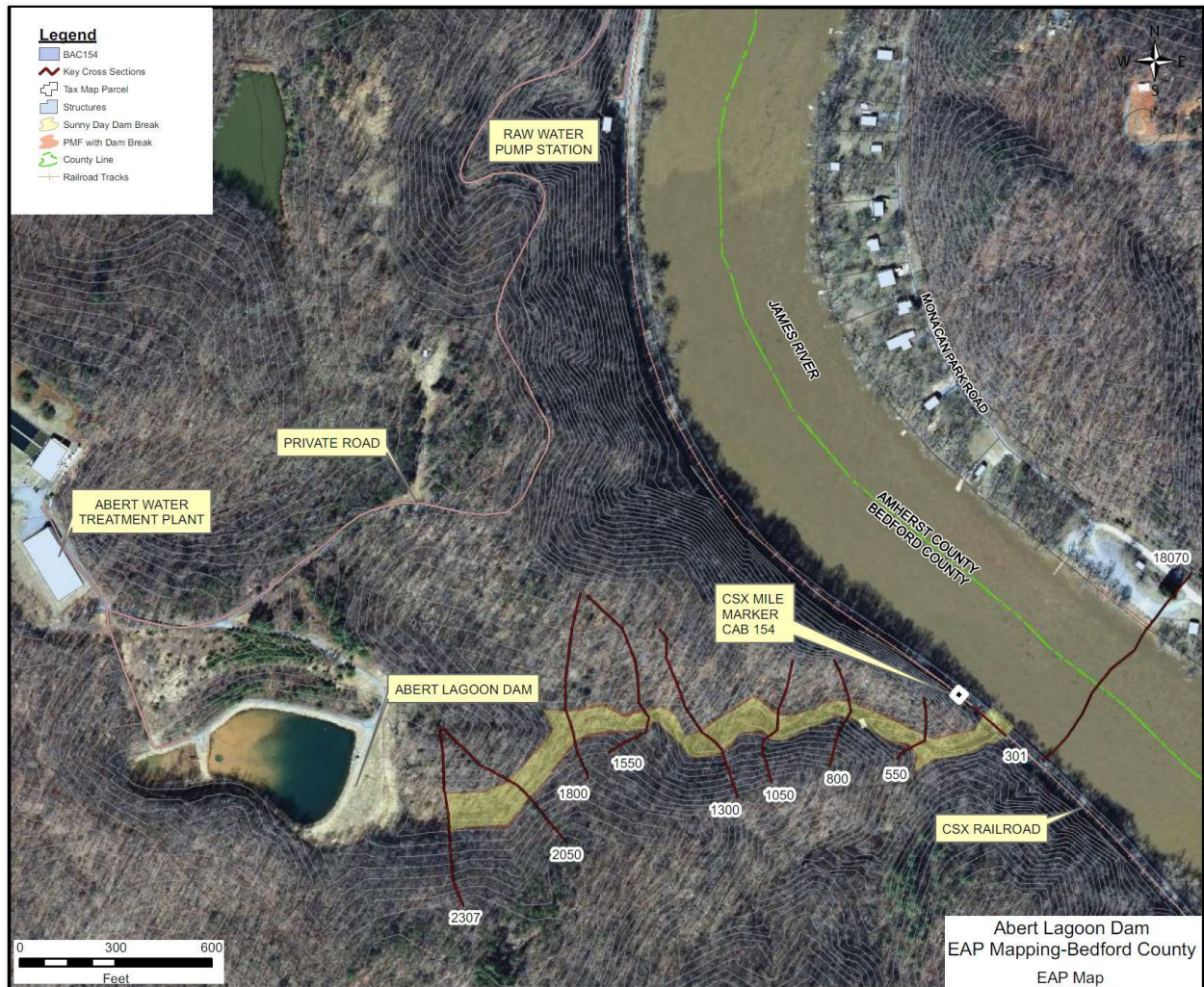


Figure 14. Inundation zone map of Abert Water Plant. (Source: Virginia DCR)

## Vulnerable structures

According to the hazard classification study in the dam EAP, the CSX Railroad, which is considered a major railway, would be overtopped by a PMF breach. Dam break overtopping would be confined to a few hundred feet of railroad track and have a duration of 12 minutes. There are no habitable buildings, facilities, or road bridges within the inundation zone; therefore, notifying CSX Transportation is the highest priority in a dam breach event.

## **Beaverdam Creek Dam**

### General information

Beaverdam Creek Dam is located along Beaverdam Creek approximately 0.27 miles upstream of State Route 635 (Jeters Chapel Road) within Bedford County, Virginia. The Beaverdam Creek Reservoir was constructed in the 1920s and is maintained by the Western Virginia Water Authority, serving as one of three water supply reservoirs for the City of Roanoke, Virginia. The reservoir covers 21 acres and stores 85-million gallons of water at full pond.



# Hazard Identification and Risk Assessment

## Dam break inundation zone

The downstream area of the dam consists of low lying forested flood plain with sparse residential development. Figure 4-64 is an overview of the inundation zone map contained in the dam failure analysis of Beaverdam Creek Dam by Timmons Group in February 2011. According to Timmons Group's analysis, Beaverdam Creek Dam currently does not have the spillway capacity to convey a 0.9 PMP event and overtops by approximately 2.91 feet. The dam will require renovations in order to comply with state regulation requirements.





# Hazard Identification and Risk Assessment

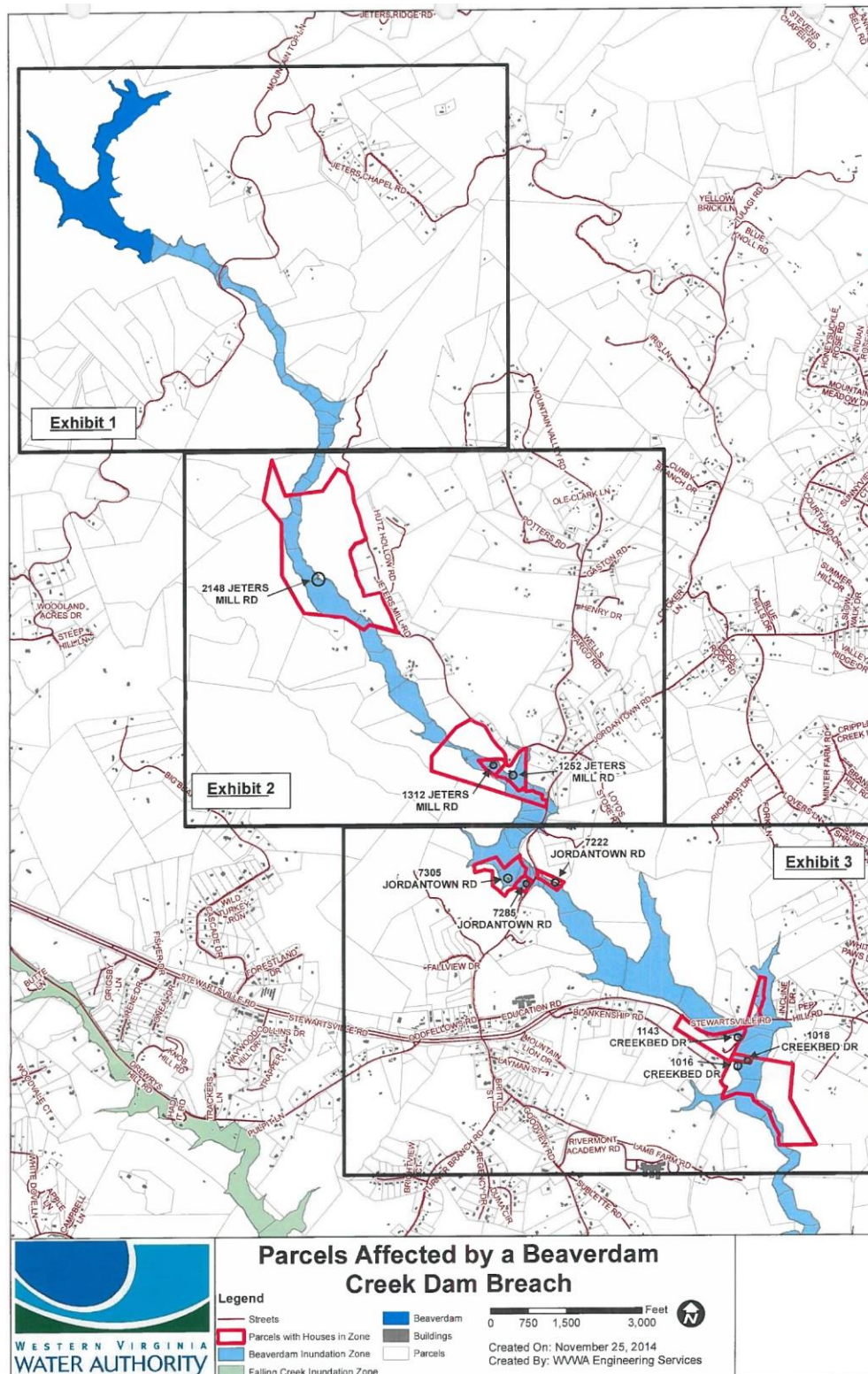


Figure 4-64 Inundation zone map of Beaverdam Creek Dam. (Source: Virginia DCR)



# Hazard Identification and Risk Assessment

## Vulnerable structures

As a result of a PMF breach, approximately 84 existing properties downstream of the Beaverdam Creek Dam would be inundated, resulting in a potential increased risk to life and property damage. Two major roads, including Stewartsville Road (Route 24) and Jordantown Road, may be flooded. Some road bridges may be impacted during a dam breach scenario (Table 4-77).

*Table 4-77 Vulnerable road bridges in dam breach zone of Beaverdam Creek Dam*

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Jordantown Rd 619	Nat Branch	0.60-RT. 24;0.65-RT 759	-79.78881	37.27847	1%, 0.2%
Stewartsville Rd24	West Fork Beaverdam Creek	1.00 RT 619; 5.00 RT 746	-79.77452	37.27061	1%, 0.2%

## **Bedford Lake Dam**

### General information

Bedford Lake Dam is located approximately 0.5 miles northwest of Colton's Mill, Bedford County, Virginia, at the headwaters of North Otter Creek within the Roanoke River Basin. It was constructed in 1935 by the Civilian Conservation Corps for recreational purposes. The walkway across the spillway was replaced by the recent owners. It is an earthfill structure approximately 700 feet long and 52 feet high. The dam is a DCR regulated dam privately owned and maintained.

### Dam break inundation zone

Figure 4-65 is an overview of the inundation zone map for the PMF of Bedford Lake Dam, completed by Froehling & Robertson, Inc. in September 2015.





# Hazard Identification and Risk Assessment

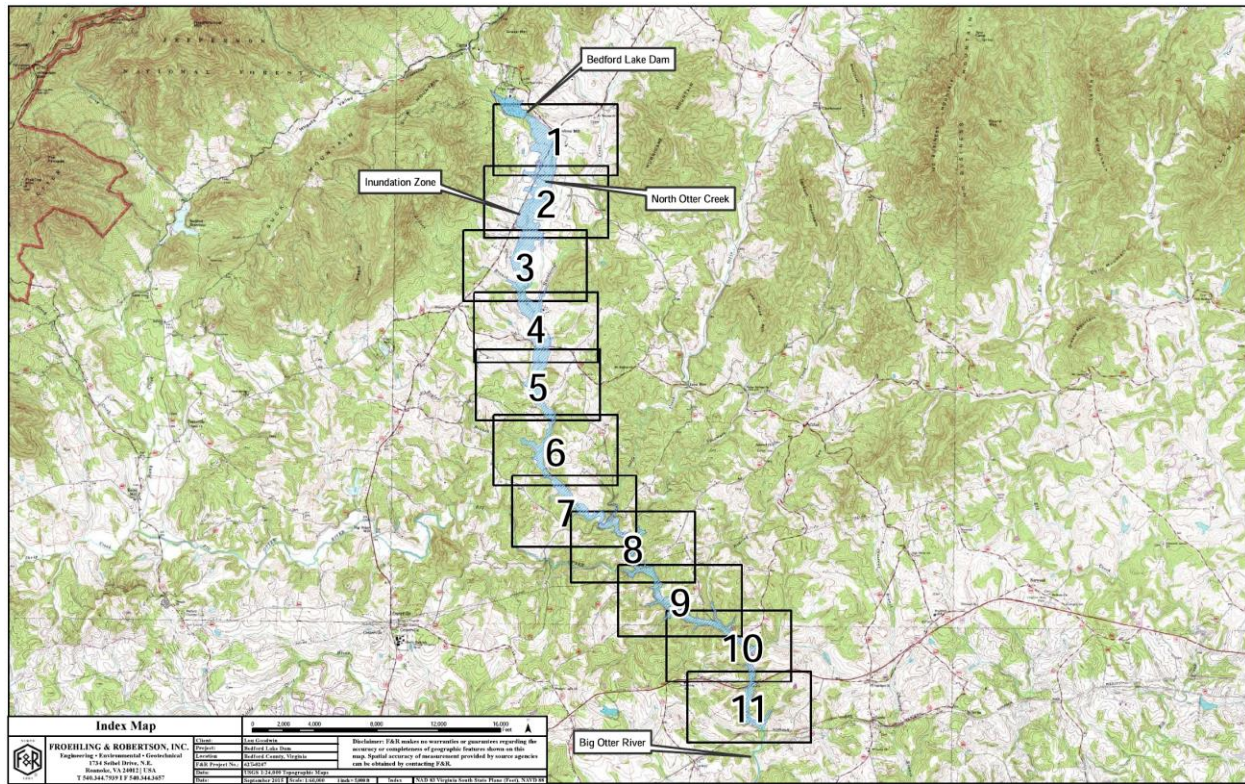


Figure 4-65 Inundation zone map of Bedford Lake Dam. (Source: Virginia DCR)

## Vulnerable structures

Table 4-78 lists broad bridges within the dam break inundation zone. Part of Big Island Highway (Route 122), and Forest Road (Route 221) may be inundated during a dam breach event. There is one electrical substation identified in the inundation zone (Table 4-79).

Table 4-78 Vulnerable road bridges in dam breach zone of Bedford Lake Dam

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Big Island Hwy 122	North Otter Creek	8.88 Rt 501; 8.50 Rt 221	-79.4648	37.46	1%, 0.2%
Forest Road 221	Big Otter River	0.16 Rt 830; 0.07 Rt 670	-79.4199	37.36447	1%, 0.2%
Hawkins Ridge Road	Roaring Run	2.10-RT 644 / 0.40-RT 670	-79.4267	37.37576	1%, 0.2%
Hurricane Dr 639	North Otter Creek	3.90 Rt 643; 0.17 Rt 122	-79.4648	37.45334	1%, 0.2%
Langford Mill 644	North Otter Creek	0.60 Rt 675; 0.20 Rt 674	-79.4535	37.39239	1%, 0.2%
Lankford Mill 644	Oslin Creek	0.00 Rt 674; 0.80 Rt 637	-79.4506	37.39455	1%, 0.2%
Otterville Rd 643	N Fork Otter River	0.65 Rt 674; 1.51 Rt 122	-79.4664	37.42394	1%, 0.2%
Roaring Run Rd 670	Roaring Run	0.05 Rt 637; 0.45 Rt 221	-79.4198	37.37083	1%, 0.2%



# Hazard Identification and Risk Assessment

Table 4-79 Vulnerable facilities and infrastructures in dam breach zone of Bedford Lake Dam

Name	Facility Type	Location	Locality	Lon	Lat	In flood zone
Electrical Substation	Electrical Substation	Big Island Hwy / North Otter Creek	Bedford	-79.4651	37.4599	1%, 0.2%

## Eagle Eyrie Lake Dam

### General information

Eagle Eyrie Dam is a 36.65 foot tall impounding structure used for supplying water to the Eagle Eyrie Baptist Conference Center. It is located on an unnamed section of Judith Creek in Bedford County, Virginia. From the dam, the tributary flows east approximately 8.9 miles before joining James River. The drainage area of the reservoir is 0.253 square miles.

### Dam break inundation zone

Figure 17 is an overview of the inundation zone map for the PMF of Eagle Eyrie Lake Dam, completed by Hurt & Proffitt, Inc. in June 2019. The upstream inundation zone caused by the dam is defined as agricultural and residential, according to the land use map found on the Bedford County GIS website. The current level of development in the 0.253 square mile drainage area is low, consisting of a few residential homes along the east portions of the drainage area. There are a few structures in the downstream inundation zone.

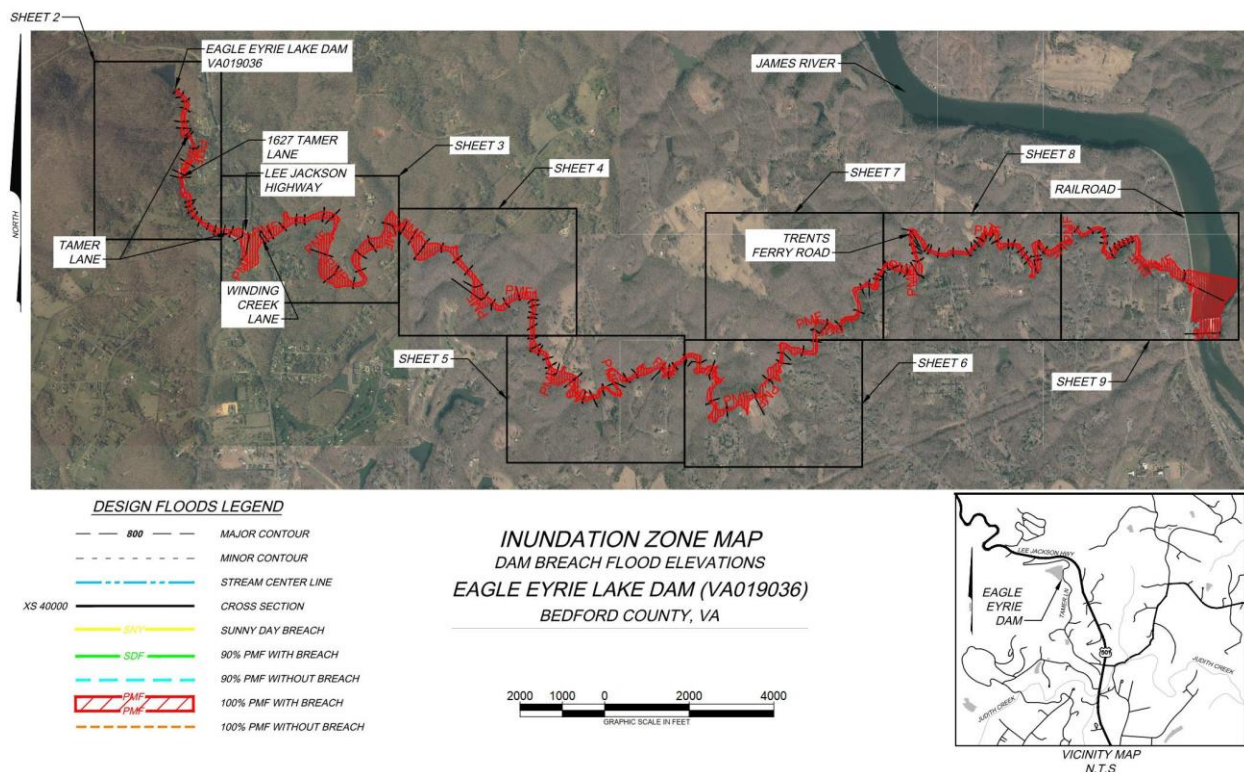


Figure 4-66 Inundation zone map of Eagle Eyrie Lake Dam. (Source: Virginia DCR)





# Hazard Identification and Risk Assessment

## Vulnerable structures

Within the inundation zone, there are several road bridges, roadways sections, and one residential home that may be inundated during a dam breach scenario. The roadways include one primary road (Lee Jackson Highway), three secondary roads (Tamer Lane, Winding Creek Lane, and Trents Ferry Road), and one private road (Gravel Road). The following road bridges may be impacted. (Table 4-80).

*Table 4-80 Vulnerable road bridges in dam breach scenario of Eagle Eyrie Lake Dam*

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Lee-Jackson HWY501	Judith Creek @ Boonsboro	0.60 Rte 647;0.01 Rte 846	-79.2649	37.46554	1%, 0.2%
Trents Ferry R 645	Judith Creek	0.05-LYNCH CL;0.05-RT 794	-79.2101	37.46881	1%, 0.2%
Winding Crk La 647	Judith Creek	0.80 Rt 501; 0.00 Rt 761	-79.2628	37.46831	1%, 0.2%

## **Elk Garden Lake Dam**

### General information

Elk Garden Lake Dam is situated on a tributary of Boyles Branch, approximately 0.6 miles upstream of Big Island Highway (Route 122) in Bedford County, Virginia. It was constructed in 1959 for recreational purposes. The dam is 30 feet tall with a crest elevation of 896 feet and a normal pool elevation of 893 feet. The principal spillway is a 12-inch diameter reinforced concrete pipe conduit sloped at a shallow drop through the top of the embankment. The emergency spillway is located to the left end of the dam and is an uncontrolled earth channel with an entrance width of 40 feet. This spillway is reported to have a design capacity equal to a 100-Year Flood event.

### Dam break inundation zone

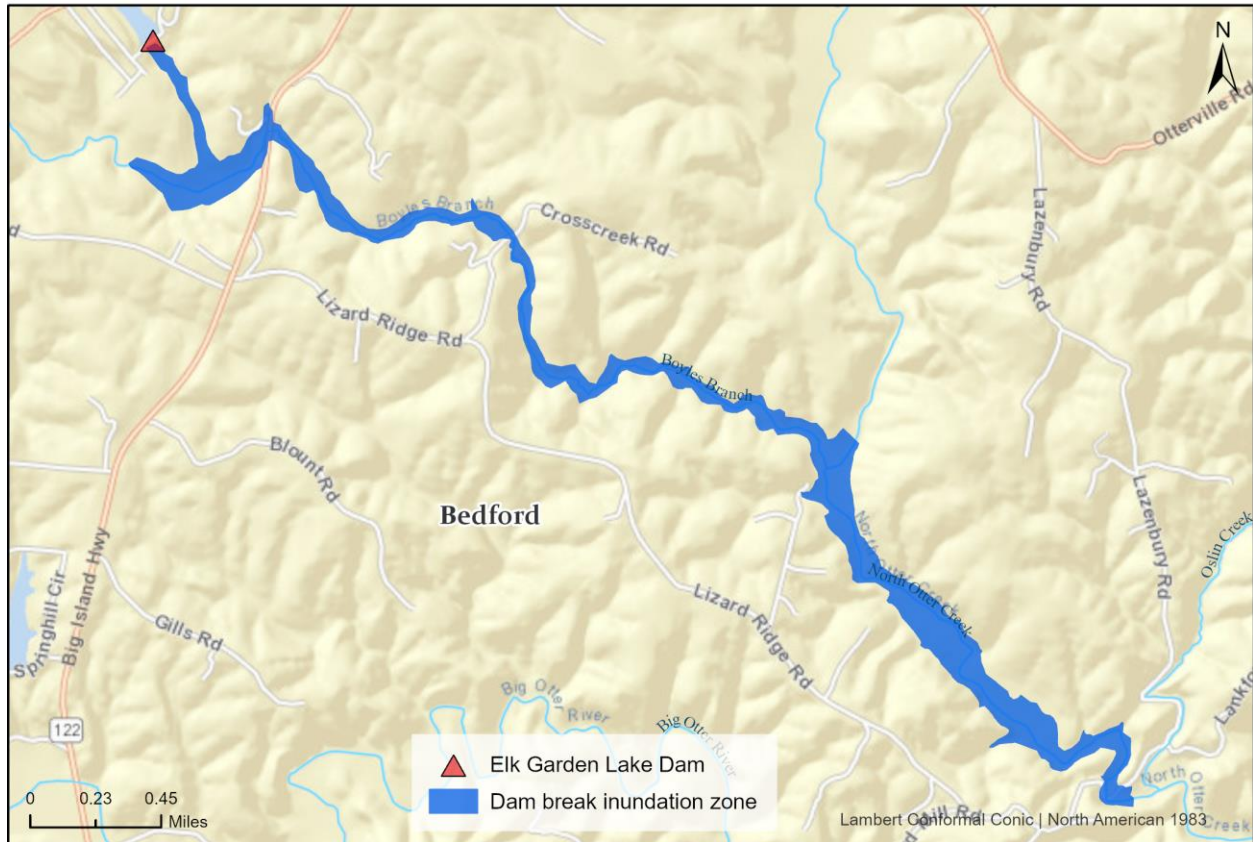
Figure 4-67 indicates the dam break inundation zone for the PMF of Elk Garden Lake Dam. This map derives from the digitalization of the DBIZ maps provided in the EAP of the dam. The dam inundation studies were conducted by Froehling & Robertson, Inc. in October 2010.



# Hazard Identification and Risk Assessment

## Dam Break Inundation Zone of Elk Garden Lake Dam in Bedford County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020



Dam break Inundation zone was digitalized from Elk Garden Lake Dam Emergency Action Plan (EAP). Dam inundation studies were conducted by Froehling & Robertson Inc. in Oct 2010.

Data source: Elk Garden Lake Dam EAP  
Center for Geospatial Information Technology at Virginia Tech. 02/2020



Figure 4-67 Inundation zone map of Elk Garden Lake Dam. (Source: Virginia DCR)

### Vulnerable structures

Table 4-81 lists the VDOT road bridge that is within the inundation zone. Part of Big Island Highway (Route 122) and Crosscreek Road (Route 676) may be impacted during a dam breach event. There are also 23 downstream parcels that may be flooded.

Table 4-81 Vulnerable road bridges and tunnels in dam breach scenario of Elk Garden Lake Dam

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Langford Mill644	North Otter Creek	0.60 Rt 675; 0.20 Rt 674	-79.45353	37.39239	1%, 0.2%



# Hazard Identification and Risk Assessment

## ***Falling Creek Reservoir Dam***

### General information

Falling Creek Dam is located in Bedford County, Virginia. The dam is 1.5 miles upstream from Virginia Route 24 on Falling Creek. The dam is used to impound water for use as a public water supply by the Western Virginia Water Authority. Falling Creek Dam is a 52 foot high earthen High Hazard Dam that was originally constructed in 1898, with major renovations in 2011. There is a water withdrawal tower in the reservoir that contains valves that control flows of raw water for water treatment or to drain. The principal spillway is a grouted riprap channel with drop gabions. The top and downstream face of the dam are armored with articulated concrete blocks designed to safely withstand overtopping flows, as the emergency spillway, up to the PMF event. Under flood conditions, operation by the principal spillway and emergency spillway (overtopping flow) is automatic and does not require any manual operation.

### Dam break inundation zone

Figure 4-68 is an overview of the inundation zone map for the PMF of Falling Creek Reservoir Dam developed by AECOM Technical Services, Inc. in 2011.

The entire upstream drainage area is undeveloped mountainous forest. In the event of a dam failure, the potentially impacted areas downstream from the dam extend approximately 8.5 miles downstream to the confluence of Falling Creek with Smith Mountain Lake. This area contains mostly suburban and rural residential properties, with the densest development located near Virginia Route 24.





# Hazard Identification and Risk Assessment

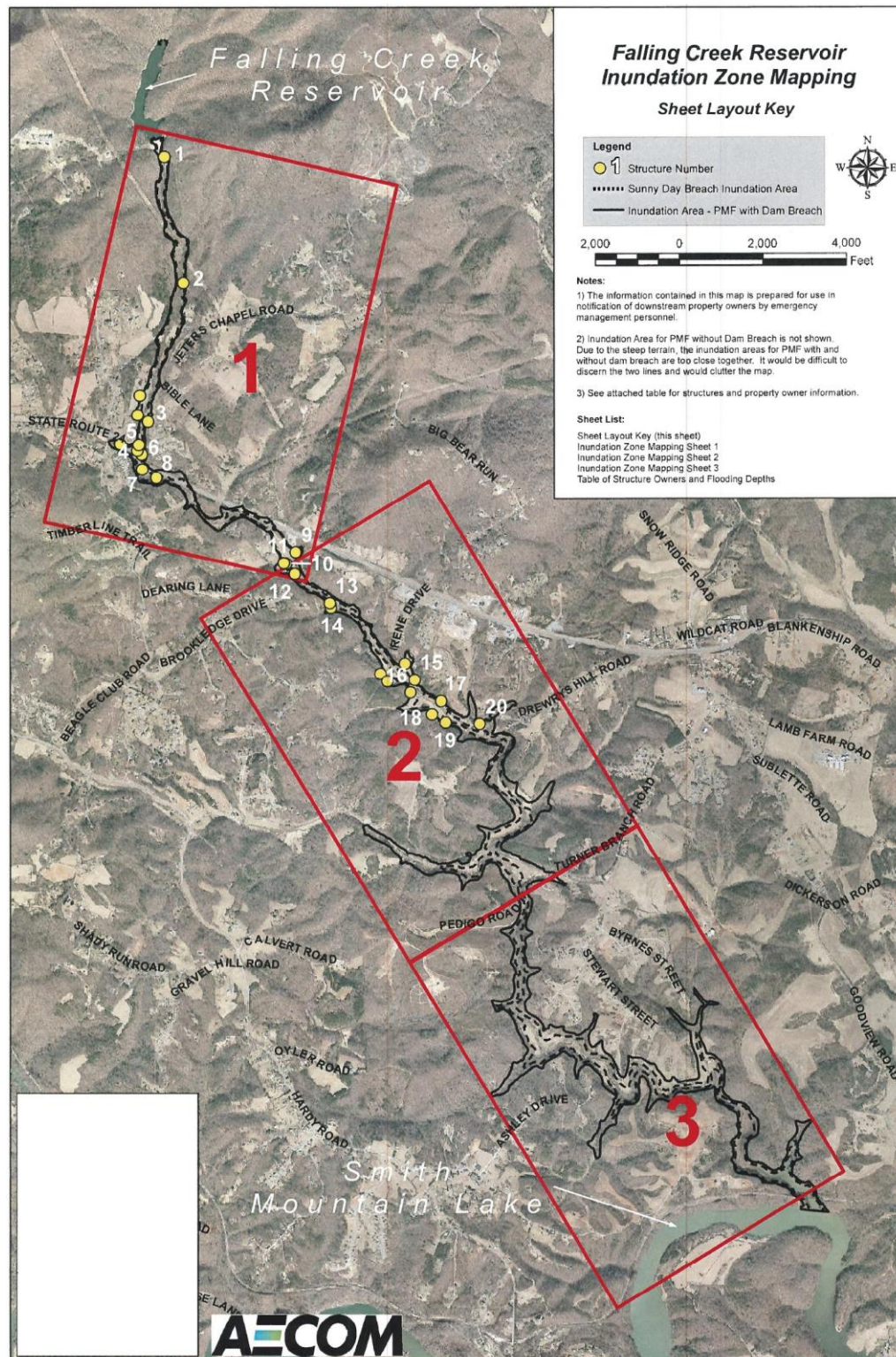


Figure 4-68 Inundation zone map of Falling Creek Reservoir Dam. (Source: Virginia DCR)





# Hazard Identification and Risk Assessment

## Vulnerable structures

During the dam breach event, several roads, structures, and one road bridge downstream of the dam may be impacted. Part of Stewartsville Road (Route 24) and Norfolk Southern Railroad tracks near the south bank of Smith Mountain Lake (79.7828°W 37.2343°N) may be flooded. Table 4-82 lists the VDOT road bridge that is within the inundation zone. 26 structures including residential buildings and barns also may be flooded. The parking lot of Mineral Springs Christian School at Bible Ln. is in the inundation area (Table 4-83).

*Table 4-82 Vulnerable road bridges and tunnels in dam breach scenario of Falling Creek Reservoir Dam*

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Turner Branch Rd 619	Falling Creek	1.50 Rt 634; 1.50 Rt 757	-79.80906	37.25662	1%, 0.2%

*Table 4-83 Vulnerable facilities and infrastructures in dam breach zone of Falling Creek Reservoir Dam*

Name	Facility Type	Location	Locality	Lon	Lat	In flood zone
Mineral Springs Christian School	Schools	1030 Bible Ln	Bedford	-79.8352	37.2865	No

## ***Ivy Lake Dam***

### General information

Ivy Lake Dam (or Ivy Hill Dam) is situated on Ivy Creek, approximately 2.5 miles northwest of Forest, in Bedford County, Virginia. It was constructed for recreational purposes. The dam is 66 feet tall, with a crest elevation of 833.0 feet and an emergency spillway elevation of 822.5 feet. The principal spillway is a 48-inch diameter reinforced concrete pipe conduit, which discharges near the toe of the embankment into a concrete stilling basin. The emergency spillway is located to the right end of the dam and is a broad crested earth spillway with an entrance width of 70 feet.

### Dam break inundation zone

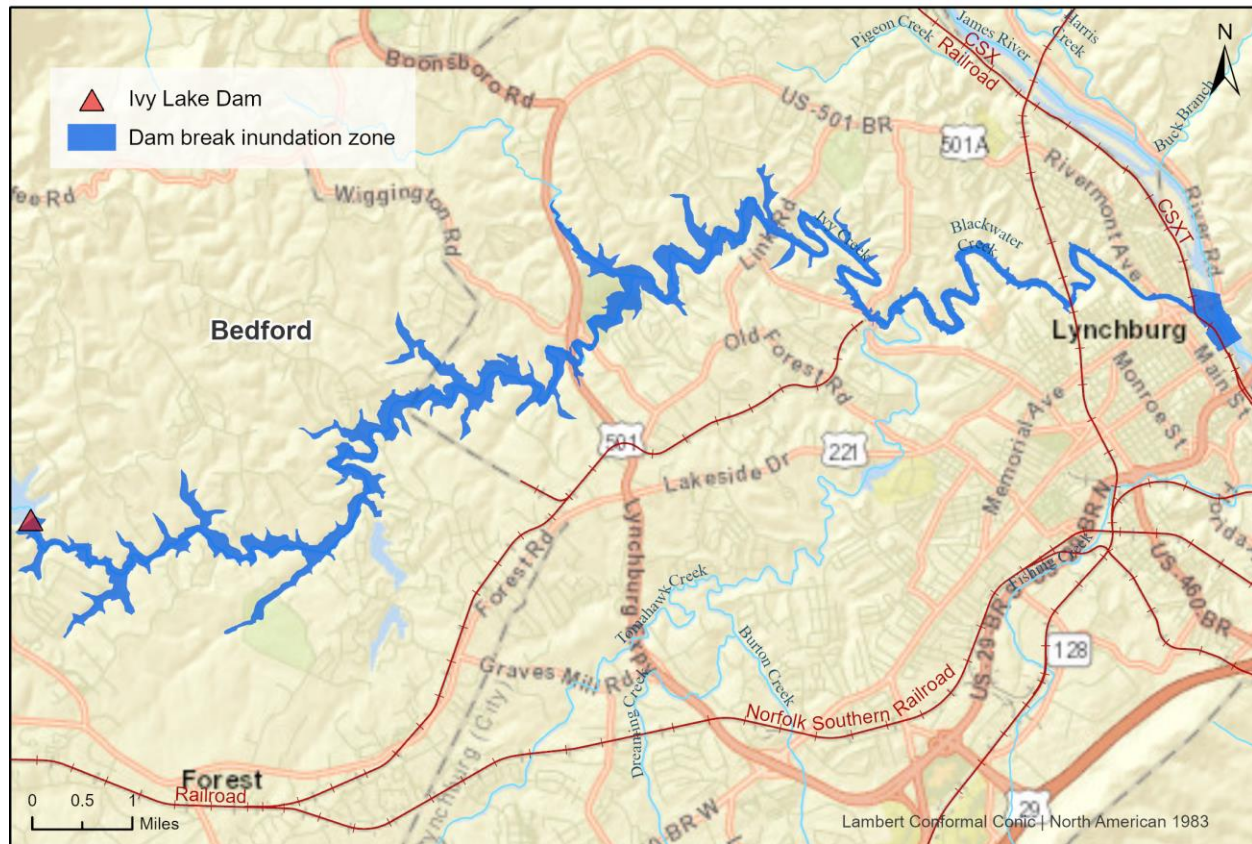
Figure 4-69 is an overview of the inundation zone map for the PMF of Ivy Lake Dam, digitized from the EAP of the dam.



# Hazard Identification and Risk Assessment

## Dam Break Inundation Zone of Ivy Lake Dam in Bedford County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020



Dam break Inundation zone was digitalized from Ivy Lake Dam Emergency Action Plan (EAP). Dam inundation studies were conducted by Froehling & Robertson Inc. in July 2018.

Data source: Elk Garden Lake Dam EAP; City of Lynchburg GIS Portal  
Center for Geospatial Information Technology at Virginia Tech. 02/2020



Figure 4-69 Inundation zone map of Ivy Lake Dam. (Source: Virginia DCR)

### Vulnerable structures

There are several roadways and bridges downstream within both Bedford County and Lynchburg City may be flooded if the Ivy Lake Dam should fail. Table 4-84 and Table 4-85 show those locations. AM&O - Jefferson Street Tunnel and U.S. Pipe in Lynchburg, as well as 2 water storage facilities and 2 sewer pump stations in Bedford, are also within the inundation zone (Table 4-86).

Table 4-84 Vulnerable roadways downstream of Ivy Lake Dam (Source: Ivy Lake Dam EAP)

Inundated Roadways	Distance From Dam (miles)	Jurisdiction
Ivy Wolf Lane	3.4	Bedford County
Ivy Lea Drive	4.4	Bedford County
Pine Bluff Drive (Rt. 1250)	5.4	Bedford County
Wigginton Road (Rt. 6004)	8.9	Bedford County
Peaks View Tenbury Drive	9.5	Lynchburg City



# Hazard Identification and Risk Assessment

Inundated Roadways	Distance From Dam (miles)	Jurisdiction
Ardmore Drive	9.7	Lynchburg City
Dandridge Drive	9.8	Lynchburg City
Irvington Springs Road	9.9	Lynchburg City
Hurdle Hill Road	12.1	Lynchburg City
Club Drive	13.8	Lynchburg City
Old Langhorne Road	15.0	Lynchburg City
Halsey Road	15.1	Lynchburg City
Hill Street (Rt. 6082)	15.1	Lynchburg City
7th Street	20.1	Lynchburg City
Jefferson Street	20.2	Lynchburg City
10th Street	20.3	Lynchburg City
11th Street	20.4	Lynchburg City
Horse Ford Road	20.5	Lynchburg City
Washington Street (Rt. 6078)	20.6	Lynchburg City
E. Lynch Street	20.7	Lynchburg City

Table 4-85 Vulnerable road bridges and tunnels in dam breach scenario of Ivy Lake Dam

Road Name	Crossing	Bridge Location	Jurisdiction	Lon	Lat	In flood zone
Cottontown Rd./621	Ivy Creek	.40-RTE 1240;.25-RTE 884	Bedford County	-79.26179	37.39696	1%, 0.2%
Cranehill Drive	Ivy Creek	0.35LINKHORN/0.01LAN GHORN	Lynchburg City	-79.19012	37.41823	No
Hawkins Mill Road	IVY CREEK	1.55-RTE 659;0.70-RTE 621	Bedford County	-79.26113	37.40342	1%, 0.2%
Hawkins Mill Rd 659	Howards Mill Creek	1.00 Lychbg; 0.50 Rt 660	Bedford County	-79.26183	37.40410	1%, 0.2%
Hollins Mill Road	Blackwater Creek	.89 RT 501 / .84 RT 29 B	Lynchburg City	-79.15955	37.42533	1%, 0.2%
Hooper Road 662	Ivy Creek	0.40 Rt 1280; 0.70 Rt 621	Bedford County	-79.28248	37.39055	1%, 0.2%
Indian Hill Road	Ivy Creek	0.01-Indian H R-0.04-Gren	Lynchburg City	-79.20731	37.42672	1%, 0.2%
Langhorne Road	Ivy Creek	0.1-Crnhill Dr./0.1-Halsy	Lynchburg City	-79.18835	37.41675	No
Link Road	Ivy Creek	0104501 0104291	Lynchburg City	-79.20311	37.42707	1%, 0.2%
Ninth Street	Kanawha	0003JEFF ST 0001DEAD END	Lynchburg City	-79.14003	37.41608	No
Rt. 501	Ivy Creek	0112RTE221 0243RTE501BU	Lynchburg City	-79.23184	37.41205	0.2%
AM&O - Jefferson Street Tunnel	7th Street	Jefferson Street	Lynchburg City	-79.13979	37.41519	0.2%



# Hazard Identification and Risk Assessment

Table 4-86 Vulnerable facilities and infrastructures in dam breach zone of Ivy Lake Dam

Name	Facility Type	Location	Locality	Lon	Lat	In flood zone
Well Lot Ridgeview Sc 1	Water Storage Facility	Ridgeview Dr, Lynchburg	Bedford	-79.2588	37.3976	No
Lake Vista Pump Station	Sewer Pump Station	2474 Cottontown Rd, Forest	Bedford	-79.2606	37.3953	1%, 0.2%
Farmington Pump Station	Sewer Pump Station	1715 Helmsdale Dr, Forest	Bedford	-79.3008	37.3845	No
U.S. Pipe	HazMat Facility	10 Adams Street, Lynchburg	Lynchburg	-79.1413	37.4208	1%, 0.2%

## **Smith Mountain Dam**

### General information

Smith Mountain Dam was built on Roanoke River by the Appalachian Power Company in the mid-1960s for the purposes of pumped-storage hydroelectricity. It is located near Roanoke, Virginia, upstream of the Leesville Dam. The two dams and reservoirs -- Smith Mountain and Leesville -- have added about 600 miles of new shoreline and about 25,000 surface acres of water for multiple uses. The dam is an Exempt Federal dam.

### Dam break inundation zone

Upstream of the Smith Mountain Dam, the drainage basin is typically rural with limited agriculture and extensive wooded area. The nearest metropolitan area, the City of Roanoke, is located approximately 45 miles upstream of the dam. There are no dams located upstream of the project that contain an appreciable amount of storage space where project inflow could be stored.

Along Roanoke River (locally known as Staunton River) downstream of the Leesville Dam, agricultural activities become more pronounced. Downstream of Leesville, the nearest population center is the Town of Altavista, which is located 10 miles downstream of the dam. Due to the close proximity to the dam, the Town of Altavista is notified first in the event of an emergency. The closest downstream dam is the Corps of Engineer's John H. Kerr Reservoir, which is located approximately 150 miles below Leesville Dam. Passage of the floods generated by dam failures at either the Smith Mountain Dam or Leesville Dam is highly dependent on the operation of the Kerr Dam, as well as flooding conditions along Dan River, which flows into Kerr Reservoir.

Figure 4-70 is an overview of the inundation zone for the PMF of Smith Mountain Dam developed by the Appalachian Power Company in July 2015.





# Hazard Identification and Risk Assessment

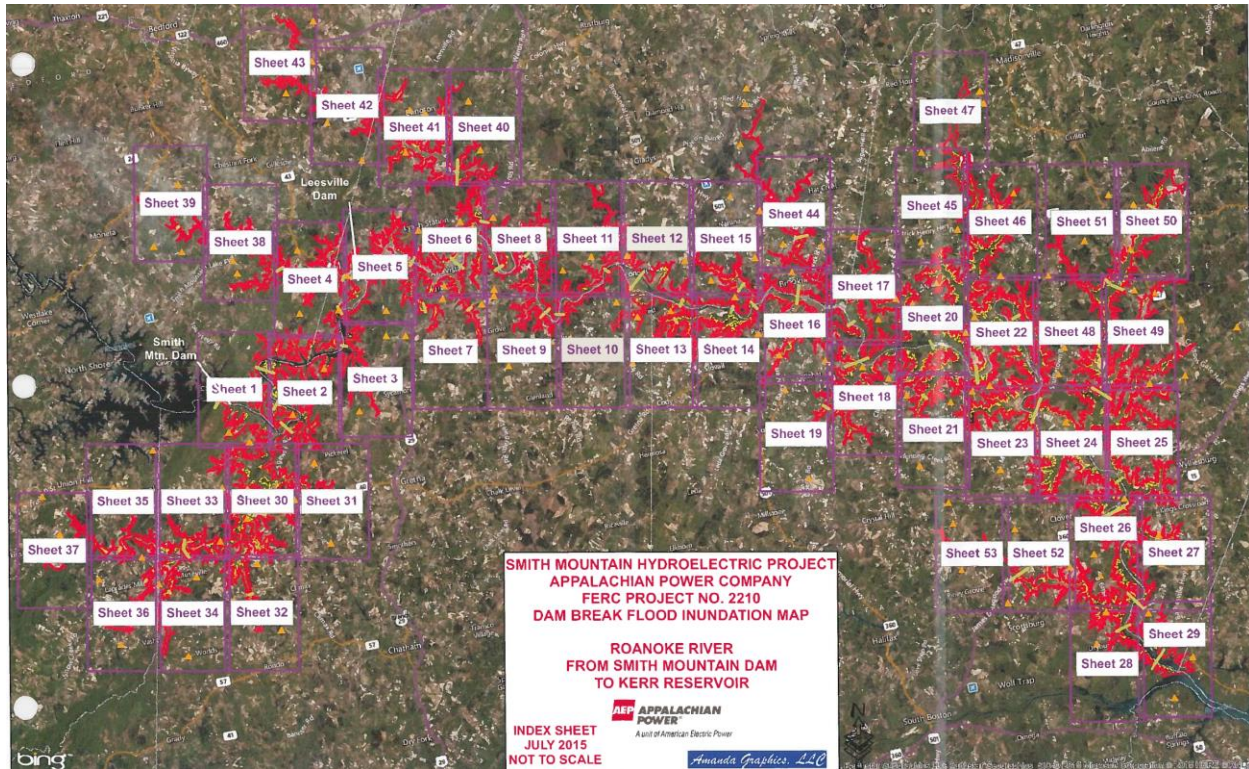


Figure 4-70 Inundation zone map of Smith Mountain Dam. (Source: Virginia DCR)

## Vulnerable structures

Many roadways, road bridges, and critical facilities downstream within Bedford County Campbell County, Town of Altavista and Town of Brookneal may be flooded if the Smith Mountain Dam should fail. Table 4-87 and Table 4-88 show locations of those structures.

The following major roads and railways may be impacted: Main Street, Bedford Avenue (Route 43) and Wards Road (Route 29) in Town of Altavista, Wickliffe Avenue and Lusardi Drive in Town of Brookneal, Bedford Highway, and N&S Railroad tracks along Roanoke River.

There are many critical facilities and vulnerable infrastructures downstream of Smith Mountain Dam. Most of them are located within the Town of Altavista and the Town of Brookneal. See Table 4-88.

Table 4-87 Vulnerable road bridges in dam breach scenario of Smith Mountain Dam

Road Name	Crossing	Bridge Location	Jurisdiction	Lon	Lat	In flood zone
AYERS RD. 737	NS RAILWAY	0.20-RT 732;1.90-RT 805	Bedford County	-79.52055	37.17055	No
Bishops Cr. Rd.628	Back Creek	0.50 Rt 629; 0.15 Camp C	Bedford County	-79.38482	37.15424	No
CARTERS MILL RD630	ASHWELL MILL CREEK	2.55-RT 626;3.35-RT 733	Bedford County	-79.46834	37.12462	1%, 0.2%
Dundee Road/	Clover Creek	1.15 Rte732; 1.65	Bedford	-79.50105	37.12572	1%, 0.2%



# Hazard Identification and Risk Assessment

Road Name	Crossing	Bridge Location	Jurisdiction	Lon	Lat	In flood zone
734		Rte626	County			
Headens Br Rd 732	Goose Creek	0.10 Rt 735; 0.00 Rt 737	Bedford County	-79.51821	37.16838	1%, 0.2%
Leesville Rd 43	Back Creek	0.15 Cpbl Co; 2.45 Rt 728	Bedford County	-79.40075	37.12856	1%, 0.2%
Rock Cliff Rd 735	Difficult Creek	3.20 Rt 731; 0.10 Rt 817	Bedford County	-79.52491	37.17852	No
SMTH MT LKE PKW626	GOOSE CREEK_ & NS RWY	0.25-RT 833;1.75-RT 630	Bedford County	-79.47584	37.1568	1%, 0.2%
Tolers Ferry R 608	Howells Creek	3.65 RT 872; 4.00 Pitt Co	Bedford County	-79.49003	37.04812	No
Wyatts Way 24	Big Otter River	0.01 Rt 709; 0.90 Rt 792	Bedford County	-79.34963	37.24541	1%, 0.2%
Wyatts Way/24	Br. of Big Otter River	1.79-Camb Co;0.19-Rt 709	Bedford County	-79.34501	37.24559	1%, 0.2%
WYATTS WAY/24	BUFFALO CREEK	0.11 CAMP CO; 7.54 RT 43E	Bedford County	-79.32418	37.25219	1%, 0.2%
Bedford Highway	Bishop Creek	1.05-Rt 896/3.20-Rt 682	Campbell County	-79.33889	37.13855	1%, 0.2%
Bedford Highway	Plumtree Branch	6.03 Alvsta/1.67 Bed CL	Campbell County	-79.37908	37.12134	1%, 0.2%
Bishop Creek Road	Bishop Creek	1.10-Rt.43/2.07-Rt.682	Campbell County	-79.33162	37.14621	1%, 0.2%
Chellis Ford Road	Goose Creek	0.20-Rt. 43/0.10-Rt 718	Campbell County	-79.38721	37.11659	1%, 0.2%
Covered Bridge Rd	Seneca Creek	1.60-Rt 761/0.60-Rt 633	Campbell County	-79.11541	37.11749	1%, 0.2%
Covered Bridge Rd	Swan Creek	.74-Rt.824/.69-Rt.821	Campbell County	-79.1525	37.09167	No
Dearborn Road	Flat Creek	0.55-Rt.694/1.26-Rt.709	Campbell County	-79.2643	37.21163	1%, 0.2%
Dearborn Road	Branch Troublesome Creek	0.27-Rt.693/0.24-Rt.914	Campbell County	-79.23632	37.19945	0.2%
Dearborn Road	Troublesome Creek	0.10-Rt 693/0.60-Rt 709	Campbell County	-79.23827	37.20486	1%, 0.2%
Epsons Road	Whipping Creek	0.30-Rt 614/1.30-Rt 613	Campbell County	-79.0065	37.0608	1%, 0.2%
Evington Road	Buffalo Creek	0.60-Rt 934/2.10-Bedfo CL	Campbell County	-79.30521	37.24731	1%, 0.2%
Gladys Road	Seneca Creek	0.12-Rt.629 / 1.80-Rt.697	Campbell County	-79.13196	37.13937	1%, 0.2%
Gladys Road	Hills Creek	0.50-Rt.1340/0.90-	Campbell	-79.20318	37.12711	No



# Hazard Identification and Risk Assessment

Road Name	Crossing	Bridge Location	Jurisdiction	Lon	Lat	In flood zone
		Rt.706	County			
Goat Island Road	Seneca Creek	0.20-Rt 700 / 0.70-Rt.703	Campbell County	-79.12268	37.10694	1%, 0.2%
Irvindale Road	Little Falling River	0.60-Rt 645 / 1.00-Rt 601	Campbell County	-78.91443	37.13079	1%, 0.2%
Lambs Church Road	Hills Creek	1.45-Rt 696 / 3.15-Rt 699	Campbell County	-79.18883	37.13892	No
Leesville Road	Otter River	0.24-Rt.626/0.85-Rt.694	Campbell County	-79.30358	37.20857	1%, 0.2%
Leesville Road	NS Railway	0.72 Rt 694/0.53 Rt 24	Campbell County	-79.28608	37.22592	No
Leesville Road	Johnson Creek	.05-Rt.626S / .05-Rt.626N	Campbell County	-79.30724	37.20628	1%, 0.2%
Lewis Ford Rd	Falling River	0.6-Rt. 641/1.2-Rt. 642	Campbell County	-78.9599	37.12661	1%, 0.2%
Mclver Ferry Rd	Branch Whipping Creek	0.17-Rt. 633/2.61-Rt. 635	Campbell County	-79.00734	37.05542	1%, 0.2%
Route 24	Flat Creek	1.45-Rt.692 / 0.95-Rt.696	Campbell County	-79.26191	37.23297	1%, 0.2%
Route 29 NBL	Big Otter River	8.89-Rt 24/.28-Rt 29BUS	Campbell County	-79.24363	37.13981	1%, 0.2%
Route 29 SBL	Otter River	8.89-Rt 24/.28-Rt 29 Bus	Campbell County	-79.24336	37.13992	1%, 0.2%
Route 43	Route 29 Bypass	0.02-Alta CL/7.67-Bed CL	Campbell County	-79.30697	37.12769	No
Route 714	Route 29 Bypass	.95-Rt 712/.10-Alta. CL	Campbell County	-79.25015	37.13795	No
Rt 29 Bypass SBL	NS Railway & Route 626	2.94-Rt 29 B/0.54-Rt 43	Campbell County	-79.29845	37.13222	No
Seneca Road	Seneca Creek	0.17-Rt 703/0.03-Dead End	Campbell County	-79.12515	37.09177	1%, 0.2%
Seneca Road	Seneca Creek	0.10- Rt 703/0.80-Rt 705	Campbell County	-79.12751	37.09434	1%, 0.2%
Swinging Bridge Rd	Falling River	1.00-Rt 601W/.20-Rt 601E	Campbell County	-78.93592	37.08383	1%, 0.2%
Three Creeks Road	Suck Creek	1.04-Rt 708/2.19-Rt 942	Campbell County	-78.98693	37.14848	No
Three Creeks Road	Mollys Creek	0.90-Rt.652/0.60-Rt.708	Campbell County	-78.97235	37.17059	1%, 0.2%
Clarion Road	Rt 29 Bypass NBL & SBL	0.40-Rt 712/0.00-Alta CL	Town of Altavista	-79.26851	37.13884	No
Clarion Road	Stream	0.09-Rt.714/1.10-Rt.712	Town of Altavista	-79.27431	37.1294	1%, 0.2%
Riverbend Road	Otter River	0.05-Rt 875/0.20-Rt	Town of	-79.24405	37.13881	1%, 0.2%



# Hazard Identification and Risk Assessment

Road Name	Crossing	Bridge Location	Jurisdiction	Lon	Lat	In flood zone
		29B	Altavista			
Route 29 Bus.	Staunton River & NS Rwy	0.00-CmpbCo./0.00-PittCo.	Town of Altavista	-79.27074	37.12679	1%, 0.2%
Dog Creek Road	Dog Creek	0.40-Rt 40 / 1.15-Rt 881	Town of Brookneal	-78.92594	37.04921	1%, 0.2%
Wickliffe Avenue	Falling River	.06-E Brknl / 4.20-Cha Co	Town of Brookneal	-78.93579	37.0536	1%, 0.2%

Table 4-88 Vulnerable facilities and infrastructures in dam breach zone of Smith Mountain Dam

Name	Facility Type	Location	Jurisdiction	Lon	Lat	In flood zone
Avoca Museum	Attractions	1514 Main St, Altavista, Va 24517	Town of Altavista	-79.2697	37.1300	No
The Mansion	Historic Site	1580 Mansion Bridge Rd, Altavista	Town of Altavista	-79.2399	37.1246	No
Lane Home Furnishings	HazMat Facility	701 5Th St, Altavista	Town of Altavista	-79.2855	37.1097	1%, 0.2%
Abbott Laboratories - Ross Products Division	HazMat Facility	1516 Main St, Altavista	Town of Altavista	-79.2658	37.1333	No
Bgf Industries	HazMat Facility	401 Amherst Avenue, Altavista	Town of Altavista	-79.2782	37.1122	1%, 0.2%
Dominion - Altavista Power Station	HazMat Facility	104 Wood Lane	Town of Altavista	-79.2734	37.1187	No
Altavista Fire Company	Fire Stations	1280 Main Street, Altavista	Town of Altavista	-79.2755	37.1199	No
Altavista Police Department	Law Enforcement	510 7Th Street, Altavista	Town of Altavista	-79.2899	37.1103	No
Altavista Power Station	Energy Facility	104 Wood Lane, Altavista	Town of Altavista	-79.2735	37.1188	No
Altavista Wastewater Plant	Wastewater Treatment Plant	Ln Access Rd, Altavista	Town of Altavista	-79.2740	37.1123	1%, 0.2%
Altavista Area YMCA Family Center	Large Population Venue	1000 Franklin Ave, Altavista, Va 24517	Town of Altavista	-79.2889	37.1140	1%, 0.2%
WODI - AM - The Rain Broadcasting, Inc.	Communication Facility	1230 Radio Road Brookneal, VA 24528	Town of Brookneal	-78.9420	37.0384	1%, 0.2%
Cat Rock Sluice	Historic Site	General Location	Town of	-78.9599	37.0436	1%,





# Hazard Identification and Risk Assessment

Name	Facility Type	Location	Jurisdiction	Lon	Lat	In flood zone
			Brookneal			0.2%
Red Hill	Historic Site	1430 Red Hill Rd	Town of Brookneal	-78.8980	37.0322	No
Brookneal Town - Falling River	Wastewater Treatment Plant	Wickliffe Ave, Brookneal	Town of Brookneal	-78.9340	37.0522	1%, 0.2%
Brookneal Town - Staunton River	Wastewater Treatment Plant	Radio Rd, Brookneal	Town of Brookneal	-78.9391	37.0376	1%, 0.2%
Green Hill	Historic Site	378 Pannills Rd, Gladys	Campbell	-79.0722	37.0621	No
Leesville Hydro Plant	Energy Facility	Rt. 754, Hurt	Campbell	-79.4022	37.0931	1%, 0.2%
Altavista Water Treatment Plant	Wastewater Treatment Plant	20 Ricky Van Shelton Dr, Hurt, Va 24563	Campbell	-79.2833	37.1045	No
Tri-County Marina	Campground	1261 Sunrise Loop, Lynch Station	Bedford	-79.4468	37.0595	1%, 0.2%
Tuck-A-Way Campground	Campground	1312 Sunrise Loop, Lynch Station	Bedford	-79.4484	37.0605	No
Smith Mountain Dam Hydro Plant	Energy Facility	Route 1, Penhook	Bedford	-79.5356	37.0413	1%, 0.2%

## ***Spring Hill Lake Dam***

### General information

Spring Hill Lake Dam (*aka* Spring Hill Estates Dam or Toms Dam) is situated on a tributary of Big Otter River, approximately 0.32 river miles upstream of it's convergence with Big Otter River in Bedford County, Virginia. The dam impounds Spring Hill Lake, an approximate 13.9 acre reservoir at normal pool. The drainage area to the Spring Hill Estates Dam was calculated to be 0.181 square miles (115.8 acres). Spring Hill Estates Dam was constructed as a recreational impoundment. The dam is 44 feet tall with a crest elevation of 829 feet and a normal pool elevation of 824 feet. This dam is unattended during normal operating conditions.

### Dam break inundation zone

Figure 4-71 is an overview of the inundation zone map for the PMF of Spring Hill Lake Dam, completed by Froehling & Robertson, Inc. in March 2017.



# Hazard Identification and Risk Assessment

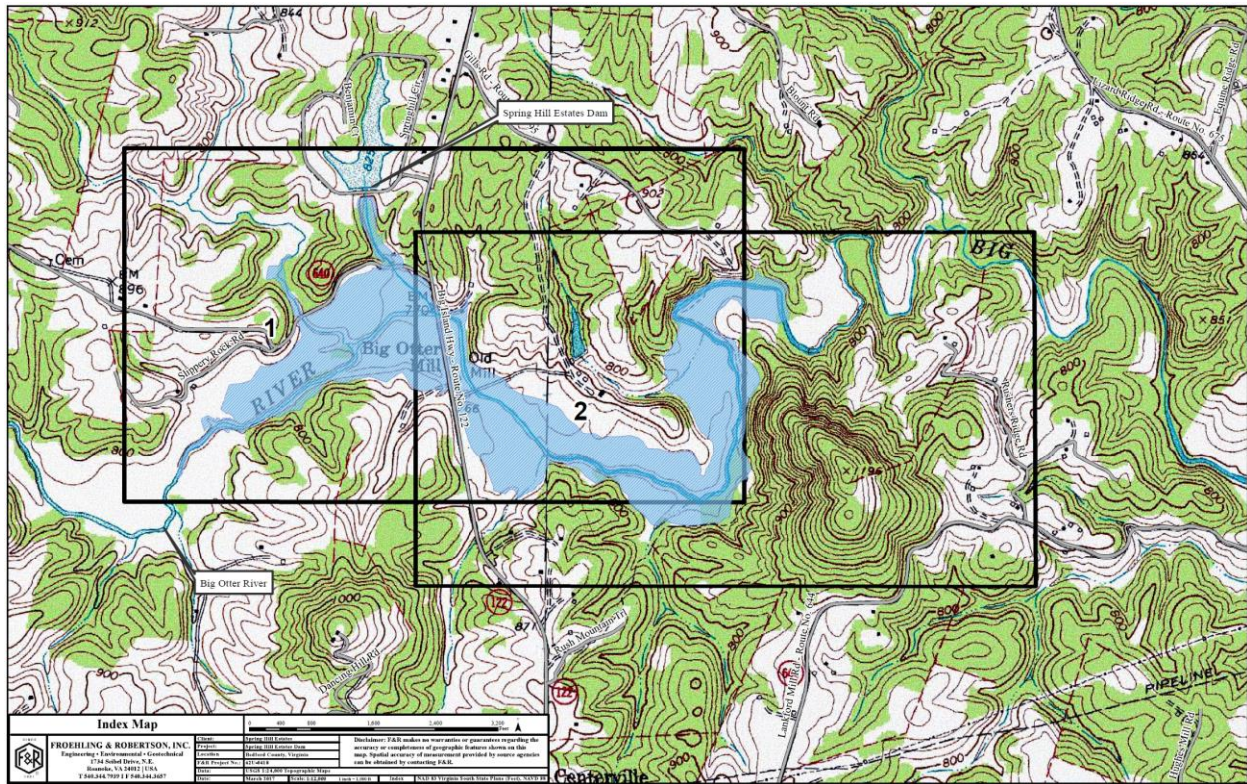


Figure 4-71 Inundation zone map of Spring Hill Lake Dam. (Source: Virginia DCR)

## Vulnerable structures

Part of Big Island Highway (Route 122) and two VDOT road bridges may be impacted within Bedford County during a dam breach event (see Table 4-89). There is also one residential structure that would be endangered should the impounding structure fail. There are no other critical facilities identified in the inundation zone.

Table 4-89 Vulnerable road bridges in dam breach scenario of Spring Hill Lake Dam

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Big Island Hwy/122	Big Otter River	00.10 RT 640;02.68 NCL BD	-79.50464	37.39275	1%, 0.2%
Forbes Mill Rd 640	Br. of Big Otter River	0.40 Rt 122; 1.00 Rt 682	-79.51079	37.39288	1%, 0.2%

## Stoney Creek Reservoir Dam (Bedford)

### General information

Stoney Creek Reservoir Dam (aka Bedford Reservoir Dam) is situated on Stoney Creek, about 7.7 miles from the Town of Bedford, in Bedford County, Virginia. The dam is used to impound water for public water supply





# Hazard Identification and Risk Assessment

and operated by the Town of Bedford. It was built in 1954 and repaired in 2012. The drainage area to the reservoir is approximately 6.2 square miles.

## Dam break inundation zone

Figure 23 is an overview of the inundation zone map for the PMF of Stoney Creek Reservoir Dam, completed by Schnabel Engineering in December 2012.

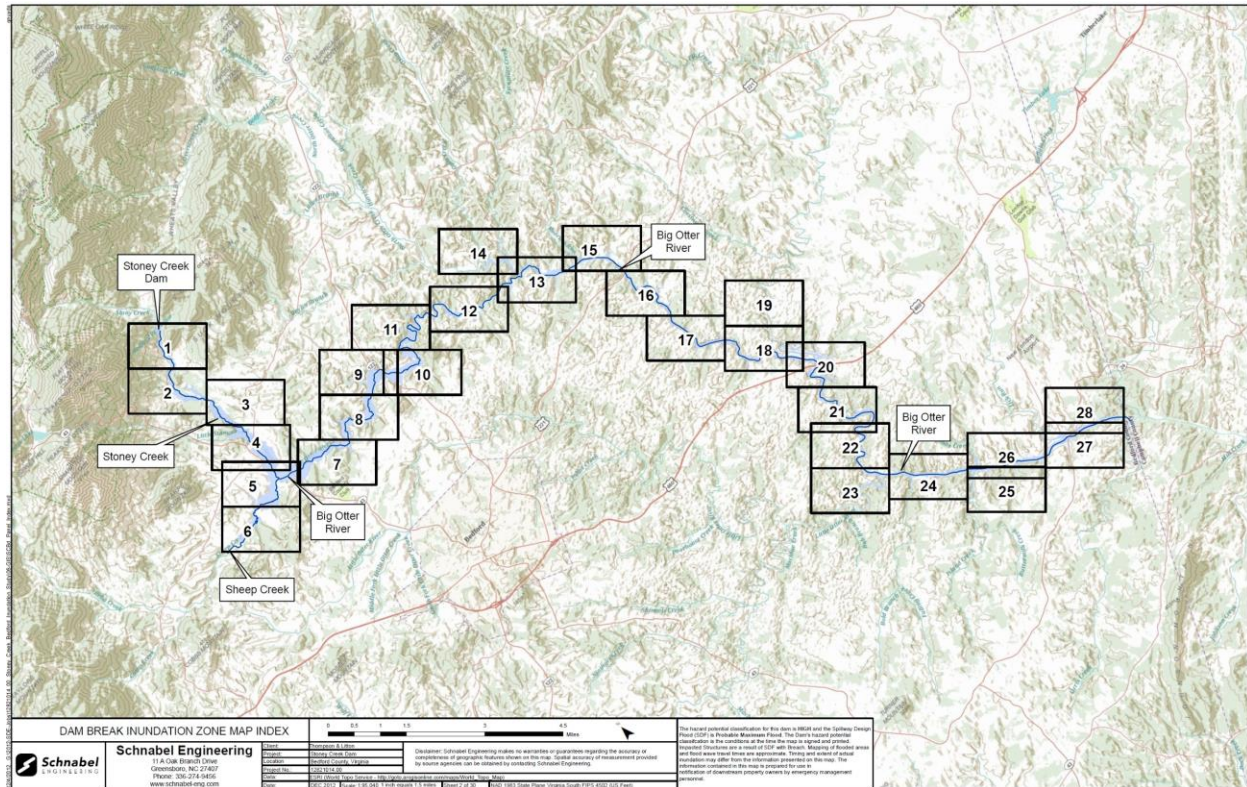


Figure 4-72 Inundation zone map of Stoney Creek Reservoir Dam. (Source: Virginia DCR)

## Vulnerable structures

There are several roadways and bridges downstream within both Bedford County may be flooded if the Stoney Creek Reservoir Dam should fail. Table 4-90 and Table 4-91 show those locations. A sewer and one water booster pump station were identified in the inundation zone (Table 4-92).

Table 4-90 Vulnerable roadways downstream of Stoney Creek Reservoir Dam

Inundated Roadways	Distance From Dam (miles)	Jurisdiction
Rt. 640/Wheats Valley Road	0.5	Bedford County
Stonesbrook Farms Road	1	Bedford County
Rt. 850/Meadors Mill Road	2	Bedford County
Rt. 643/Jopling Road	3.4	Bedford County
Rt. 43/Peaks Road	4.2	Bedford County
Rt. 43/Peaks Road	4.6	Bedford County
Rt. 122/Big Island Hwy	8.1	Bedford County



# Hazard Identification and Risk Assessment

Inundated Roadways	Distance From Dam (miles)	Jurisdiction
Rt. 644/Lankford Mill Road	12.7	Bedford County
US 221/Forest Road	16.4	Bedford County
US 460/East Lynchburg Salem Turnpike	21.6	Bedford County
Rt. 24/Wyatts Way	30.2	Bedford County
Railroad Near Della Wood Lane	17.2	Bedford County

Table 4-91 Vulnerable road bridges in dam breach scenario of Stoney Creek Reservoir Dam

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
460 EBL	Big Otter River	6.34 Bedfd; 5.94 Camp Co	-79.39473	37.30892	1%, 0.2%
Big Island Hwy/122	Big Otter River	00.10 RT 640;02.68 NCL BD	-79.50464	37.39275	1%, 0.2%
E.Ly.Sa.Tk 460 WBL	BIG OTTER RIVER	5.94 CMBL CO; 6.34 Bedfd	-79.39396	37.30847	1%, 0.2%
Forbes Mill Rd 640	Br. of Big Otter River	0.40 Rt 122; 1.00 Rt 682	-79.51079	37.39288	1%, 0.2%
Forest Road 221	Big Otter River	0.16 Rt 830; 0.07 Rt 670	-79.41991	37.36447	1%, 0.2%
Gilly/Bush/Rd.R706	Elk Creek	0.20 Rt 460; 2.32 Rt 668	-79.39337	37.31040	1%, 0.2%
Hawkins Ridge Road	Roaring Run	2.10-RT 644 / 0.40-RT 670	-79.42671	37.37576	1%, 0.2%
Jopling Road 643	Stony Creek	0.40 Rt 640; 0.10 Rt 43	-79.55390	37.40374	No
Langford Mill644	North Otter Creek	0.60 Rt 675; 0.20 Rt 674	-79.45353	37.39239	1%, 0.2%
Lankford MI RD/644	Big Otter River	0.01-RT 673; 0.50-RT 675	-79.46536	37.38664	1%, 0.2%
Meadows Mill R 850	Stony Creek	0.00 D END; 0.30 Rt 640	-79.55508	37.42156	No
Peaks Road / 43	Stony Creek	0.30-RT.682S;0.27-RT.682N	-79.55515	37.39276	1%, 0.2%
Peaks Road /43	Big Otter River	2.69 Bdfrd; 0.00 Rte. 682S	-79.55122	37.38959	1%, 0.2%
Roaring Run Rd 670	Roaring Run	0.05 Rt 637; 0.45 Rt 221	-79.41984	37.37083	1%, 0.2%
Wyatts Way 24	Big Otter River	0.01 Rt 709; 0.90 Rt 792	-79.34963	37.24541	1%, 0.2%
Wyatts Way/24	Br. of Big Otter River	1.79-Camb Co;0.19-Rt 709	-79.34501	37.24559	1%, 0.2%

Table 4-92 Vulnerable facilities and infrastructures in dam breach zone of Stoney Creek Reservoir Dam

Name	Facility Type	Location	Locality	Lon	Lat	In flood zone
Pump Station #6	Sewer Pump Station	Peaks Rd / Woods Rd	Bedford	-79.5516	37.3894	1%, 0.2%
Water Pump Station - 5 (Town Of Bedford Water)	Water Booster Pump Station	4690 Peaks Rd	Bedford	-79.5531	37.3897	1%, 0.2%





# Hazard Identification and Risk Assessment

## ***Stroobants Dam***

### General information

Stroobants Dam is a DCR-regulated dam located in Bedford County, Virginia, about 1 mile north of where Route 24 crosses Big Otter River. It is a DCR-regulated dam with the regulation agency identified as "undetermined - unknown Dam Initiative (former DRAGNET)".

### Dam break inundation zone

Figure 4-73 is an overview of the inundation zone map for the PMF of Stroobants Dam, developed by Hurt & Proffitt in December 2016. The inundation zone of Stroobants Dam shares some common areas with Otter River Raw Water Terminal Reservoir Dam in Campbell County.

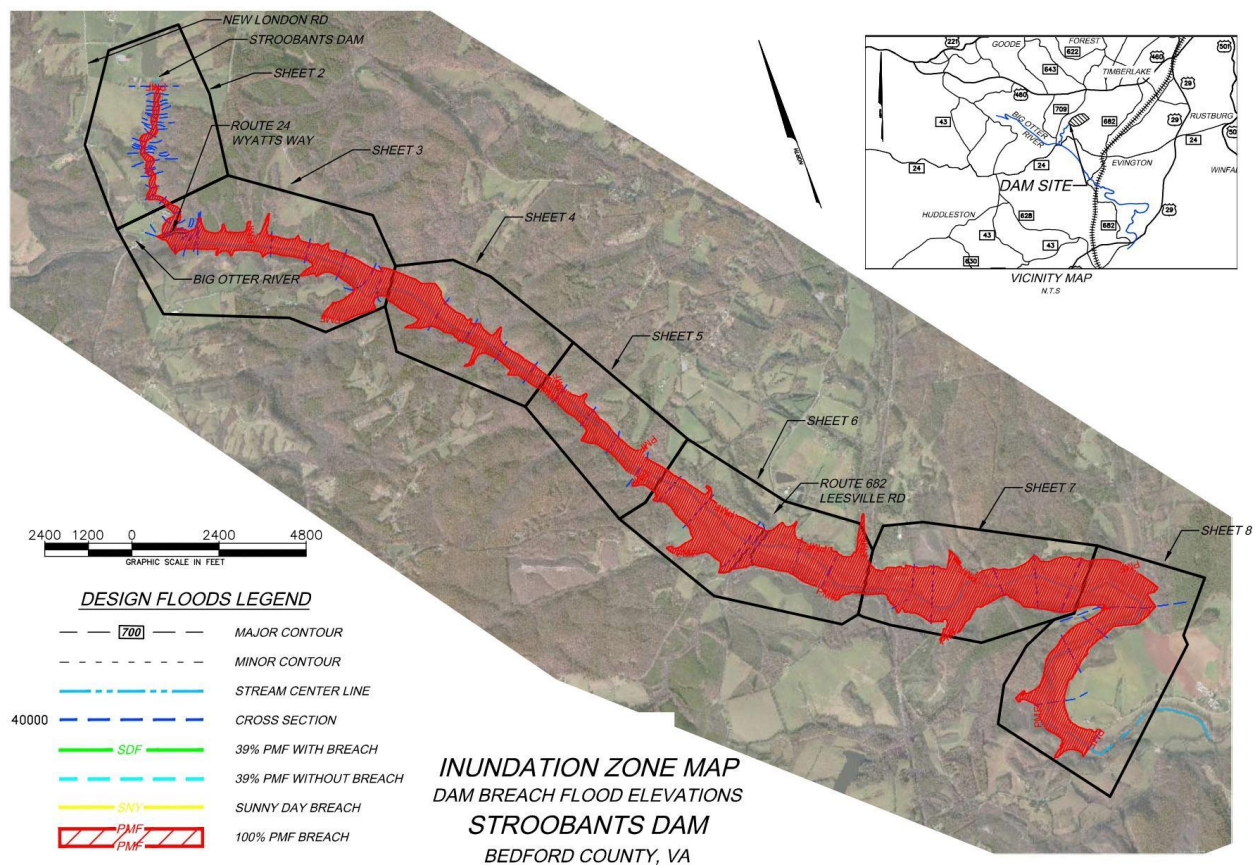


Figure 4-73 Inundation zone map of Stroobants Dam. (Source: Virginia DCR)

### Vulnerable structures

Leesville Road (Route 682) and Wyatts Way (Route 24) may be inundated during the dam breach event. Two road bridges and two vulnerable facilities (Campbell County Utility and Service Authority pump station and Walnut Hill historic site) may be impacted (Table 4-93 and Table 4-94).



# Hazard Identification and Risk Assessment

*Table 4-93 Vulnerable road bridges in dam breach scenario of Stroobants Dam*

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Leesville Road	Otter River	0.24-Rt.626/0.85-Rt.694	-79.30358	37.20857	1%, 0.2%
Wyatts Way/24	Br. of Big Otter River	1.79-Camb Co;0.19-Rt 709	-79.34501	37.24559	1%, 0.2%

*Table 4-94 Vulnerable facilities and infrastructures in dam breach zone of Stroobants Dam*

Name	Facility Type	Location	Locality	Lon	Lat	In flood zone
Walnut Hill	Historic Site	129 Johnson Mountain Rd	Campbell County	-79.3079	37.2088	No
Campbell Co Util And Serv Auth/Sewer Pump Station	Sewer Pump Station	9625 Leesville Rd, Evington	Campbell County	-79.2997	37.2075	1%, 0.2%

## ***Woods Landing Dam***

### General information

Woods Landing Dam is located adjacent to Woodcock Drive in Bedford County, Virginia, and is owned by the Woods Landing Home Owners Association (WLHOA). The parcel of property encompassing the lake and dam are identified by Bedford County as Tax Map Parcel 30-A-6G. Woods Landing Dam is an earthfill embankment approximately 38.6 feet high, 340 feet long, crest width equal to 10 feet, and a crest elevation equal to 774.8 feet NAVD 88 that creates a maximum pool impounding volume equal to approximately 138 acre-feet. The normal pool elevation is 770.9 feet NAVD 88, with a corresponding normal pool impounding volume equal to approximately 103 acre-feet. Flow from the lake outfalls into a tributary waterway for a short distance, through a culvert at the CSX Railroad, and ultimately into James River.

### Dam break inundation zone

Figure 4-74 is an overview of the inundation zone map for the PMF of Woods Landing Dam, completed by Wiley & Wilson in April 2010.





# Hazard Identification and Risk Assessment

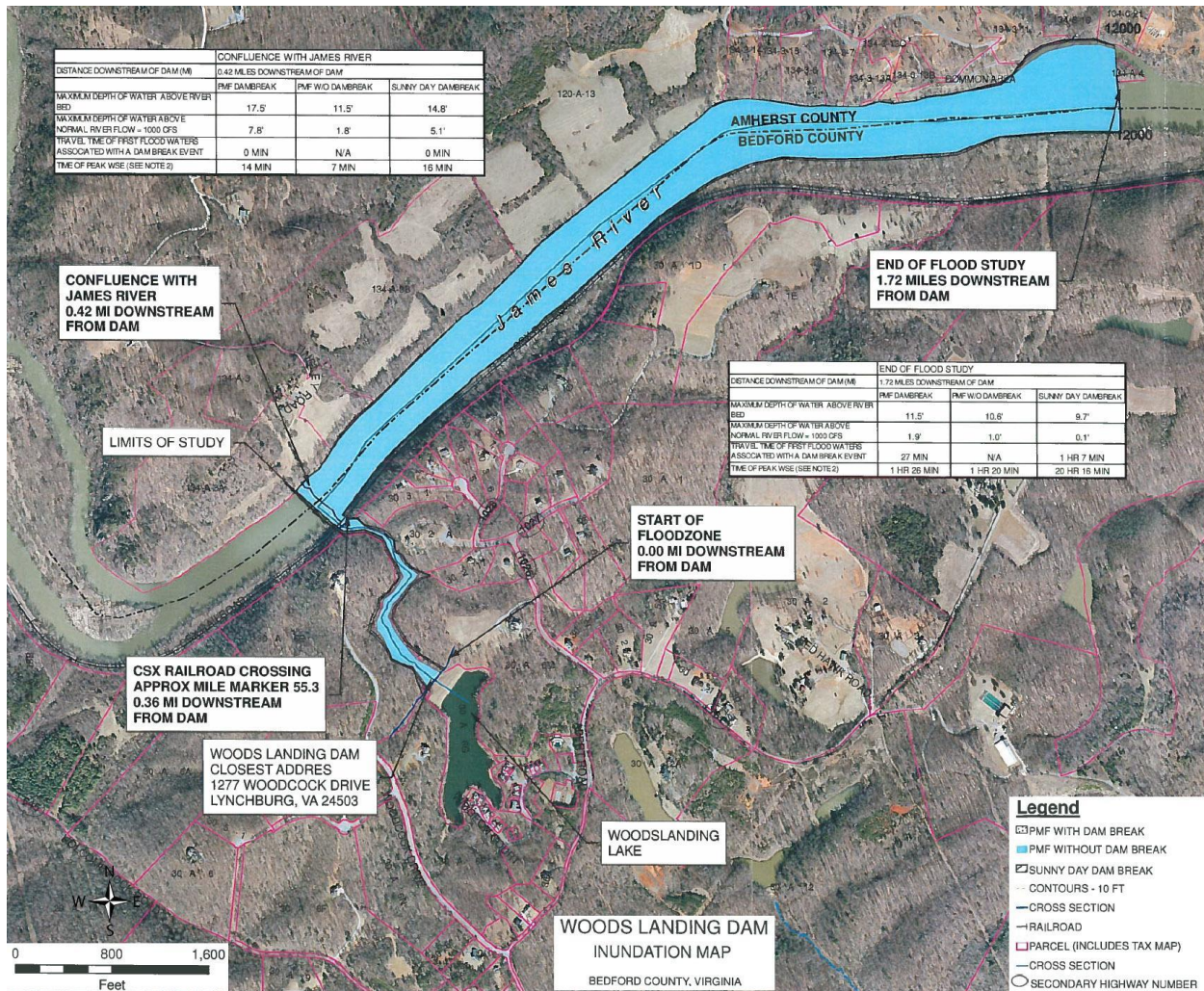


Figure 4-74 Inundation zone map of Woods Landing Dam. (Source: Virginia DCR)

## Vulnerable structures

The CSX Railroad crossing approximately 0.36 mile downstream from the Woods Landing Dam (79.25142°W 37.49720°N) may be impacted during a dam breach scenario. There are no vulnerable facilities within the inundation zone. The property within the inundation zone is mostly vacant land or unoccupied residential structures.

### 4.4.3.4 Campbell County, Altavista, and Brookneal

There are a total of 34 dams within Campbell County recorded in DCR's DSIS inventory (Table 4-95). Of those dams, 22 are of unknown/undetermined category and 2 (6%) dams are classified as high hazard potential (Figure 4-75).

#### 4.4.3.4.1 Principal Dam Breach Problems

The following issues have been identified for dam breach scenarios in Campbell County (also see Table 4-96):



# Hazard Identification and Risk Assessment

- Vulnerable facilities within the Town of Altavista, including Altavista Power Station, Altavista Fire Company, Altavista Area YMCA Family Center, Altavista Wastewater Plant, Altavista Power Station, several hazmat facilities, and so on are in the maximum inundation area.
- Vulnerable facilities in the maximum inundation zone within the Town of Brookneal: two historical sites, one communication facility, and water treatment plants with associated pump stations.
- Several historic sites, water treatment plants with associated pump stations in the county's incorporated area are in the maximum inundation area
- Several bridge and culvert impacts
- Several residences and businesses in the maximum inundation area
- Nuclear facility property in dam breach maximum inundation area

*Table 4-95 Number of Dams in each Hazard Potential Category within Campbell County, Virginia.*

Hazard Potential	Number of Dams
HIGH	2
HIGH, SPECIAL	1
SIGNIFICANT	5
LOW	3
LOW, SPECIAL	1
UNKNOWN	22

*Table 4-96 Critical facility and infrastructure in dam break inundation area within Campbell County*

Facility Name	Facility Type	Address	Coordinates	Floodplain	Inundation Zone
Avoca Museum	Attractions	1514 Main St, Altavista	37.1300, -79.2697	No	Smith Mountain Dam
WODI - AM - The Rain Broadcasting, Inc.	Communication Facility	1230 Radio Road Brookneal, VA 24528	37.0384, -78.9420	1%, 0.2%	Smith Mountain Dam
Altavista Power Station	Energy Facility	104 Wood Lane, Altavista	37.1188, -79.2735	No	Smith Mountain Dam
Leesville Hydro Plant	Energy Facility	Rt. 754, Hurt	37.0931, -79.4022	1%, 0.2%	Smith Mountain Dam
Altavista Fire Company	Fire Stations	1280 Main Street, Altavista	37.1199, -79.2755	No	Smith Mountain Dam
Lane Home Furnishings	HazMat Facility	701 5Th St, Altavista	37.1097, -79.2855	1%, 0.2%	Smith Mountain Dam
Abbott Laboratories - Ross Products Division	HazMat Facility	1516 Main St, Altavista	37.1333, -79.2658	No	Smith Mountain Dam
BGF Industries	HazMat Facility	401 Amherst Avenue, Altavista	37.1122, -79.2782	1%, 0.2%	Smith Mountain Dam
Dominion - Altavista Power Station	HazMat Facility	104 Wood Lane, Altavista	37.1187, -79.2734	No	Smith Mountain Dam





# Hazard Identification and Risk Assessment

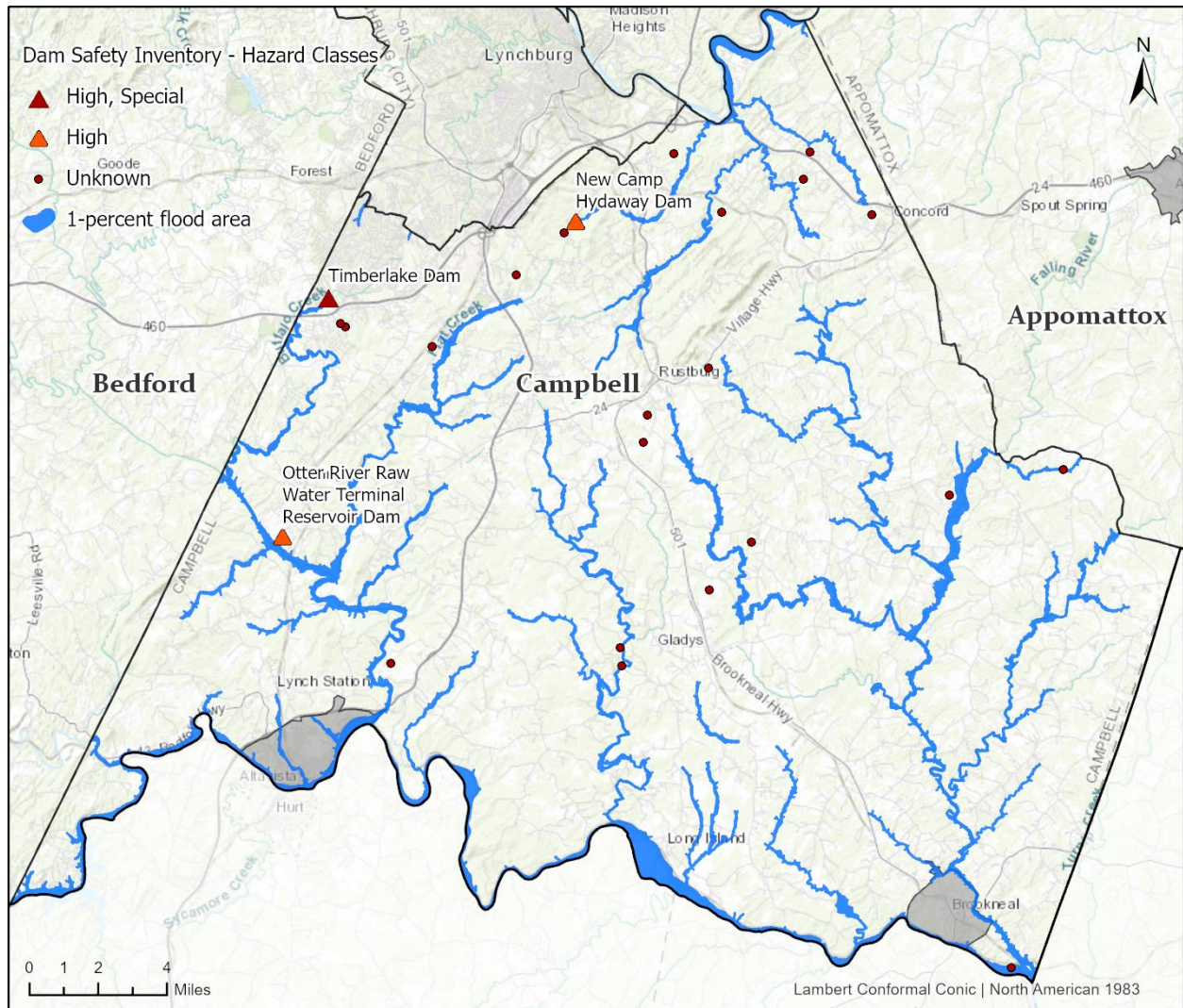
Facility Name	Facility Type	Address	Coordinates	Floodplain	Inundation Zone
Lynchburg Casting Industries	HazMat Facility	1132 Mt Athos Rd	37.4027, -79.0595	0.2%	Reusens Dam
Cat Rock Sluice	Historic Site	Brookneal	37.0436, -78.9599	1%, 0.2%	Smith Mountain Dam
Green Hill	Historic Site	378 Pannills Rd, Gladys	37.0621, -79.0722	No	Smith Mountain Dam
Red Hill	Historic Site	1430 Red Hill Rd, Brookneal	37.0322, -78.8980	No	Smith Mountain Dam
The Mansion	Historic Site	1580 Mansion Bridge Rd, Altavista	37.1246, -79.2399	No	Smith Mountain Dam
Walnut Hill	Historic Site	129 Johnson Mountain Rd, Evington	37.2088, -79.3079	No	Otter River Raw Water Terminal Reservoir Dam; Stroobants Dam
Six Mile Bridge	Historic Site	Mount Athos Rd & James River	37.3932, -79.0612	1%, 0.2%	Ivy Lake Dam; Reusens Dam
Altavista Area YMCA Family Center	Large Population Venue	1000 Franklin Ave, Altavista	37.1140, -79.2889	1%, 0.2%	Smith Mountain Dam
Altavista Police Department	Law Enforcement	510 7Th Street, Altavista	37.1103, -79.2899	No	Smith Mountain Dam
Campbell Co Util And Serv Auth/Sewer Pump Station	Sewer Pump Station	9625 Leesville Rd, Evington	37.2075, -79.2997	1%, 0.2%	Otter River Raw Water Terminal Reservoir Dam; Stroobants Dam
Brookneal Town - Falling River	Wastewater Treatment Plant	Wickliffe Ave, Brookneal	37.0522, -78.9340	1%, 0.2%	Smith Mountain Dam
Brookneal Town - Staunton River	Wastewater Treatment Plant	Radio Rd, Brookneal	37.0376, -78.9391	1%, 0.2%	Smith Mountain Dam
Altavista Wastewater Plant	Wastewater Treatment Plant	Ln Access Rd, Altavista	37.1123, -79.2740	1%, 0.2%	Smith Mountain Dam
Altavista Water Treatment Plant	Wastewater Treatment Plant	20 Ricky Van Shelton Dr, Hurt	37.1045, -79.2833	No	Smith Mountain Dam
Otter River Water Treatment Plant	Wastewater Treatment Plant	9605 Leesville Rd, Evington	37.2113, -79.2988	No	Otter River Raw Water Terminal Reservoir Dam
Otter River Water Tank	Water Storage Facility	9625 Leesville Rd, Evington	37.2109, -79.2992	No	Otter River Raw Water Terminal Reservoir Dam



# Hazard Identification and Risk Assessment

## High and Unknown Hazard Dams in Campbell County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: Virginia Dam Safety Inventory System, as of 02/07/2020  
Center for Geospatial Information Technology at Virginia Tech. 02/2020



Figure 4-75 Location of High and Unknown hazard dams in Campbell County, Virginia.

### 4.4.3.4.2 Risk Analysis of Individual Dams

#### ***New Camp Hydaway Dam***

##### General information

New Camp Hydaway Dam is located south of the City of Lynchburg in Campbell County, Virginia, just upstream of Route 677 along Opossum Creek and approximately 2,500 feet downstream of the existing Camp Hydaway Dam. The dam creates a 37-acre impoundment used for recreation. The drainage area at the dam is 2.69 square





# Hazard Identification and Risk Assessment

miles. The reservoir flood storage capacity is 915 acre-feet at the emergency spillway crest elevation, 813.5 feet. Downstream of the dam, Opossum Creek passes under VA Route 677 (Camp Hydaway Road) and then passes under several railroads and roads (including VA Route 677 Camp Hydaway Road, Route 669 Lone Jack Road, Route 501 Campbell Highway, Route 660 Eastbrook Road, and Route 460 Richmond Highway) before flowing into James River. This structure is classified as High Hazard Potential.

Note: The New Camp Hydaway Dam, Inventory No. 031035 is not constructed yet. Issuance of a DCR impounding structure construction permit for this dam is not anticipated until late Spring/early Summer 2020. The existing Camp Hydaway Dam, Inventory No. 031013 is currently present upstream of the proposed new and enlarged lake. The existing dam/lake will be decommissioned as part of the overall construction plan of new and enlarged dam/lake.

## Dam Break Scenario

Figure 4-76 is an overview map of the inundation zone for the PMF of New Camp Hydaway Dam, prepared by Geoffrey L. Cowan in October 2019 for the temporary EAP for final construction permit application for the dam.

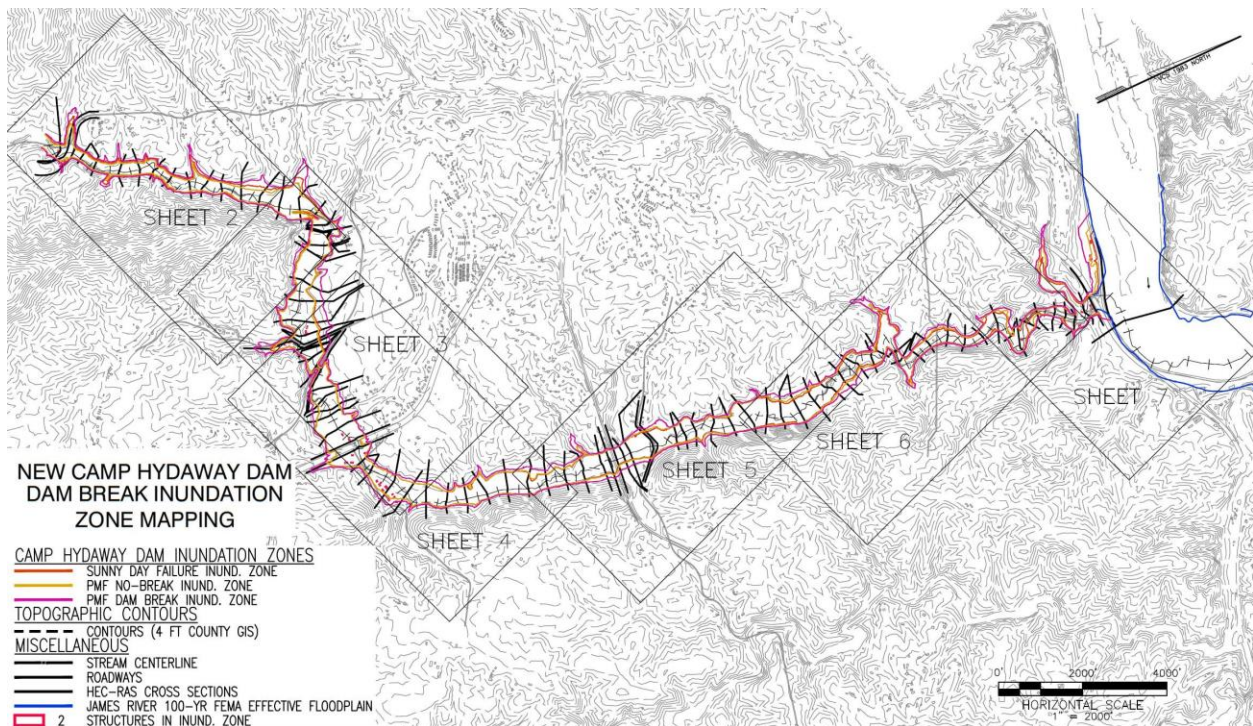


Figure 4-76 Inundation zone map of New Camp Hydaway Dam. (Source: Virginia DCR)

## Vulnerable structures

Three road bridges may be impacted during a dam breach event (Table 4-97). No critical facilities are found in the inundation zone.



# Hazard Identification and Risk Assessment

*Table 4-97 Vulnerable road bridges in dam breach scenario of New Camp Hydaway Dam*

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Opossum Creek	Camp Hydaway Road	1.60-Rt 664/1.48-Rt 1480	-79.1424	37.34468	1%, 0.2%
Opossum Creek	Eastbrook Road	1.10-Rt 665/2.20-Rt 662	-79.0902	37.35913	1%, 0.2%
Opossum Creek	NBL Campbell Hwy	1.87-Lynch CL/0.01-Rt 667	-79.1063	37.34481	1%, 0.2%

## **Otter River Raw Water Terminal Reservoir Dam**

### General information

The Otter River Raw Water Terminal Reservoir is a 42-foot tall impounding structure designed for water production in 1989. Surface water does not flow into the reservoir. Water is pumped into it from Big Otter River, which is approximately 0.2 miles downhill from the reservoir. Big Otter River is a tributary to Roanoke River in Campbell County, Virginia south of the Town of Evington. The water treatment plant is located within 150-feet of the toe of the reservoir embankment and one home is located downhill of the water treatment facility. Depending upon the location of a dam breach, the water treatment plant may or may not be directly in the path of the flood waters. If the dam were to breach directly above the water treatment plant, the plant would be significantly damaged and loss of life would be probable if it were occupied at the time. This reservoir is therefore classified as having a High Hazard Potential.

### Dam Break Scenario

Figure 4-77 is an overview map of the inundation zone for the PMF of Otter River Raw Water Terminal Reservoir Dam, completed by Prepared by Hurt & Proffitt, Inc. in April 2018 for the EAP of the dam.





# Hazard Identification and Risk Assessment

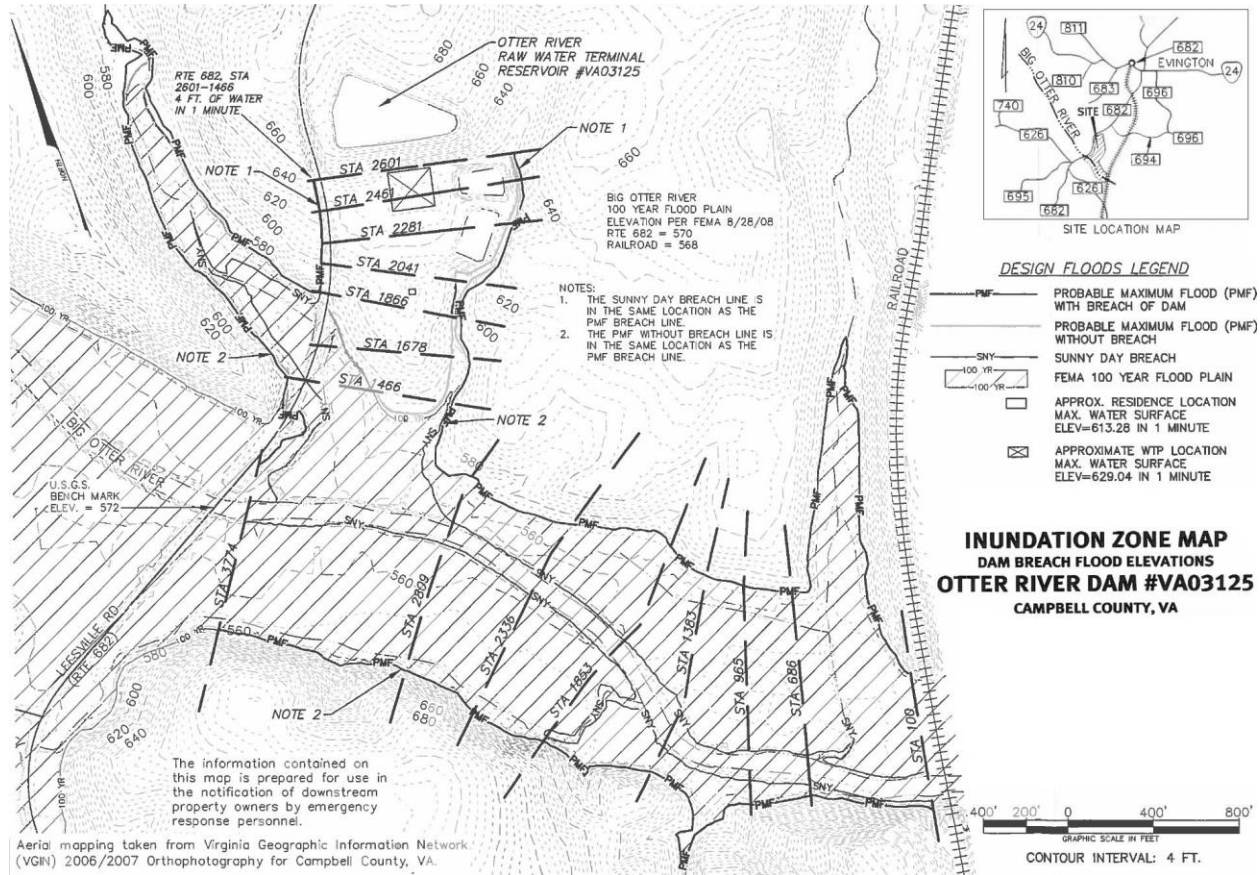


Figure 4-77 Inundation zone map of Otter River Raw Water Terminal Reservoir Dam. (Source: Virginia DCR)

## Vulnerable structures

The Otter River Water Treatment Plant and associated water tank and sewer pump station are in the inundation zone, along with Walnut Hill historic site (Table 4-98). Leesville Rd. would be impacted during dam failure. No road bridges are found in the inundation zone.

Table 4-98 Vulnerable facilities and infrastructures in dam breach zone of Otter River Raw Water Terminal Reservoir Dam

Name	Facility Type	Location	Locality	Lon	Lat	In flood zone
Walnut Hill	129 Johnson Mountain Rd, Evington	Historic Site	Campbell	-79.3079	37.2088	No
Otter River Water Tank	9625 Leesville Road	Water Storage Facility	Campbell	-79.2992	37.2109	No
Otter River Water Treatment Plant	9605 Leesville Rd, Evington	Wastewater Treatment Plant	Campbell	-79.2988	37.2113	No
Campbell Co Util And Serv Auth/ Sewer Pump Station	9625 Leesville Rd, Evington	Sewer Pump Station	Campbell	-79.2997	37.2075	1%, 0.2%



# Hazard Identification and Risk Assessment

## ***Timberlake Dam***

### General information

The Timberlake Dam is located at the end of Timberlake Drive, Lynchburg. The dam is classified as a High Hazard Dam as determined by the Hazard Classifications performed by Hurt and Proffitt. It creates a 57-acre impoundment used for recreation. The drainage area is approximately 3,174.4 acres or 4.96 square miles. The reservoir flood capacity storage is 1,449 acre-feet at the emergency spillway crest, elevation 813.6 feet. This site is operated by the Timberlake Homeowners Association in Campbell County.

### Dam break inundation zone

Downstream of the Timberlake Dam, Buffalo Creek flows through commercial and residential areas. Figure 4-78 shows the inundation zone for the PMF of the dam, digitized from a scan of EAP map. The original map was completed by Hurt & Proffitt, Inc. in June 2019.





# Hazard Identification and Risk Assessment

## Dam Break Inundation Zone of Timberlake Dam in Campbell County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020

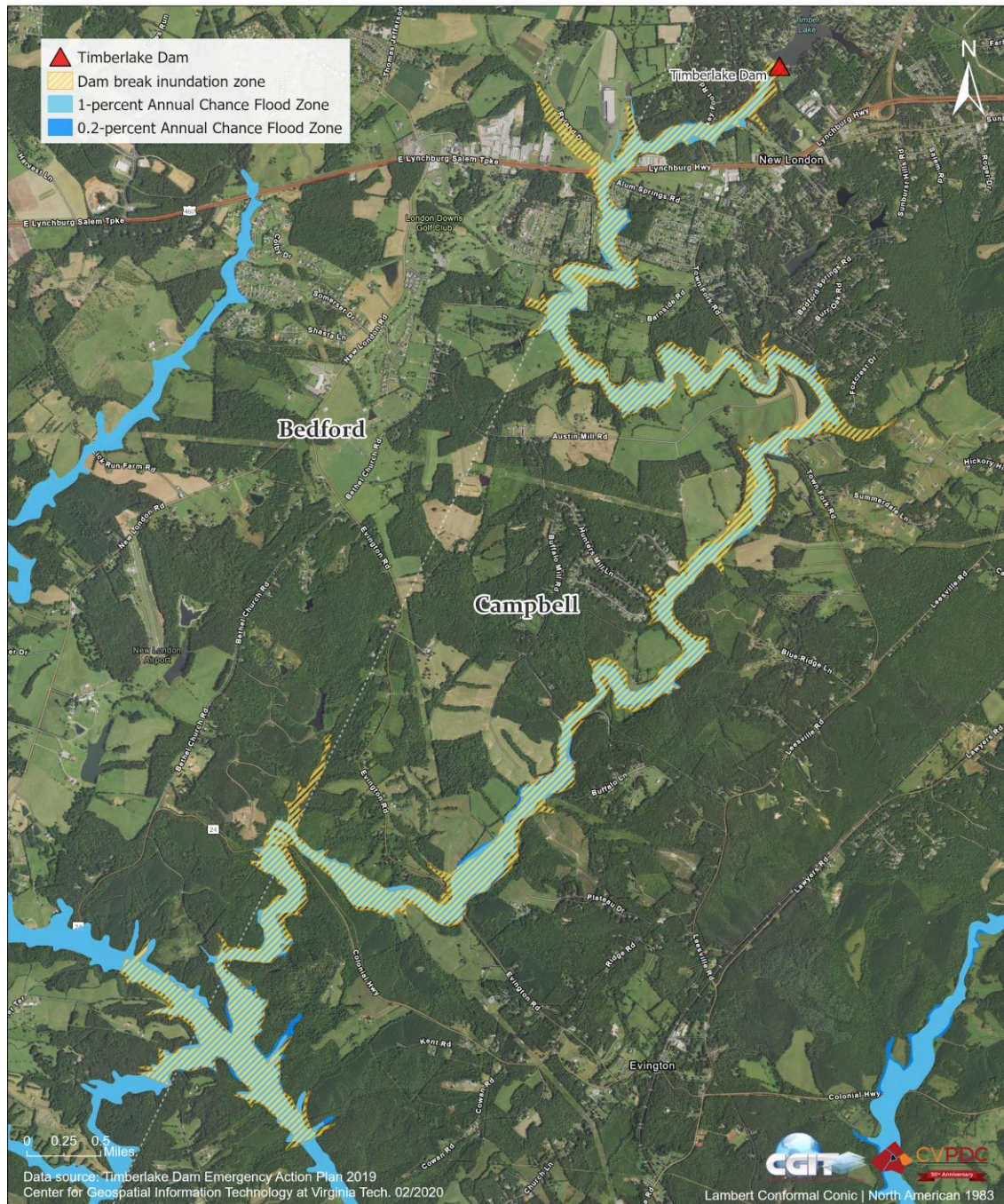


Figure 4-78 Inundation zone map of Timberlake Dam. (Source: Virginia DCR)

### Vulnerable structures

Several roads are subject to inundation during a dam breach even, including Turkeyfoot Road (Route 623), Lynchburg Highway (Route 460), Alum Springs Road (Route 858), Town Fork Road (Route 623), Evington Road



# Hazard Identification and Risk Assessment

(Route 811) and Wyatts Way Road (Route 24). Eight road bridges may also be impacted (Table 4-99). No critical facilities are found in the inundation zone.

*Table 4-99 Vulnerable road bridges in dam breach zone of Timberlake Dam*

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Wyatts Way/24	Buffalo Creek	0.11 Camp Co; 7.54 Rt 43E	-79.3242	37.25219	1%, 0.2%
Alum Spgs. Rd 858	Buffalo Creek	0.02 Rt 649; 0.02 Cpbl Co	-79.291	37.30425	1%, 0.2%
Route 460 WBL	Buffalo Creek	0.06-Bed Co/1.34-460 Bus	-79.2899	37.30508	1%, 0.2%
Town Fork Road	Buffalo Creek	0.06-Rt.1594/0.30-Rt.625	-79.273	37.2841	1%, 0.2%
Turkeyfoot Road	Buffalo Creek	.19-Rt 460 / .18-Rt 1400	-79.2812	37.30777	1%, 0.2%
Evington Road	Buffalo Creek	0.60-Rt 934/2.10-Bedfo CL	-79.3052	37.24731	1%, 0.2%
Town Fork Road	Buffalo Creek	0.65-Rt.871 / 0.15-Rt.625	-79.2747	37.29001	1%, 0.2%
Buffalo Mill Road	Buffalo Creek	2.93 Rt 625/1.37 Rt 682	-79.2947	37.26195	No

#### 4.4.3.5 City of Lynchburg

There are a total of 6 dams within the City of Lynchburg recorded in DCR DSIS inventory (Table 4-100). Of those dams, 2 are of unknown/undetermined category and 3 (50%) are classified as High Hazard Potential, including College Lake Dam, Lake Summit Dam, and Lakeland Dam (Figure 4-79).

The City of Lynchburg Open Data Portal provides the inundation zone GIS dataset for high hazard dams in the city. It is worth noting that digitized EAP maps (or DBIZ maps) for high hazard dams elsewhere in the PDC are unavailable from DCR or local governments. Geospatial boundaries from dam inundation studies facilitate more accurate risk assessment and make loss analyses possible (as in this section). They should be considered in the future plan update for other jurisdictions once available.

##### 4.4.3.5.1 Principal Dam Breach Problems

The following issues have been identified for dam breach scenarios in the City of Lynchburg:

- Four electrical substations
- Water treatment plant
- Children's Museum
- Lynchburg Expy, Lakeside Drive, and Timberlake Rd
- CSX Transportation Railroad and Norfolk Southern Railroad impacts
- Several bridge and culvert impacts
- Several residences and businesses in the maximum inundation area (some outside the 100-year floodplain)
- Redevelopment area overlaps with the dam breach inundation area
- Recent high hazard dam breach (College Lake Dam)





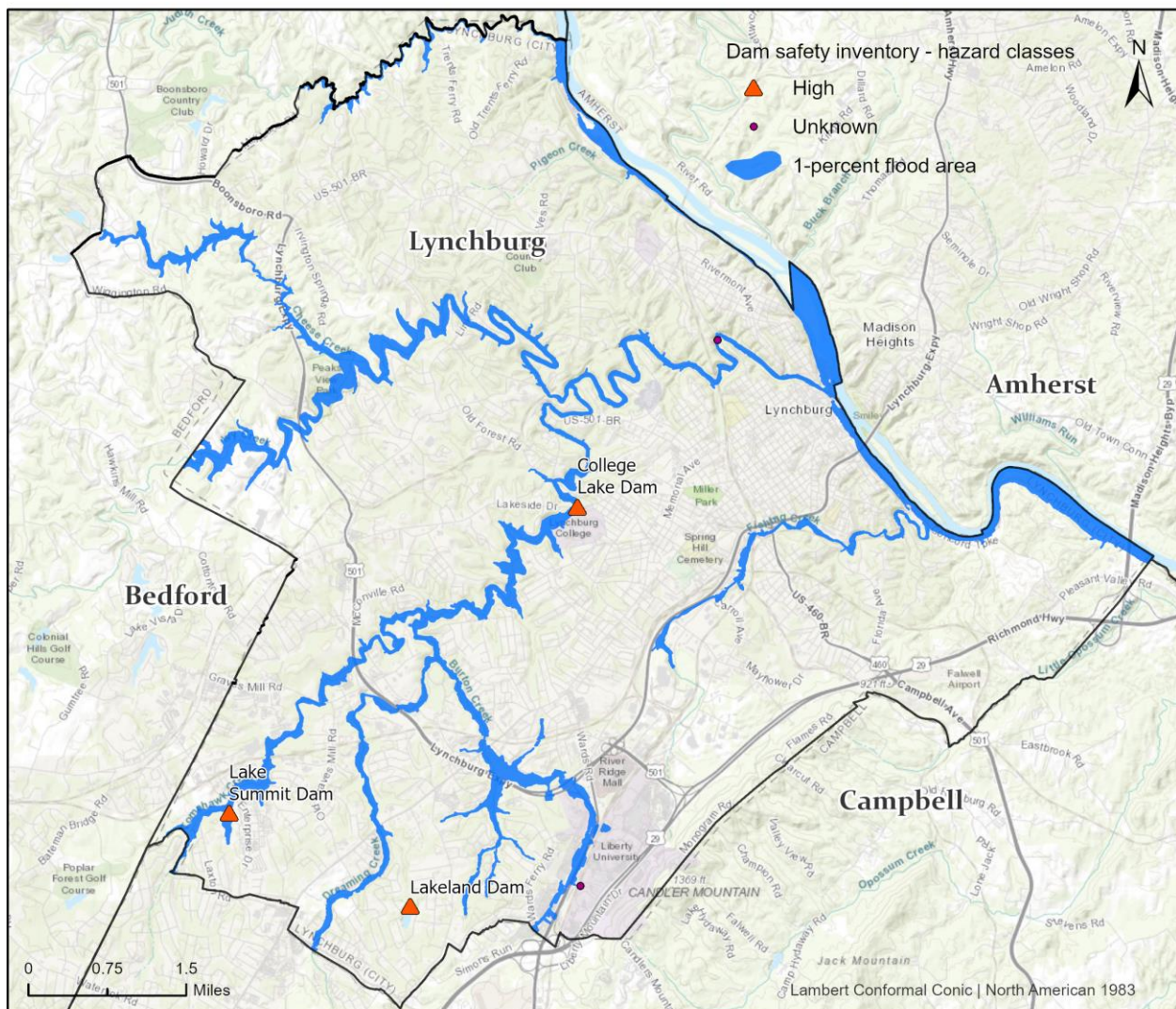
# Hazard Identification and Risk Assessment

Table 4-100 Number of Dams in each Hazard Potential Category within Lynchburg City, Virginia.

Hazard Potential	Number of Dams
HIGH	3
HIGH, SPECIAL	0
SIGNIFICANT	0
LOW	1
LOW, SPECIAL	0
UNKNOWN	2

## High and Unknown Hazard Dams in Lynchburg City, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020





# Hazard Identification and Risk Assessment

## 4.4.3.5.2 Vulnerable Population

The high hazard dams within Lynchburg, as well as outside dams near the city border (Ivy Lake Dam and Reusens Dam), account for approximately 6,270 acres total inundation areas across the City of Lynchburg and surrounding jurisdictions. Of these inundation areas, there are about 1,800 acres (8% of the entire area of the city) within the boundary of Lynchburg. The vulnerable populations within or near the inundation zone include 16.5% of the young and 18.7% of the old population, 14.9% of the black population and 12.7% of the Native American population (also see Figure 4-80, Figure 4-81, Figure 4-82, and Figure 4-83). Table 4-101 describes these demographic profiles of the downstream inundation areas from the dams and compares those to the overall demographic makeup of the city.

*Table 4-101 Comparison of demographics in DBIZ and in City of Lynchburg (Source: US Census 2010)*

	Young Population (age <18)	Old Population (age>65)	White Population	Black Population	Native American Population
Lynchburg City (Total)	14,773	10,551	48,670	22,138	237
DBIZ area (Total)	2,441	1,977	6,913	3,295	30
DBIZ area (Percentage)	16.5%	18.7%	14.2%	14.9%	12.7%

## 4.4.3.5.3 Critical Facilities and Infrastructure

The Amazement Square Child Museum and electrical substation near James River are located in the dam inundation zones of Lynchburg's high hazard dams. The Reusens Dam Hydro Plant and one of its electrical substations sit in the Reusens Dam (Amherst County) inundation zone which traverses the city; the Westrock Converting Company, U.S. Pipe, and Lynchburg Foundry Co. Lower Basin Plant are found in the Ivy Lake Dam (Bedford County) inundation zone (Table 4-102).

*Table 4-102 Critical facility and Infrastructure in dam break inundation zone within City of Lynchburg*

Facility Name	Address	Facility Type	Coordinate	Floodplain	Inundation Zone
Amazement Square Child Museum	27 9Th St, Lynchburg	Attractions	37.4162, -79.1403	0.2%	College Lake Dam
Electrical Substation	127 Stonewall St, Lynchburg	Electrical Substation	37.4194, -79.1447	No	College Lake Dam
Electrical Substation	4370 Hydro St, Lynchburg	Electrical Substation	37.4622, -79.1872	1%; 0.2%	Reusens Dam (Amherst)
Reusens Dam Hydro Plant	4300 Hydro Street, Lynchburg	Energy Facility	37.4630, -79.1867	1%; 0.2%	Reusens Dam (Amherst)
Westrock Converting Company	1801 Concord Turnpike, Lynchburg	HazMat Facility	37.4034, -79.1281	1%; 0.2%	Ivy Lake Dam (Bedford)
U.S. Pipe	10 Adams Street, Lynchburg	HazMat Facility	37.4208, -79.1413	1%; 0.2%	Ivy Lake Dam (Bedford)



# Hazard Identification and Risk Assessment

Facility Name	Address	Facility Type	Coordinate	Floodplain	Inundation Zone
Lynchburg Foundry Co Lower Basin Plant	Garnet Street And Concord Turnpike	HazMat Facility	37.4071, -79.1318	1%; 0.2%	Ivy Lake Dam (Bedford)

*Note: The inundation zone formed by high hazard dams in both Lynchburg and adjacent jurisdictions near the city border are taken into account.*

#### 4.4.3.5.4 Community Growth Areas

Lynchburg's Comprehensive Plan 2013-2030 includes 19 locations as the community's future growth areas. These areas include Revitalization Areas, which focus on encouraging reinvestment and sensitive redevelopment in older commercial districts, and Development/Redevelopment Areas which focus on encouraging coordinated planning for large tracts of vacant, developable land that incorporates smart growth techniques on key gray-field and green-field sites throughout the City (Figure 4-84). Most of these growth areas don't overlap with the inundation zone, except the Downtown area near James River, and the Wyndhurst area, which includes Tomahawk Creek.





# Hazard Identification and Risk Assessment

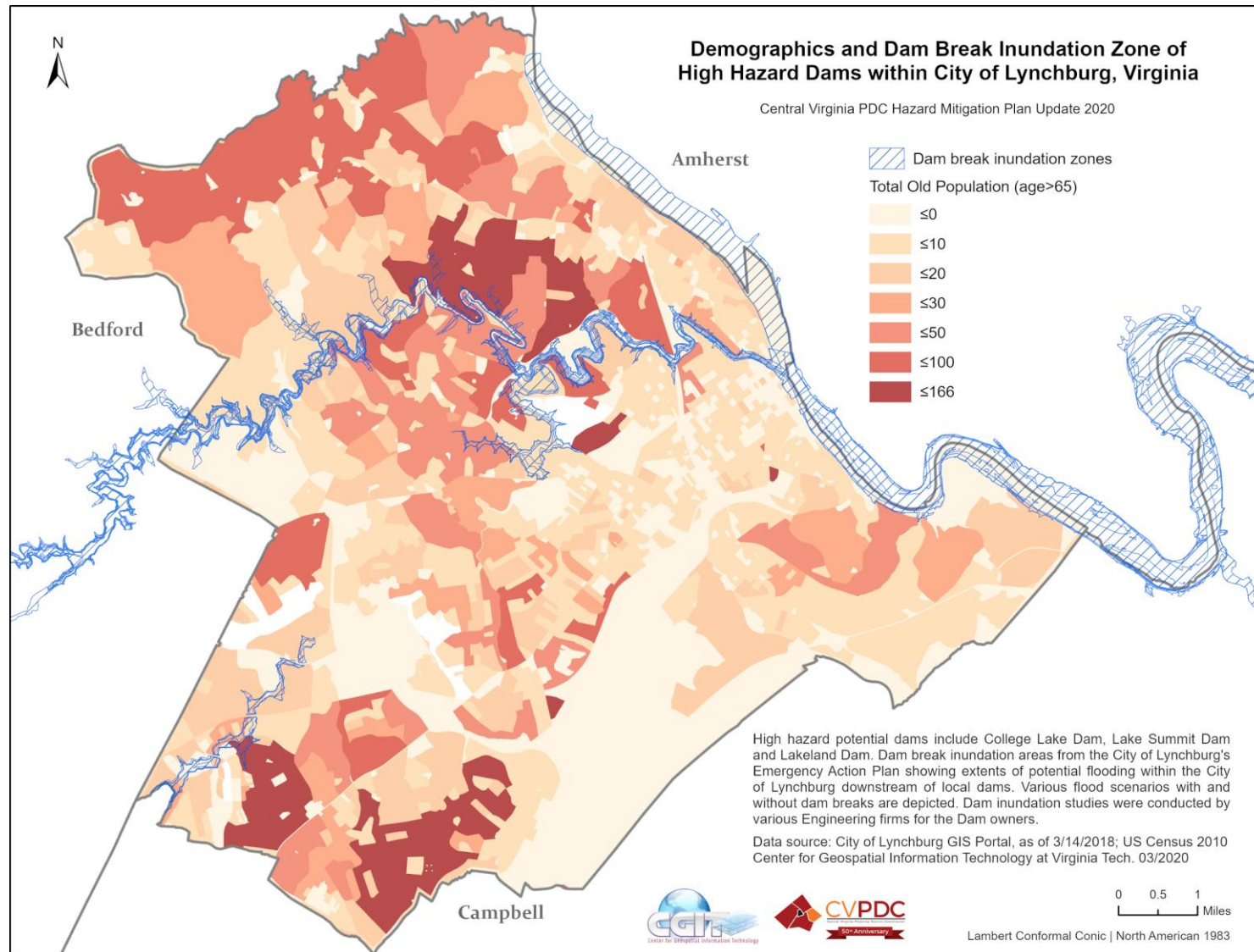


Figure 4-80 Demographics in dam break inundation zone of high hazard dams within City of Lynchburg, Virginia: Total old population (age > 65)





# Hazard Identification and Risk Assessment

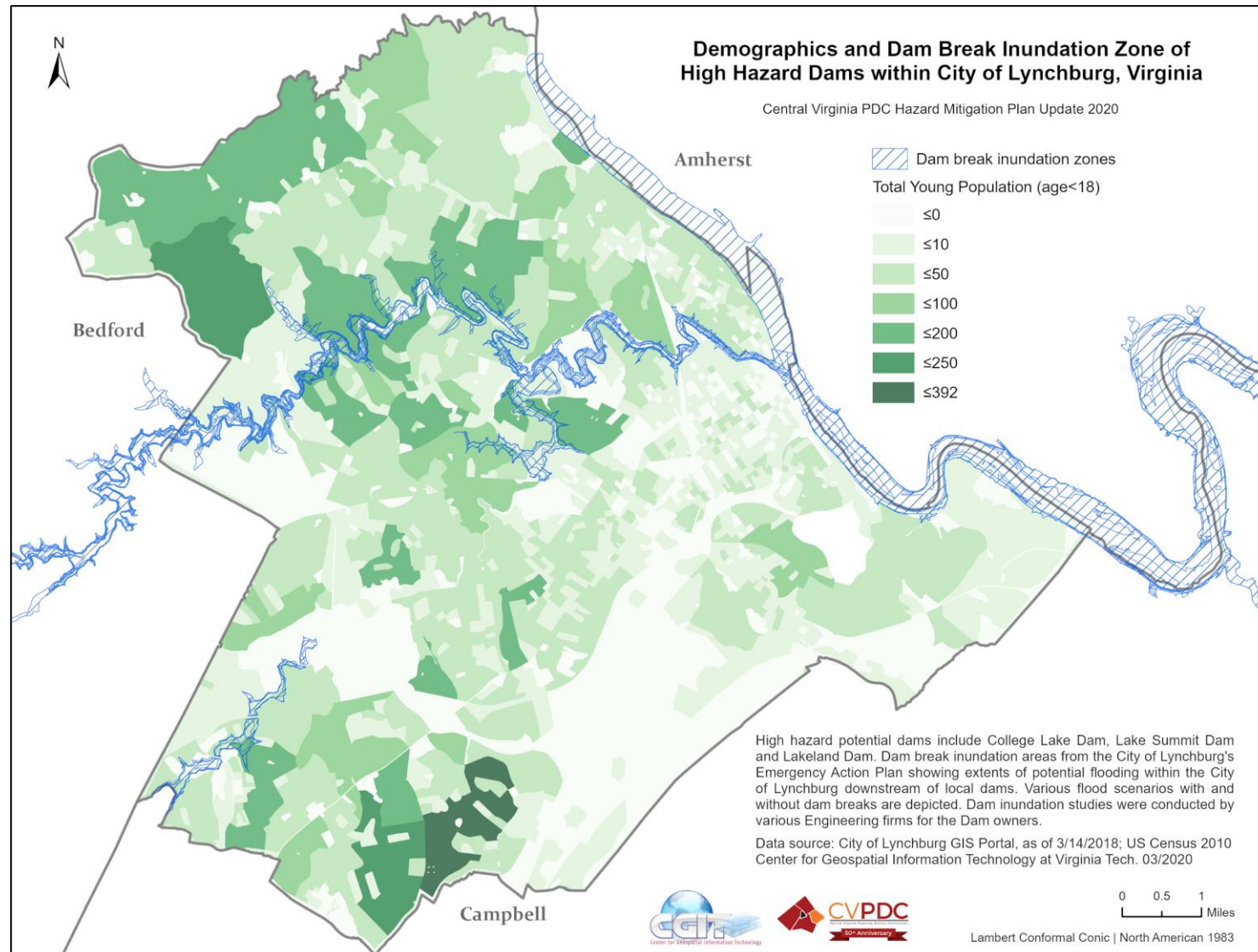


Figure 4-81 Demographics in dam break inundation zone of high hazard dams within City of Lynchburg, Virginia: Total young population (age < 18)



# Hazard Identification and Risk Assessment

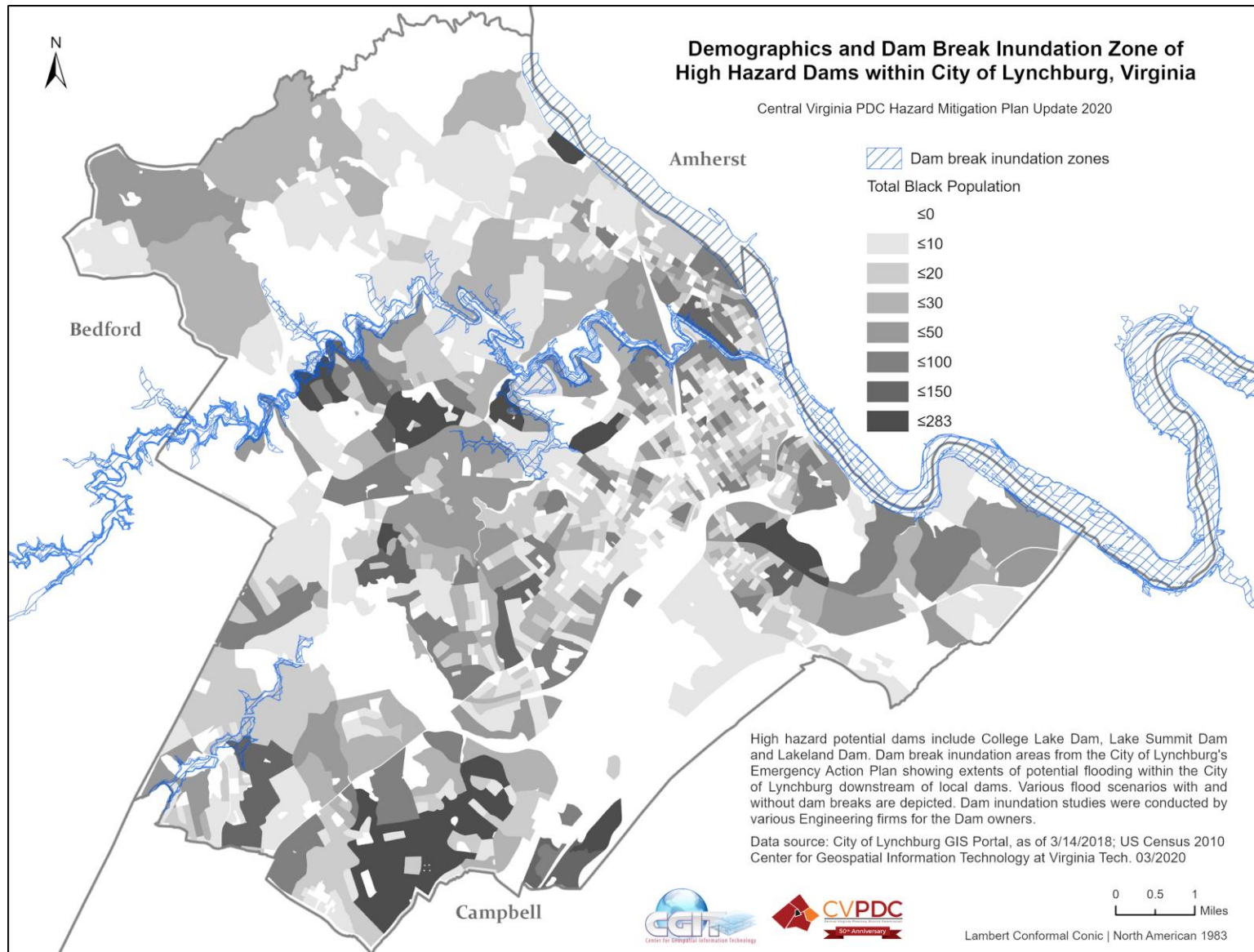


Figure 4-82 Demographics in dam break inundation zone of high hazard dams within City of Lynchburg, Virginia: Total Black population



# Hazard Identification and Risk Assessment

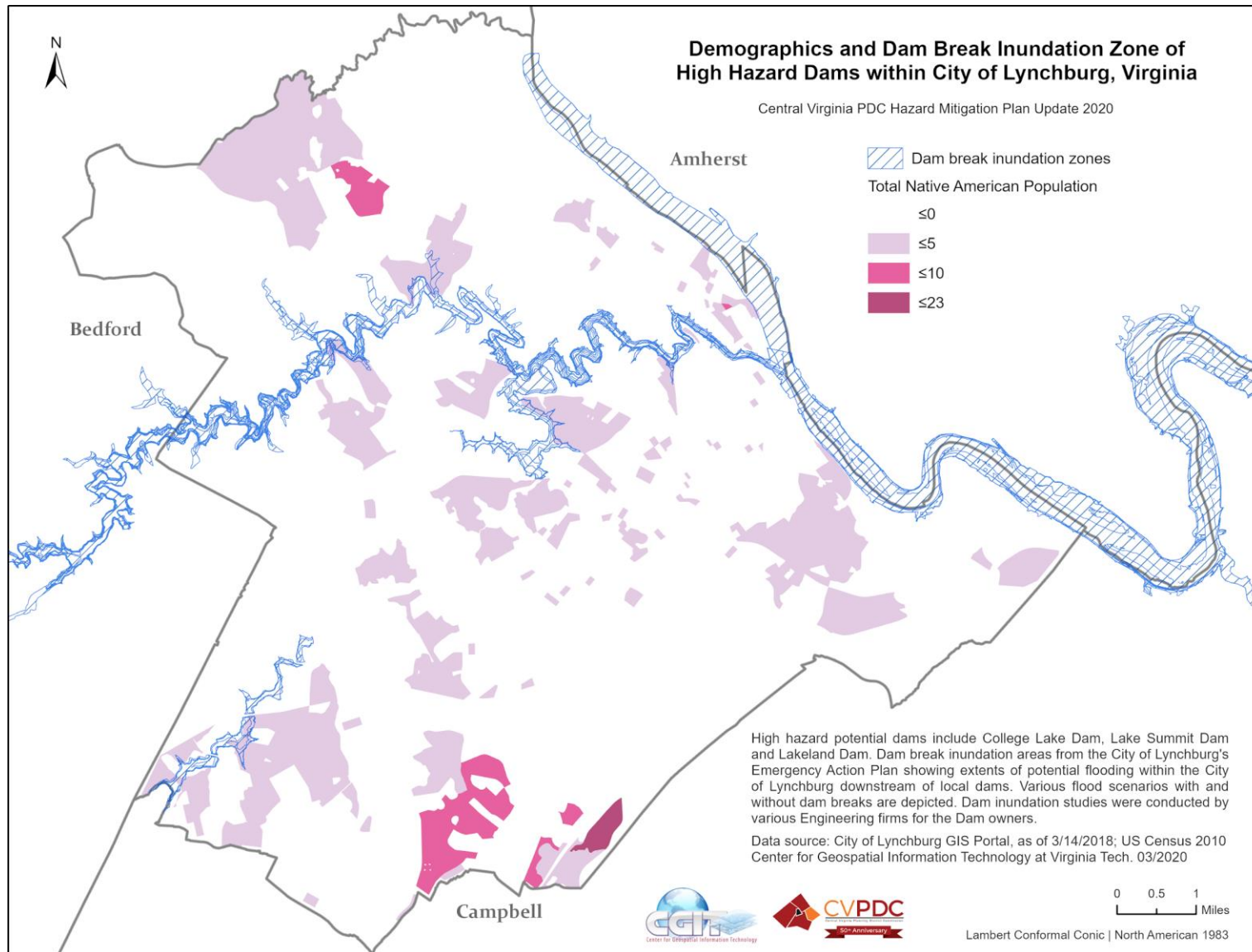


Figure 4-83 Demographics in dam break inundation zone of high hazard dams within City of Lynchburg, Virginia: Total Native American population





# Hazard Identification and Risk Assessment

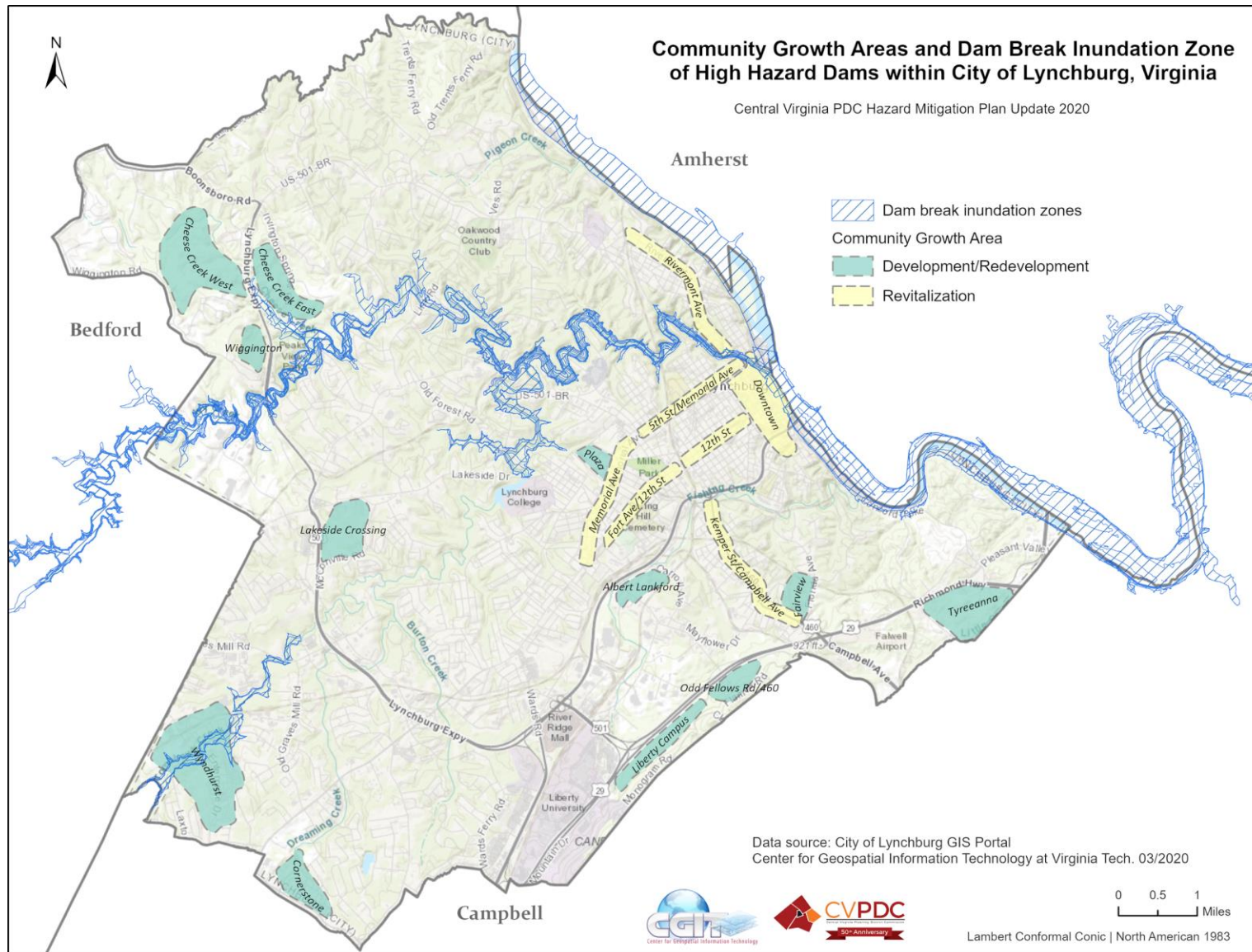


Figure 4-84 Community growth areas and dam break inundation zone of high hazard dams within City of Lynchburg, Virginia





# Hazard Identification and Risk Assessment

## 4.4.3.5.5 Risk Analysis of Individual Dam

### ***Lake Summit Dam***

#### General information

Lake Summit Dam is situated on Tomahawk Creek, approximately 0.2 miles upstream of Enterprise Drive (Rt. 1415) in Lynchburg, Virginia. The dam impounds Summit Lake, an approximate 8-acre reservoir at normal pool. The drainage area to the Summit Dam was calculated to be 1.1 square miles (706 acres) and predominantly consists of developed areas. Summit Dam was constructed as a recreational impoundment. The dam is 28 feet tall with a crest elevation of 761.6 feet and a normal pool elevation of 754.0 feet. The principal spillway consists of a 5-foot diameter concrete inlet tower with a 5-foot diameter outfall pipe. The exit channel discharges into the natural channel. The auxiliary spillway is located along the dam's left abutment with a grass control section and a bottom width of 30 feet. The spillway is reported to have a design capacity exceeding the 1-percent annual chance flood event. The dam is currently classified as a high hazard structure.

#### Dam break inundation zone

Figure 4-85 is the inundation zone map for the PMF of Lake Summit Dam. The digital format of the inundation zone boundary was provided by the City of Lynchburg GIS Portal.<sup>32</sup> The original data was developed as part of the EAP for the dam prepared May 29, 2014 by Froehling & Robertson, Inc.

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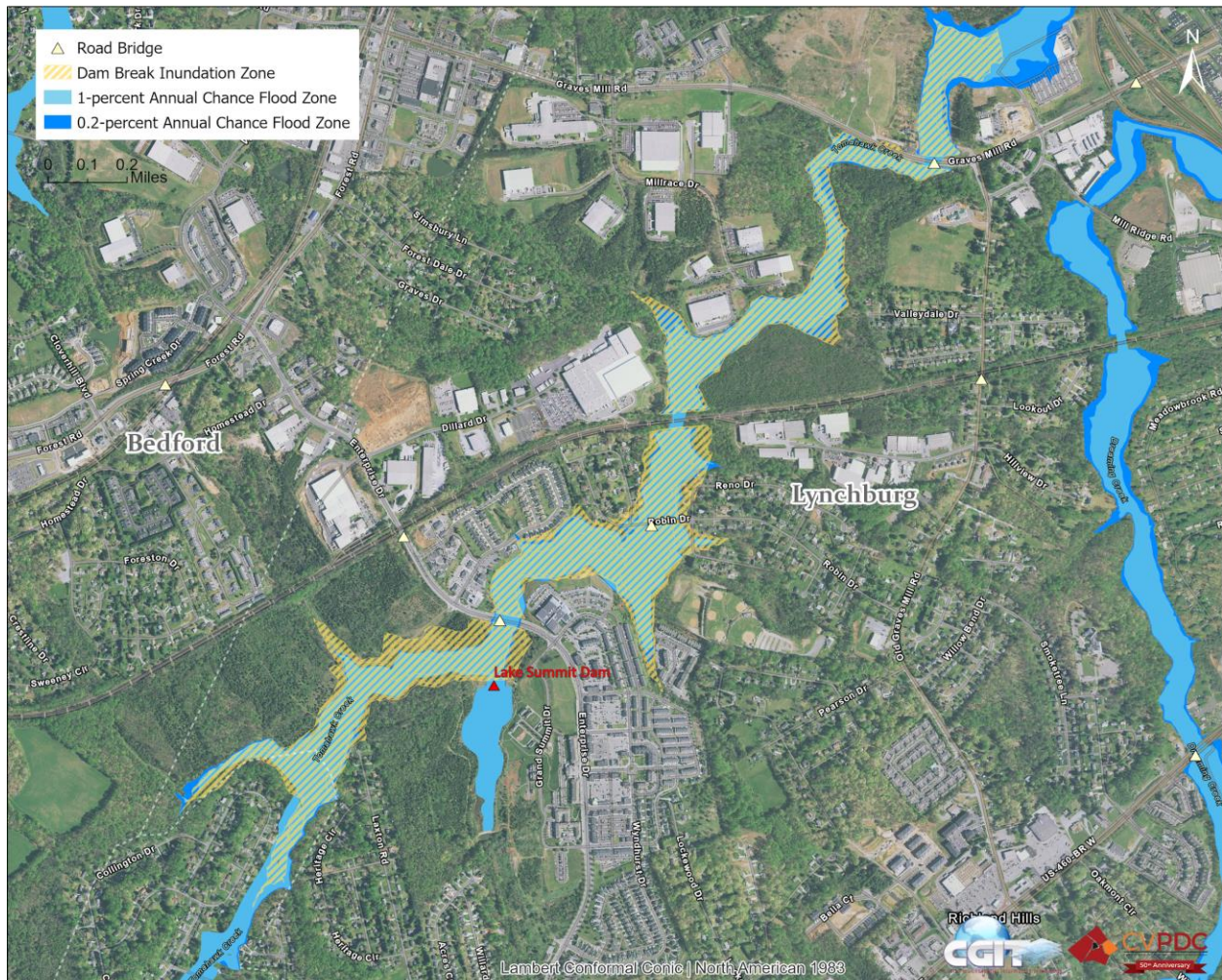
<sup>32</sup> Know My Zone! Flood and Dam Inundation Zone Look Up - Map.  
<https://www.arcgis.com/home/item.html?id=aea88b27b83943caa6a86b5411c475c5>



# Hazard Identification and Risk Assessment

## Dam Break Inundation Zone of Lake Summit Dam, Lynchburg, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020



Dam Inundation areas from the City of Lynchburg's Emergency Action Plan showing extents of potential flooding within the City of Lynchburg downstream of local dams. Various flood scenarios with and without dam breaks are depicted. Dam inundation studies were conducted by various Engineering firms for the Dam owners.

Data source: City of Lynchburg GIS Portal, as of 3/14/2018

Center for Geospatial Information Technology at Virginia Tech. 04/2020

Figure 4-85 Inundation zone map of Lake Summit Dam. (Source: Virginia DCR)

### Vulnerable structures

These roads may be impacted during a dam breach scenario: Graves Mill Road, Springvale Drive, Reno Drive, and Little Creek Road. Table 4-103 lists several vulnerable road bridges within the inundation zone. There is no critical facility in the zone.

Table 4-103 Vulnerable road bridges and tunnels in dam breach scenario of Lake Summit Dam

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Graves Mill Road	Tomahawk Creek	1.20RT221/.02 OLDGRVSMILL	-79.2282	37.3748	1%, 0.2%
Robin Drive	Tomahawk Creek	0.04 LCR - 0.56 OGMR	-79.2385	37.3642	1%, 0.2%
Enterprise Drive	Tomahawk Creek	.7 FR 661 / 1.0 RT. 1520	-79.2441	37.361	1%, 0.2%





# Hazard Identification and Risk Assessment

## Lakeland Dam

### General information

Lakeland Dam is a recreational dam that is located in Lynchburg, Virginia. It is an earthen dam and is approximately 550 feet long and 25.2 feet high. The width of the crest of the dam is 12.0 feet with an elevation of 858.5 feet. Lakeland Lake has a drainage area of 0.28 square miles and is 8.3 acres in area when the water level is at the primary spillway elevation of 854.0 feet. The discharge for the dam releases into a tributary that feeds into Dreaming Creek, which is located about one mile downstream from the dam. The dam is owned and operated by the Lakeland Club, Inc.

### Dam break inundation zone

Figure 4-86 is the inundation zone map for the PMF of Lakeland Dam, digitized from a scan of the EAP of the dam. The original map was prepared by Warner White Engineering Partners, Inc., in February 2013.

### Dam Break Inundation Zone of Lakeland Dam, Lynchburg, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020



Dam Inundation areas from the City of Lynchburg's Emergency Action Plan showing extents of potential flooding within the City of Lynchburg downstream of local dams. Various flood scenarios with and without dam breaks are depicted. Dam inundation studies were conducted by various Engineering firms for the Dam owners.

Data source: Lakeland Dam Emergency Action Plan 2013

Center for Geospatial Information Technology at Virginia Tech. 04/2020

Figure 4-86 Inundation zone map of Lakeland Dam. (Source: Virginia DCR)



# Hazard Identification and Risk Assessment

## Vulnerable Structures

The following roads may be impacted during a dam breach scenario: primary roads, including Lynchburg Expy (near Exit 11) and Timberlake Rd; and local secondary roads including Mill Ridge Rd, Graves Mill Rd, Takoma St, Lawton Ln, and Rhonda Rd. Table 4-104 lists the vulnerable road bridges within the inundation zone.

*Table 4-104 Vulnerable road bridges and tunnels in dam breach scenario of Lakeland Dam*

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Timberlake Road	Dreaming Creek	0104291 EXP 0110CAMPB CL	-79.2186	37.3575	1%, 0.2%
Graves Mill Road	Dreaming Creek	.08 L.Bowen Dr .2 Old Mil	-79.212	37.3744	1%, 0.2%

## **College Lake Dam**

### General information

College Lake Dam is a High Hazard Potential earth embankment dam designed by the Virginia Highway Department (now the Virginia Department of Transportation) and constructed in 1934. Lakeside Drive (US Route 221) is a two-lane, heavily trafficked road that runs along the dam crest. The dam impounds College Lake, a recreational impoundment owned by the University of Lynchburg. The dam is located on Blackwater Creek, 7.32 miles upstream from its confluence with James River in downtown Lynchburg.

The dam is a 35.4 foot high earth embankment dam with a central clay core. The dam is about 300 feet long, with a crest width of about 54 feet. The upstream slope of the dam is approximately 2.25:1 (horizontal to vertical) and is partially armored with riprap. The original masonry primary spillway at the east abutment built in 1939 was removed about 1960, leaving a 60 foot wide uneven exposed rock cut which now serves as the principal spillway. No emergency spillway has ever existed. Freeboard at normal water level is approximately 11 feet. A concrete arch bridge carrying Lakeside Drive spans this spillway with the bridge abutments defining each end. An aboveground 24 inch sanitary sewer supported by concrete piers passes over the primary spillway through the bridge opening. A 42 inch below ground sanitary sewer passes through the west abutment.

### Dam Break Scenario

The dam break analysis and inundation mapping of College Lake Dam were completed by Black & Veatch for the City of Lynchburg, and are contained in the May 2019 EAP of the dam. Figure 4-87 provides an overview of the inundation zone and the location of vulnerable facilities within the zone.

### Vulnerable Structures

During a dam breach event, several major roadways may be impacted. CSX Transportation railroad tracks near the south bank of James River and part of Norfolk Southern Railroad may be flooded. Lakeside Drive would be closed from Old Forest Road to Moorman Drive. Highways and local main arteries like Langhorne Rd (Route 501), 5th Street (Route 163), Rivermont Avenue (Route 501A), etc. would be impacted (Figure 4-88). In addition, the following roads would be blocked if the dam breaks.

- 20 block 7th St
- 20 block 9th St
- 3000 block Birchwood Dr
- 20-40 block Cabell St





# Hazard Identification and Risk Assessment

- 0-20 block Clifton St
- 100 block Halsey Rd
- 2300 block Heronhill Pl
- 2800 block Hill St
- 3200 block Hill St
- 1900 block Hillsdale Rd
- 100-500 block Hillside Ct
- 700 block Jefferson St
- 2800 block Kulman Pl
- 2200 block Oriole Pl
- 200-300 block Peninsular St
- 100-200 block Stonewall St
- 1900 block Thomson Dr

There are also several vulnerable road bridges and the Amazement Square Children's Museum are located in the dam breach zone of College Lake Dam (Table 4-105 and Table 4-106).

*Table 4-105 Vulnerable road bridges in dam breach scenario of College Lake Dam*

Road Name	Crossing	Bridge Location	Lon	Lat	In flood zone
Cranehill Drive	Ivy Creek	0.35LINKHORN/0.01LANGHORN	-79.19012	37.41823	No
Hill Street	Blackwater Creek	0025BDWAY ST 0009LGHE RD	-79.18784	37.41218	1%, 0.2%
Hollins Mill Road	Blackwater Creek	.89 RT 501 / .84 RT 29 B	-79.15955	37.42533	1%, 0.2%
Lakeside Drive	Blackwater Creek	0019291 0084WCL LYNC	-79.18393	37.40163	0.2%
Langhorne Road	Ivy Creek	0.1-Crnhill Dr./0.1-Halsy	-79.18835	37.41675	No
Langhorne Road	Blackwater Creek	.0-Halsey/.14-Kulman	-79.18866	37.41574	No
Old Forest Road	Blackwater Creek	0047221 0125LINKHYDR	-79.18791	37.40524	1%, 0.2%

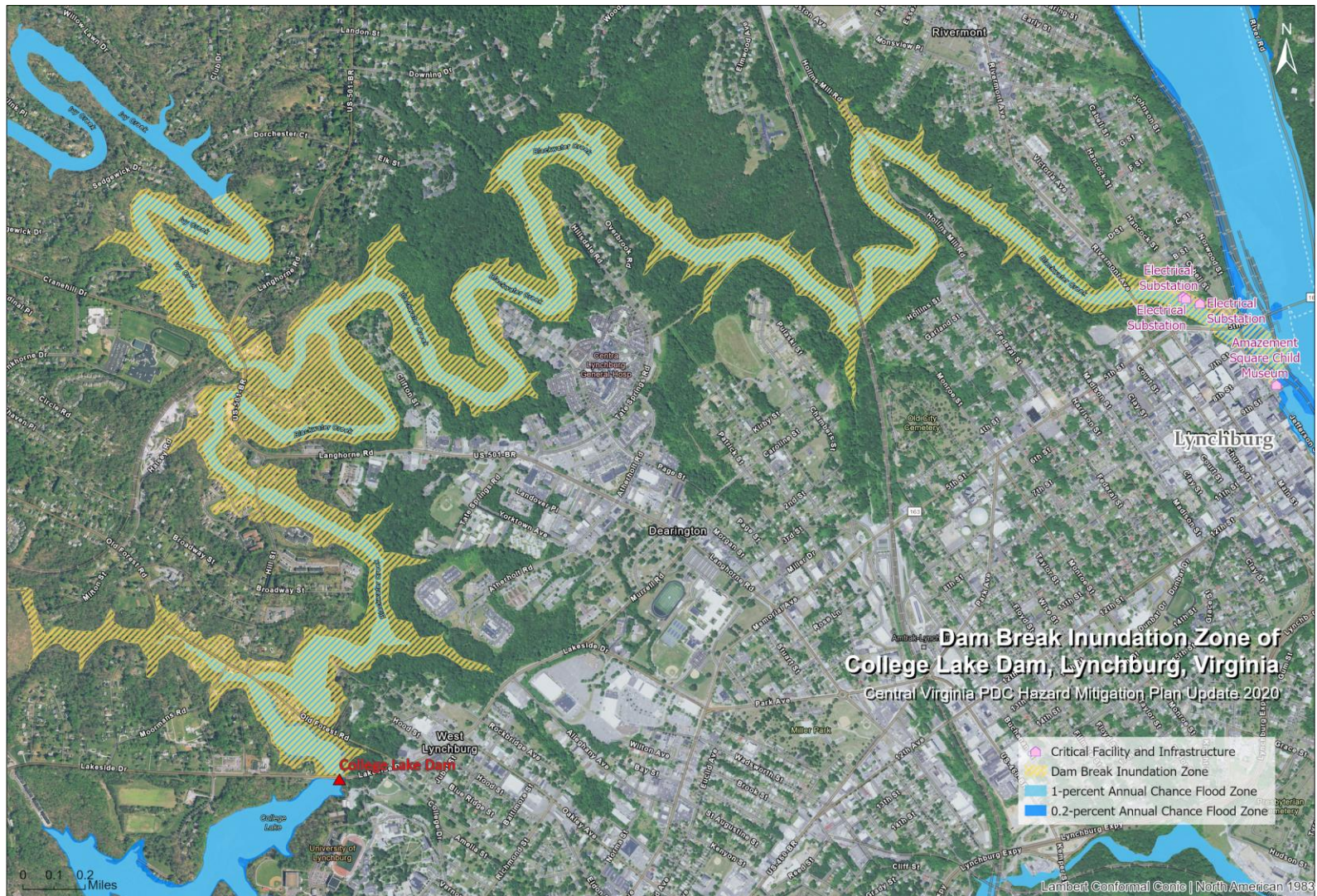
*Table 4-106 Vulnerable facilities and infrastructures in dam breach zone of College Lake Dam*

Name	Facility Type	Location	Locality	Lon	Lat	In flood zone
Amazement Square Children's Museum	Museum	27 9th St	Lynchburg	-79.1405	37.41619	No





# Hazard Identification and Risk Assessment



Dam inundation areas from the City of Lynchburg's Emergency Action Plan showing extents of potential flooding within the City of Lynchburg downstream of local dams. Various flood scenarios with and without dam breaks are depicted. Dam inundation studies were conducted by various Engineering firms for the Dam owners.  
Data source: City of Lynchburg GIS Portal, as of 3/14/2018  
Center for Geospatial Information Technology at Virginia Tech. 04/2020

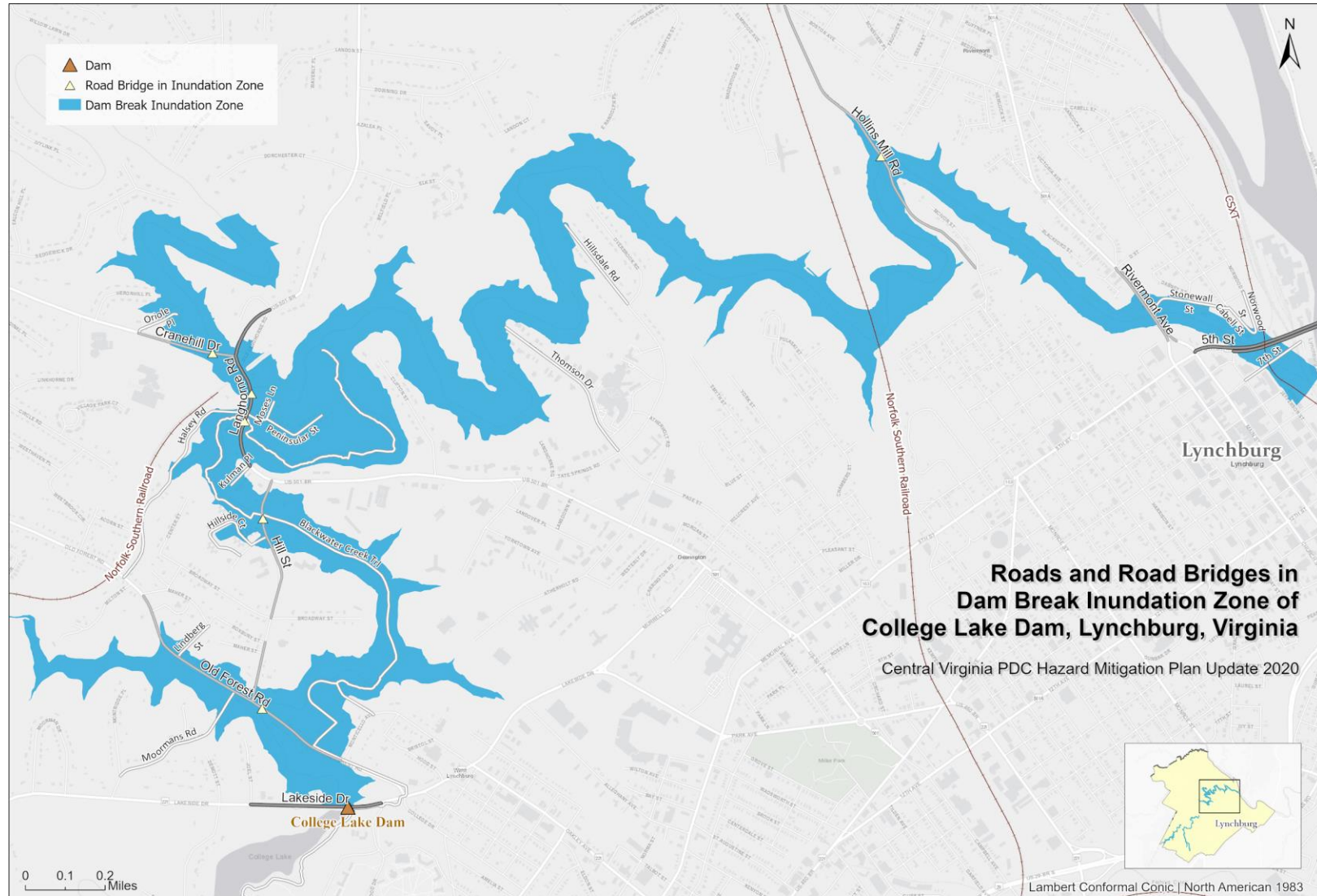


Figure 4-87 Dam Break Inundation Zone of College Lake Dam





# Hazard Identification and Risk Assessment



Dam Inundation areas from the City of Lynchburg's Emergency Action Plan showing extents of potential flooding within the City of Lynchburg downstream of local dams. Various flood scenarios with and without dam breaks are depicted. Dam inundation studies were conducted by various Engineering firms for the Dam owners. Data source: City of Lynchburg GIS Portal, as of 3/14/2018; VGIN RCL 2019Q4; US DOT National Bridge Inventory | Center for Geospatial Information Technology at Virginia Tech. 04/2020



Figure 4-88 Vulnerable Roads and Road Bridges in Dam Break Inundation Zone of College Lake Dam



# Hazard Identification and Risk Assessment

## Economic Losses analysis

Flood scenarios inundation study of high hazard dams are as follows:

- PMF with dam break
- PMF without dam break
- 90 Percent PMF with dam break
- 90 Percent PMF without dam break
- 20 percent PMF with dam break
- 20 Percent PMF without dam break
- Sunny day

Using Hazus, a PMF with dam break scenario was used to estimate a failure of the College Lake Dam. The PMF is the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the drainage basin under study.

A flood depth grid for the College Lake Dam failure scenario was prepared using  $\frac{1}{8}$  arc second (approximately 10 meters or 33 feet) DEM and the College Lake Dam failure scenario inundation area (Lynchburg Open Data portal).<sup>33</sup> The dam inundation area boundary is taken from the City of Lynchburg's EAP and shows the extent of potential flooding within the City downstream of local dams. Various flood scenarios with and without dam breaks are depicted in the plan.

Hazus level 2 analysis was conducted for the above scenario to estimate the direct losses from a dam breach. The Hazus default depth damage functions were replaced by higher loss depth damage functions found in the Hazus library. Detailed building level information required to run a level two analysis was combined from various sources. More information about the methodology and datasets can be found within the flooding hazard data section as well as the appendices. The direct economic loss estimates are provided in Table 4-107 and Table 4-108. Figure 4-89 displays the buildings that will be damaged from this scenario based on the losses incurred in the City of Lynchburg.

*Table 4-107 Direct Economic Losses for Impacted Facilities (College Lake Dam Breach Scenario)*

Capital Stock Exposure		Capital Stock Losses				Loss Ratio	
Building Exposure (\$K)	Contents Exposure (\$K)	Building Loss (\$K)	Contents Loss (\$K)	Inventory Loss (\$K)	Total Loss (\$K)	Buildings %	Contents %
93,880.56	71,080.75	47,320.33	55,223.03	1,346.43	103,889.79	56.2	77.9

*Table 4-108 Direct Economic Losses by Building Occupancy (College Lake Dam Breach Scenario)*

Locality	Residential (\$K)	Commercial (\$K)	Industrial (\$K)	Government (\$K)	Religion (\$K)	Education (\$K)
Total Loss (\$K)	37,233.02	56,252.96	7,362.67	0	731.36	963.35

<sup>33</sup> <http://data-cityoflynchburg.opendata.arcgis.com/datasets/dam-inundation>

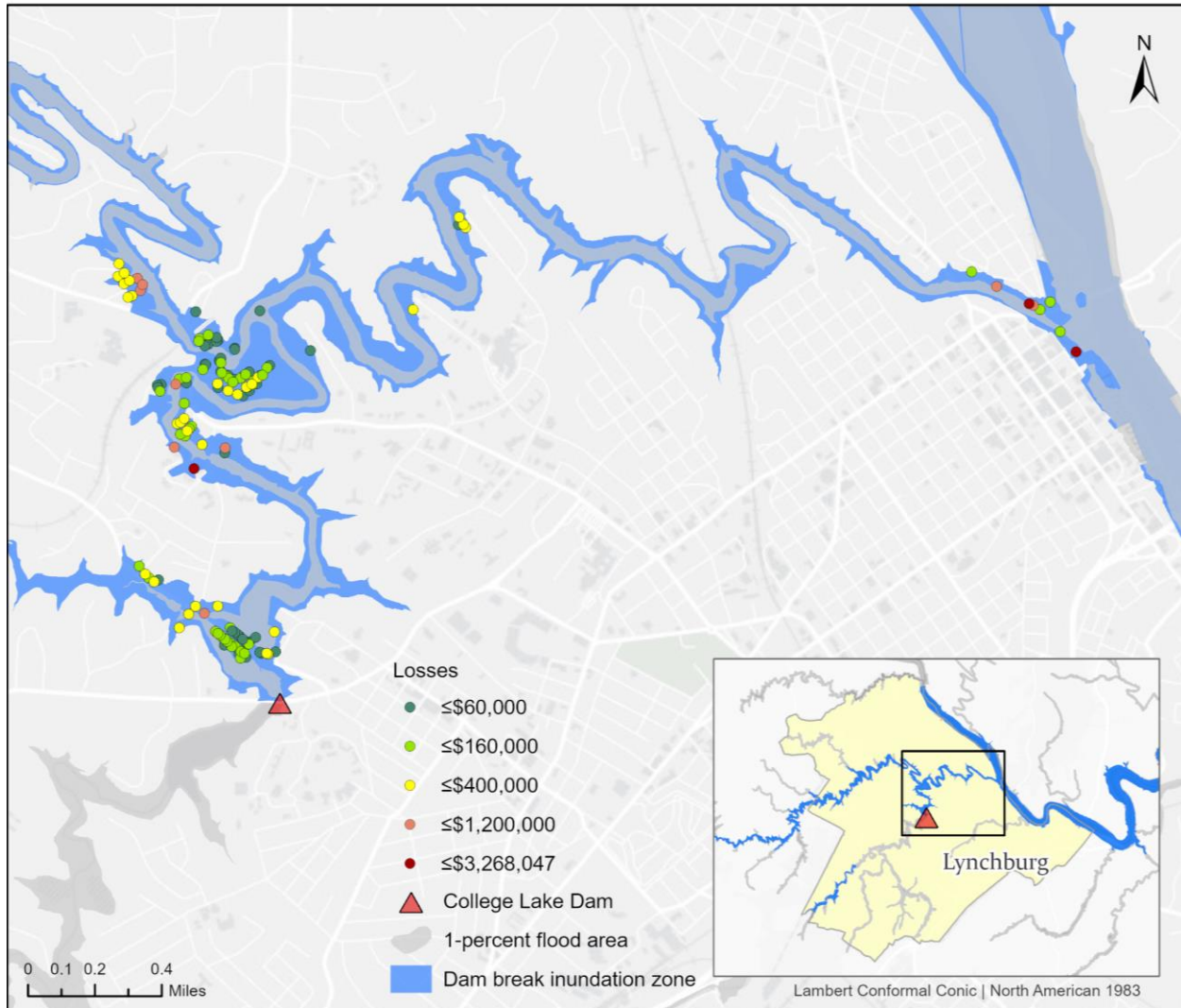




# Hazard Identification and Risk Assessment

## Building Losses from College Lake Dam Break Inundation in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Dam Inundation areas from the City of Lynchburg's Emergency Action Plan showing extents of potential flooding within the City of Lynchburg downstream of local dams. Various flood scenarios with and without dam breaks are depicted. Dam inundation studies were conducted by various Engineering firms for the Dam owners.

Data source: City of Lynchburg GIS Portal, as of 3/14/2018; HAZUS-Level 2 Analysis  
Center for Geospatial Information Technology at Virginia Tech. 08/2019



*Figure 4-89 Building Losses from College Lake Dam Break Inundation (Hazard-Level 2 Analysis)*

### 4.4.4 Probability of Future Occurrences

Predicting the probability of flooding due to dam failure requires a detailed, site-specific engineering analysis for each dam in question. Failure may result from hydrologic and hydraulic design limitations, or from geotechnical or operational factors. The data and time necessary to perform a probabilistic failure analysis for each dam in the region is beyond the scope of this plan.



# Hazard Identification and Risk Assessment

## 4.4.5 References

- City of Lynchburg. *City of Lynchburg Comprehensive Plan: Planning for the Future 2013-2030*. 2013. <http://www.lynchburgva.gov/comprehensive-plan>
- Commonwealth of Virginia Hazard Mitigation Plan, March 2018
- Federal Emergency Management Agency. *Assessing the Consequences of Dam Failure: A How-To Guide*. Fairfax, Virginia, March 2012. <https://damsafety.org/sites/default/files/files/FEMA%20TM%20AssessingtheConsequencesofDamFailure%20March2012.pdf>.
- Federal Emergency Management Agency. *Federal guideline for inundation mapping of flood risks associated with dam incidents and failures*. FEMA P-946. July 2013. <https://damsafety.org/sites/default/files/FEMA%20Federal%20Guidelines%20InundatnMap%20P946.pdf>
- New River Valley Regional Commission. *Chapter 4: Hazard Identification and Risk Assessment (HIRA)*. in New River Valley Hazard Mitigation Plan Update 2017. 2017. [http://nrvc.org/hazardmitigation/assets/pdf/04\\_HIRAComplete\\_Final.pdf](http://nrvc.org/hazardmitigation/assets/pdf/04_HIRAComplete_Final.pdf).
- Virginia Department of Conservation and Recreation. *DCR Dam Classification: What does it mean? Why does it change?* <https://www.dcr.virginia.gov/dam-safety-and-floodplains/damclass>
- Virginia Department of Conservation and Recreation. *Dam Safety and Floodplain Management Grants*. <https://www.dcr.virginia.gov/dam-safety-and-floodplains/dsfpm-grants>
- Warner, J., et al. *The Timberlake Dam failure: A hydrometeorological assessment*. in North American Water and Environment Congress & Destructive Water. ASCE, 1996.



# Hazard Identification and Risk Assessment

## 4.5 Hurricane

### 4.5.1 Hazard Profile

A hurricane is a classification of a tropical cyclone in which the maximum sustained surface wind is 74 miles per hour (mph) or more. The term hurricane is used for Northern Hemisphere tropical cyclones east of the International Dateline to the Greenwich Meridian. The term typhoon is used for Pacific tropical cyclones north of the Equator west of the International Dateline.

A tropical cyclone is the general term for a low-pressure system that originates over tropical or subtropical waters, with organized deep convection and a closed surface wind circulation about a well-defined center. Once formed, a tropical cyclone is maintained by the extraction of heat energy from the ocean at high temperature and heat export at the low temperatures of the upper troposphere. In this they differ from extratropical cyclones, which derive their energy from horizontal temperature contrasts in the atmosphere (baroclinic effects).<sup>34</sup>

Depending on strength, they are classified as hurricanes (> 74 mph wind), tropical storms (39-73 mph), or tropical depressions (< 38 mph). Tropical cyclones involve both atmospheric and hydrologic characteristics, such as severe winds, storm surge flooding, high waves, coastal erosion, extreme rainfall, thunderstorms, lightning, and, potentially, tornadoes. Storm surge flooding can push inland and increase riverine flooding associated with heavy inland rains. High winds associated with hurricanes cause widespread debris due to damaged and downed trees, damaged buildings, and power outages.

#### 4.5.1.1 Geographical Location and Extent

The hurricanes that affect Virginia typically form in the Atlantic or Gulf of Mexico during the months of June through November. Virginia has been struck by 48 hurricanes from 1900 to 2018 according to the National Hurricane Center. Most hurricanes affect eastern Virginia due to its proximity to the coast; however, it is not uncommon for hurricanes and tropical storms to track through the state and impact inland jurisdictions. According to NOAA's storm events database, the CVPDC area has not experienced a direct hurricane landfall since 1950. The CVPDC area's location makes it susceptible to the remnants of hurricanes bringing heavy rains and winds throughout the region.

#### 4.5.1.2 Magnitude / Severity / Frequency

As a hurricane develops, barometric pressure (measured in millibars or inches) at the center falls and winds increase. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm. When sustained winds reach or exceed 74 mph, the storm is classified as a hurricane. Hurricane intensity is categorized 1-5 by the Saffir-Simpson Hurricane Damage Scale (Table 4-109). The Saffir-Simpson Scale categorizes hurricane intensity based upon maximum sustained wind speeds and barometric pressure which are combined to estimate potential damage. Categories 3, 4, and 5 are classified as "major" hurricanes, and while hurricanes within this range comprise only 20% of total tropical cyclone landfalls, they cause 70% of the damage in the United States. Table 4-110 describes expected damage per hurricane category.

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<sup>34</sup> National Hurricane Center. Glossary of NHC Terms. <https://www.nhc.noaa.gov/aboutgloss.shtml>



# Hazard Identification and Risk Assessment

Table 4-109 Saffir-Simpson Hurricane Damage Scale (Source: National Weather Service)

Category	Maximum Sustained Wind Speed (MPH)	Minimum Surface Pressure (Millibars)	Summary
1	74-95	Greater than 980	Very dangerous winds will produce some damage
2	96-110	979-965	Extremely dangerous winds will cause extensive damage
3	111-130	964-945	Devastating damage will occur
4	131-155	944-920	Catastrophic damage will occur
5	155+	Less than 920	Catastrophic damage will occur

Table 4-110 Hurricane Damage Classification (Source: National Hurricane Center)

Category	Damage Level	Description
1	Minimal	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage.
2	Moderate	Some roofing material, door, and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings may break their moorings.
3	Extensive	Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain may be flooded well inland.
4	Extreme	More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland.
5	Catastrophic	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required.

## 4.5.1.3 Previous Occurrences

The National Oceanic and Atmospheric Administration has tracked the path of all tropical cyclones (including hurricanes) from 1851 to 2018. The tropical cyclone track map in Figure 4-90 shows the historical occurrences of tropical cyclones that have passed through the CVPDC area. There has only been one categorized hurricane that passed through and it occurred in 1896 when hurricanes were unnamed. In total, 7 tropical storms and 3 tropical depressions were tracked through the CVPDC area. It should be noted that the paths shown in the map indicate the location of the centerline of the storms. Impacts from tropical cyclones and hurricanes span many miles in all directions of the designated track.

Recent hurricanes affecting the region include:



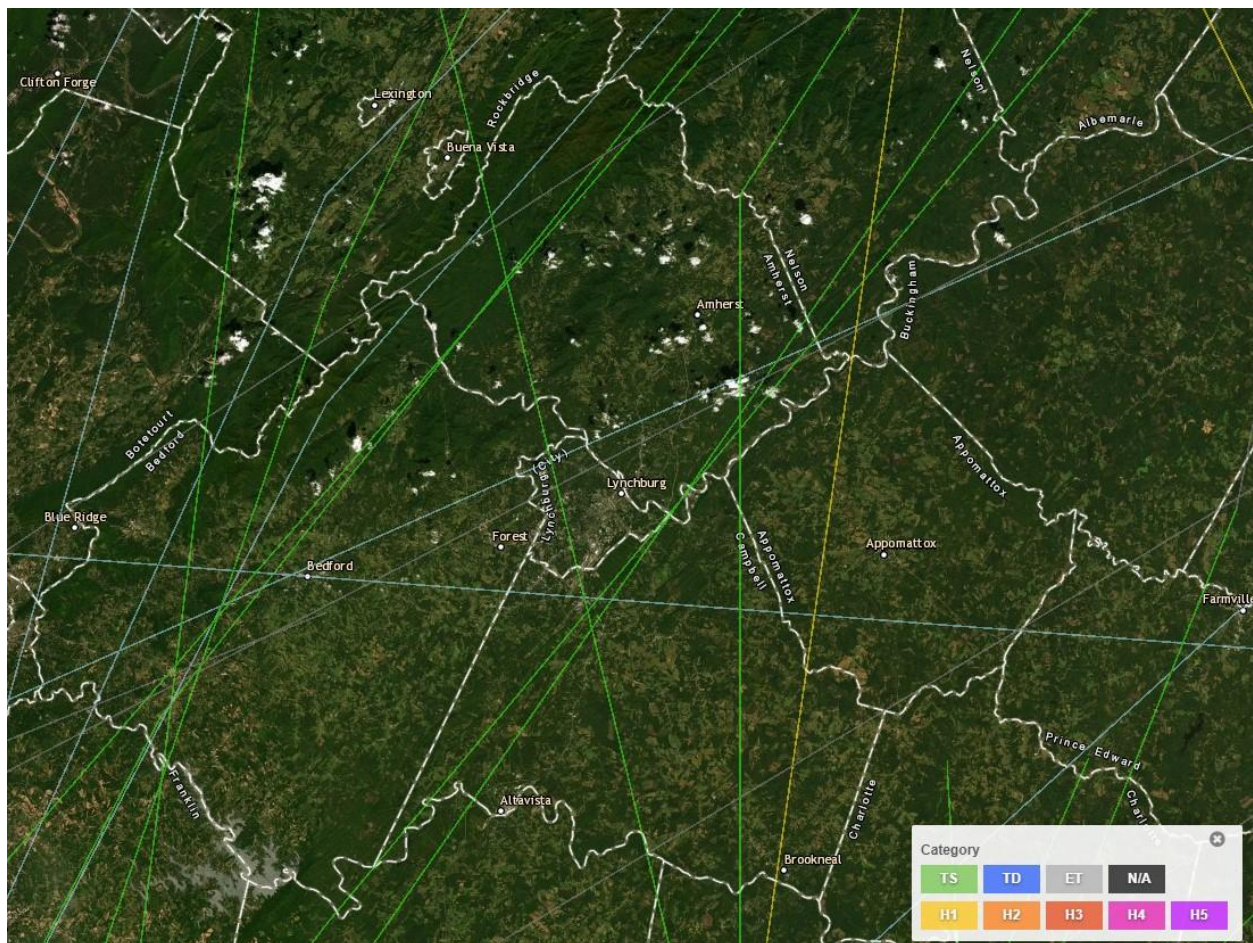


# Hazard Identification and Risk Assessment

**Hurricane Camille (1969)** Camille made landfall in the gulf coast as a category 5 and weakened to a tropical depression before reaching Virginia. Areas within Amherst, Bedford, and Campbell Counties, as well as the City of Lynchburg, were impacted by the storm.

**Hurricane Fran (1996)** Fran was downgraded to a tropical storm before reaching the area, but still had widespread effects. Rainfall amounts between 8 and 20 inches fell over the mountains and Shenandoah Valley, leading to record-level flooding in many locations within this region.

**Hurricane Isabel (2003)** Isabel's track passed east of the CVPDC area at hurricane strength, which was enough to cause wind and flood damage locally.



Legend: **H1 - H5** represent category 1 through 5 hurricanes, **TS** - Tropical Storm, **TD** - Tropical Depression, **ET** - the system is classified as extratropical

Figure 4-90 CVPDC Area Tropical Cyclone Tracks from 1851-2018 (Source: National Hurricane Center)

#### 4.5.1.4 Relationship to Other Hazards

Figure 4-91 shows the interrelationship (causation, concurrence, etc.) between this hazard and other hazards discussed in this plan update.



# Hazard Identification and Risk Assessment

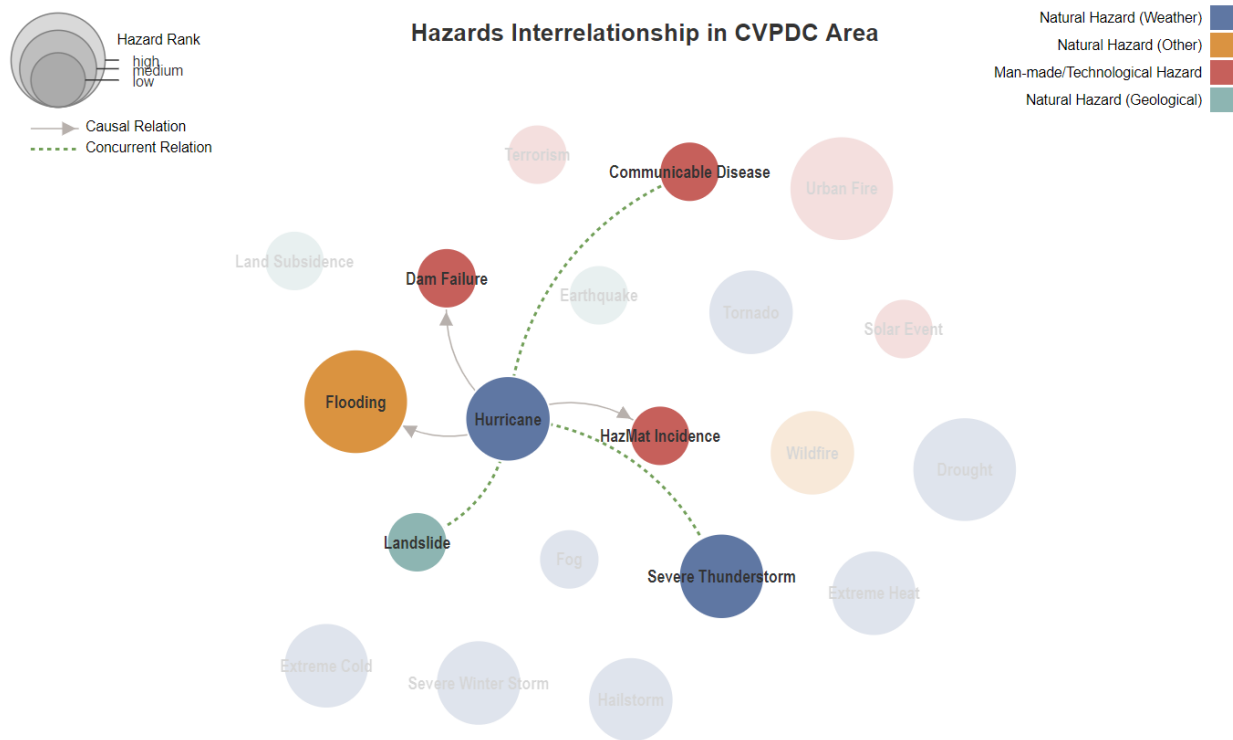


Figure 4-91 Hazards interrelationship

## 4.5.2 Impact and Vulnerability

Hurricanes are one of the most devastating natural disasters in the United States. Although the CVPDC area rarely experienced a direct landfalling hurricane in the past, it is still susceptible to the remnants of an event. Secondary hazards from a hurricane event could include heavy rains, flooding, high winds, and tornadoes. A foot or more of rain may fall in less than a day, causing flash floods and mudslides. The rain eventually drains into the large rivers, which may still be flooding for days after the storm has passed. The storm's driving winds can topple trees, utility poles, and damage buildings. Communication and electricity can be lost for days and roads made impassable due to fallen trees and debris.

Vulnerability and impact are generally measured in terms of population and property damage from hurricane winds. Potential injuries and damages to the property vary based on the hurricane category and various other factors.

## 4.5.3 Risk Assessment and Jurisdictional Analysis

Hazus (Version 4.2) software was used to complete the hurricane wind analysis for vulnerability and loss estimates. The model uses state of the art wind field models and calibrated and validated hurricane data. Wind speed has been calculated as a function of central pressure, translation speed, and surface roughness. This assessment is based on a Level 1 analysis with default parameters and no local data adjustments. In this analysis, the hurricane model ran at the census tract level. The results are captured in the vulnerability analysis and loss estimation.



# Hazard Identification and Risk Assessment

## 4.5.3.1 Ground Surface Roughness

In Hazus software, a critical component in the modeling of hurricane wind effects, damage, and loss to buildings and facilities is the assessment of the ground roughness. As the ground surface becomes rougher, the wind speeds near the ground decrease, although the upper level wind speed remains the same. The wind loads experienced by structures located in a typical suburban, treed, or urban environment (*i.e.*, high surface roughness area) are much lower than those experienced by buildings located in relatively unobstructed regions such as waterfront and open field locations (*i.e.*, low surface roughness area). The surface roughness is measured by roughness length, which is defined as the height at which the mean wind speed theoretically becomes zero due to substrate roughness. The smaller the roughness length, the smoother the ground surface is. In this plan update, critical facilities built on low surface roughness areas (roughness length < 0.3 meter) are considered as at higher risk in a hurricane event, and are identified as in Table 4-111. Most of these facilities are located in Bedford County, while the rest are in Campbell County. Figure 4-92, Figure 4-93, Figure 4-94, Figure 4-95, Figure 4-96, and Figure 4-97 are a series of ground surface roughness maps at census block level for the PDC and each jurisdiction. Bedford County has more low surface roughness areas than other jurisdictions in the region.

*Table 4-111 Critical facilities in low ground surface roughness areas (roughness length < 0.3m) in CVPDC Area*

Locality	Facility Name	Facility Type	Location	Coordinates
Bedford County	Spring Valley Farm Campground	Campground	2077 Meadors Spur Rd, Moneta	37.2234, -79.6669
Bedford County	Wheelabrator Landfill (Winoa Usa, Inc.)	HazMat Facility	3 Abrasive Ave	37.3462, -79.5526
Bedford County	Bedford Memorial Hospital	Public Health	1613 Oakwood St	37.3513, -79.5172
Bedford County	Liberty High	Schools	100 Liberty Minutemen Dr	37.3717, -79.4980
Bedford	Pump Station #8	Sewer Pump Station		37.3537, -79.5212
Bedford County	Montvale Pump Station	Sewer Pump Station		37.3788, -79.7098
Bedford County	Electrical Substation	Electrical Substation		37.3746, -79.5021
Campbell County	Gladys Volunteer Fire Department	Fire Stations	8569 Brookneal Highway	37.1600, -79.0717
Campbell County	Otter River Water Tank	Water Storage Facility	9625 Leesville Rd	37.2109, -79.2992
Campbell County	Otter River Water Treatment Plant	Wastewater Treatment Plant	9605 Leesville Rd	37.2113, -79.2988
Campbell County	Campbell Co Util And Serv Auth/Sewer Pump Station	Sewer Pump Station	Leesville Rd, Evington	37.2075, -79.2997





# Hazard Identification and Risk Assessment

## Ground Surface Roughness for Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020

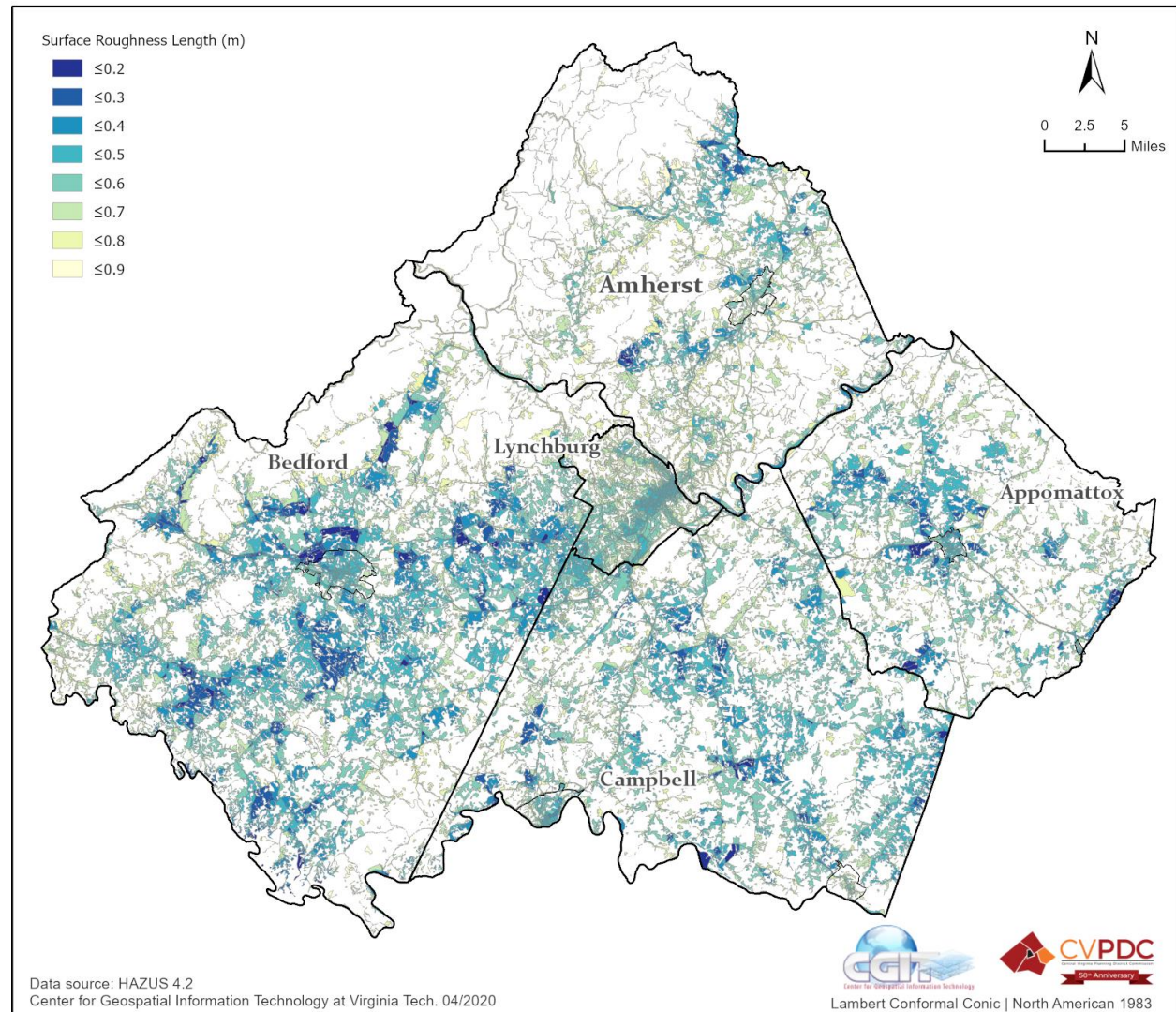


Figure 4-92 Ground surface roughness map for CVPDC Area





# Hazard Identification and Risk Assessment

## Ground Surface Roughness for Amherst County, Virginia

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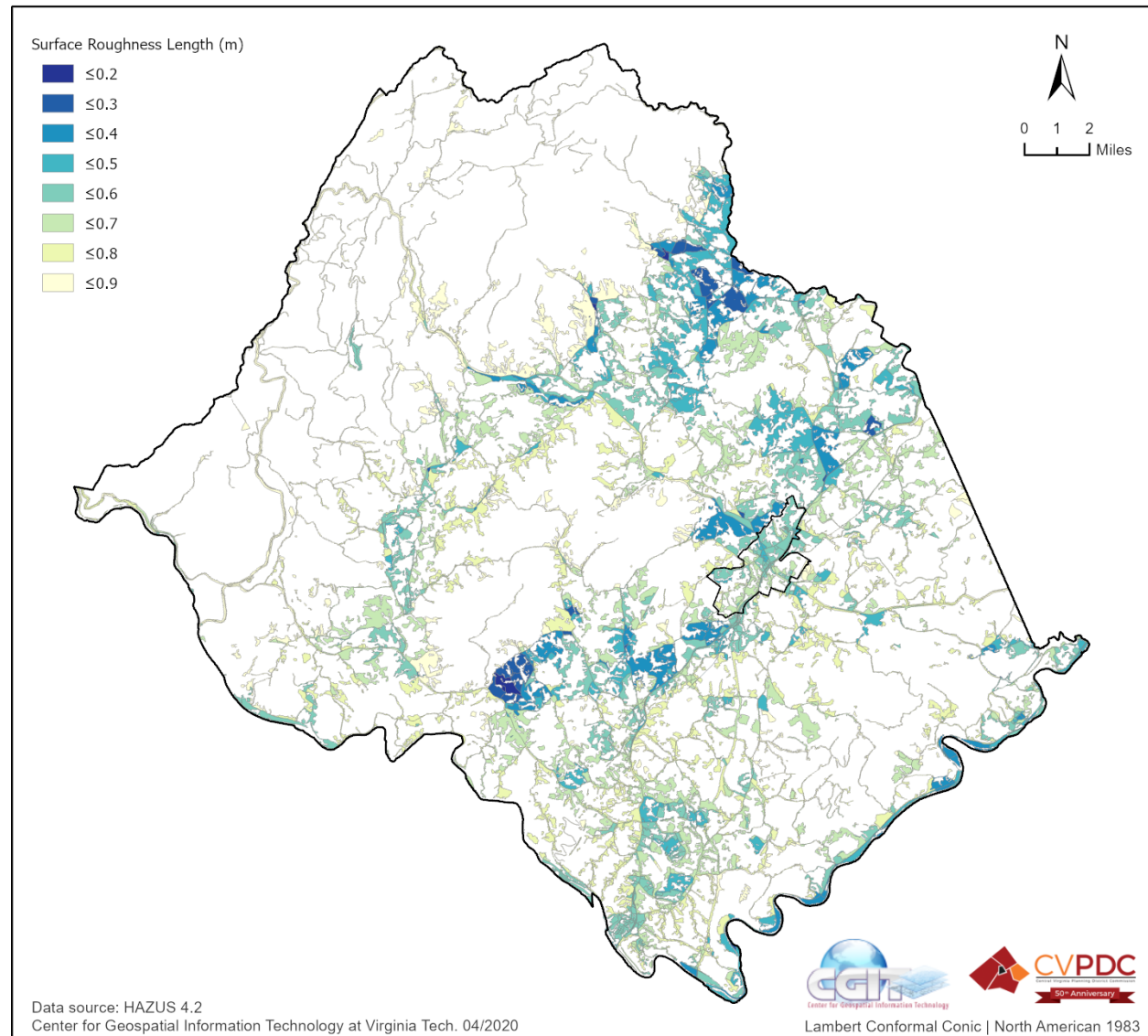


Figure 4-93 Ground surface roughness map for Amherst County in CVPDC Area



# Hazard Identification and Risk Assessment

## Ground Surface Roughness for Appomattox County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020

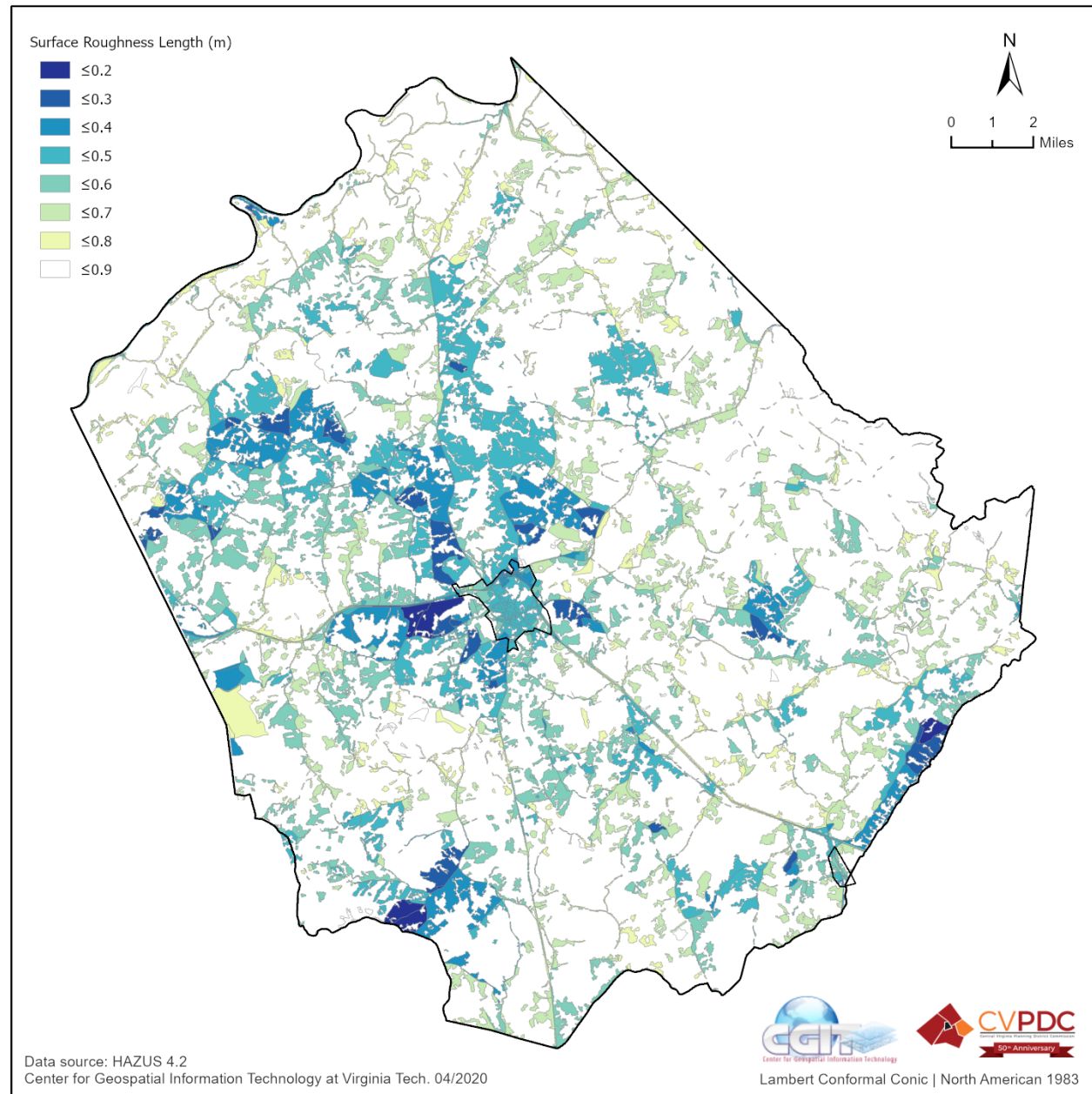


Figure 4-94 Ground surface roughness map for Appomattox County in CVPDC Area



# Hazard Identification and Risk Assessment

## Ground Surface Roughness for Bedford County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020

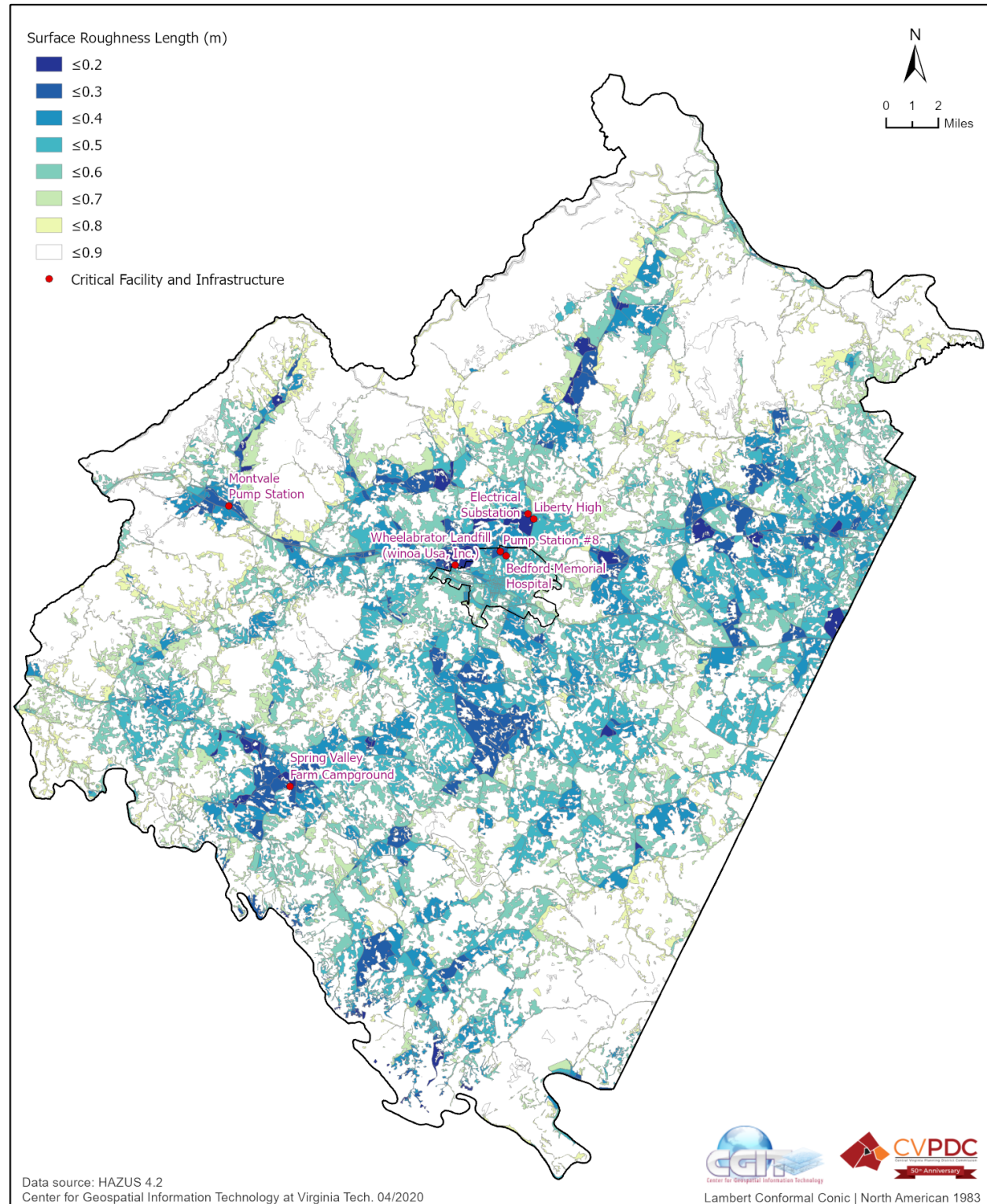


Figure 4-95 Ground surface roughness map for Bedford County in CVPDC Area





# Hazard Identification and Risk Assessment

## Ground Surface Roughness for Campbell County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020

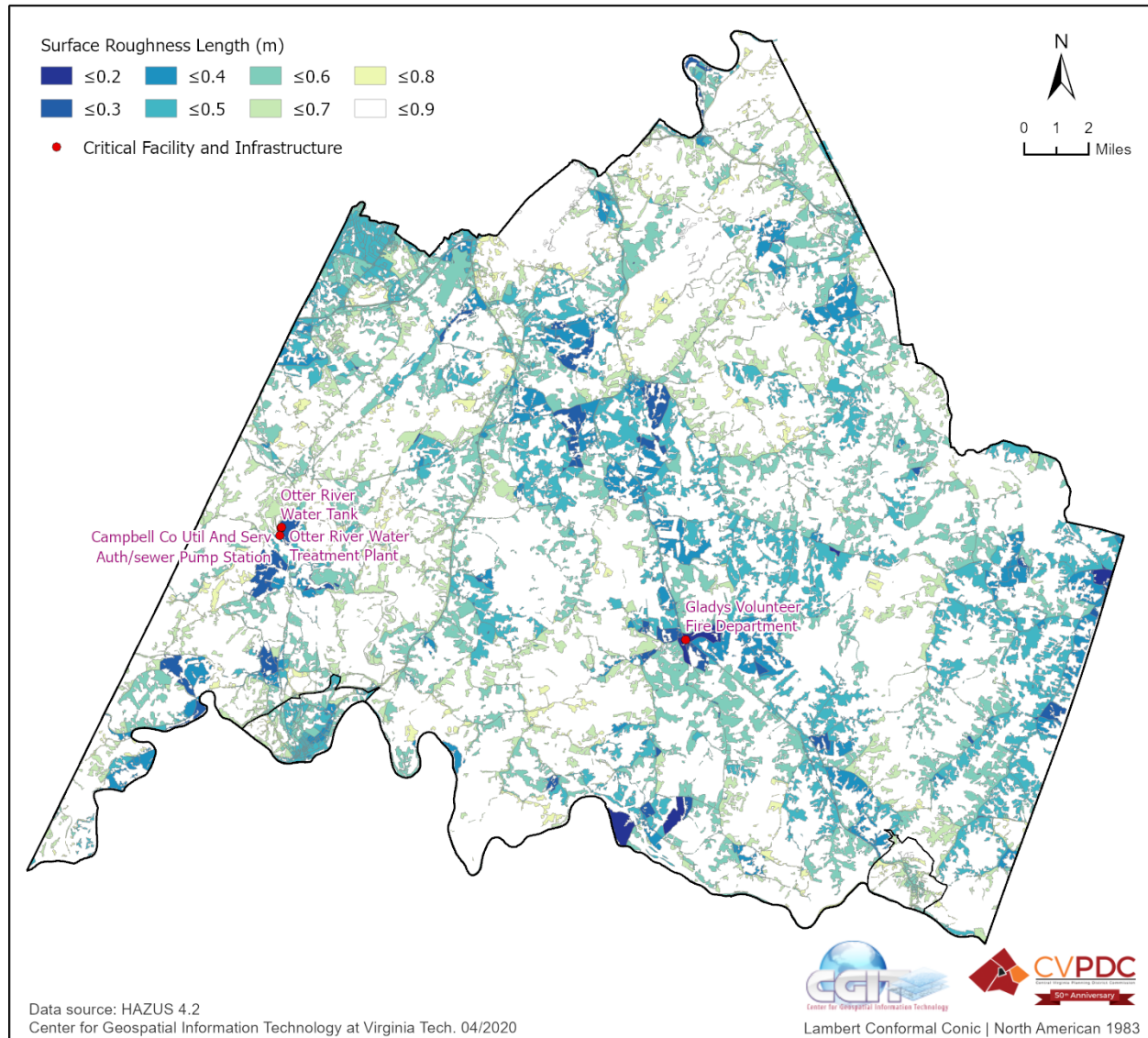


Figure 4-96 Ground surface roughness map for Campbell County in CVPDC Area





# Hazard Identification and Risk Assessment

## Ground Surface Roughness for City of Lynchburg, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020

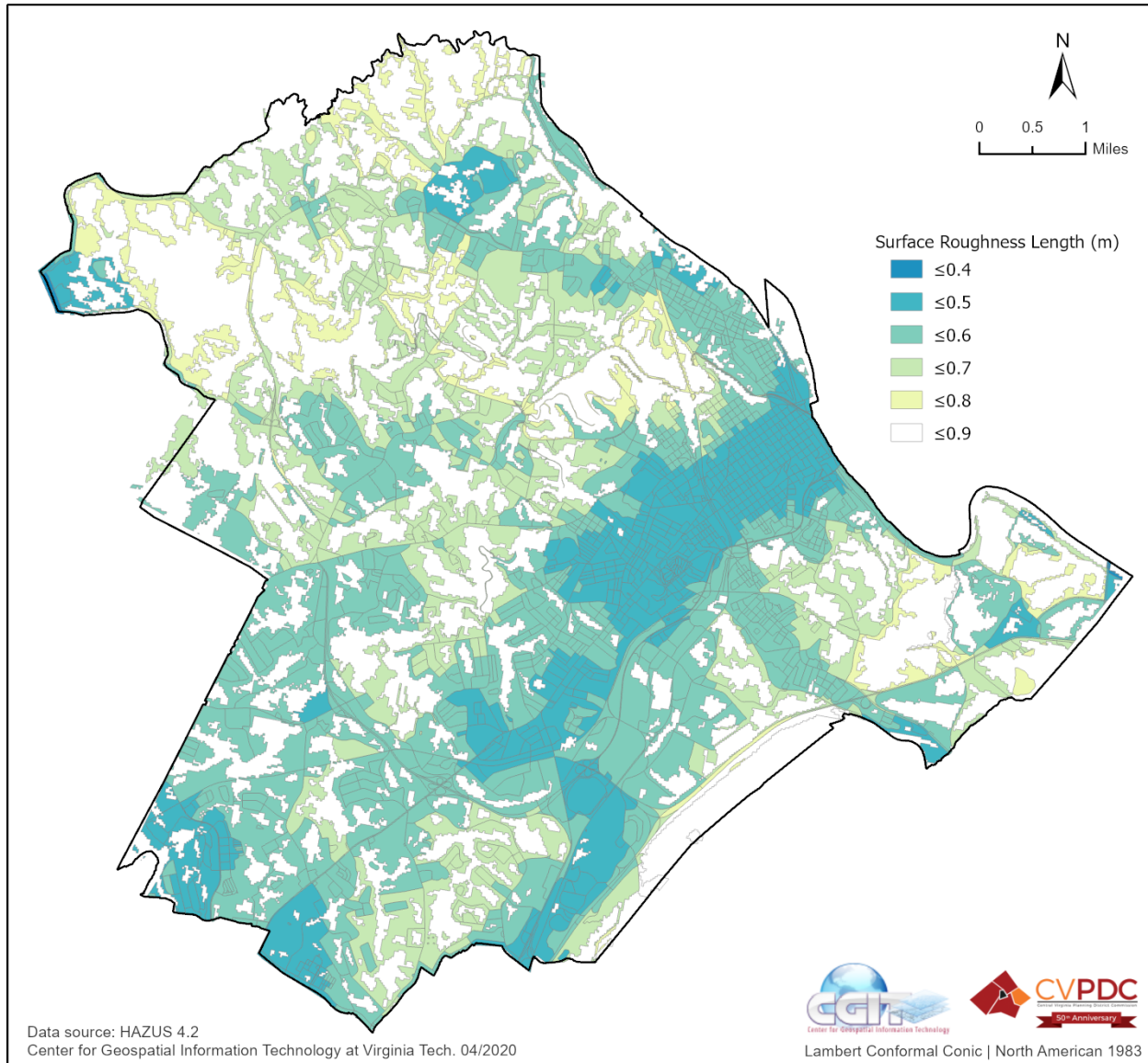


Figure 4-97 Ground surface roughness map for City of Lynchburg in CVPDC Area

### 4.5.3.2 Loss Analysis (Probabilistic Hurricane Scenario)

Hazus uses historical hurricane tracks and computer modeling to identify the probabilistic tracks of a range of hurricane events. When a hurricane impacts these areas, these maps can be used to determine what areas will be more impacted than others (in the U.S. Census tract level).

Probability is the percent chance that a hurricane of a specific magnitude will occur in any given year (Table 4-112). Probabilistic scenarios were used to run the hazard identification and risk analysis. The scenario considers the associated impacts of many thousands of potential storms that have tracks and



# Hazard Identification and Risk Assessment

intensities reflecting the full spectrum of Atlantic and Central Pacific hurricanes (Hazus User Manual). The probabilistic windspeeds shown in Table 4-112 are provided by the ASCE in their 7-98 publication.

*Table 4-112 Hurricane Return Period and its Chance of Occurrence*

Return Period (Years)	10	20	50	100	200	500	1000
Chance of Occurrence in any given year (%)	10	5	2	1	0.5	0.2	0.1
ASCE windspeed values (mph)	25-32	37-43	53-58	62-66	69-74	77-82	84-88

Loss estimation for the hurricane module is based on specific input data including square footage of buildings for specified types or population, and information on the local economy that is used in estimating losses. The loss categories used to calculate annualized losses in the CVPDC area is shown in Table 4-113.

*Table 4-113 Hazus direct economic loss categories and descriptions*

Category		Input	Output
Capital stock	Building damage	Cost per sq. ft. to repair damage by structural type and occupancy for each level of damage	Cost of building repair or replacement of damaged and destroyed buildings
	Contents damage	Replacement value by occupancy	Cost of damage to building contents
	Inventory loss	Annual gross sales in \$ per sq. ft.	Loss of building inventory as contents related to business activities
Income	Relocation loss	Rental costs per month per sq. ft. by occupancy	Relocation expenses (for businesses and institutions)
	Capital related loss	Income in \$ per sq. ft. per month by occupancy	Capital-related incomes losses as a measure of the loss of productivity, services, or sales
	Wages loss	Wages in \$ per sq. ft. per month by occupancy	Employee wage loss as described in income loss
	Rental loss	Rental costs per month per sq. ft. by occupancy	Loss of rental income to building owners

## 4.5.3.2.1 Capital Stock Loss and Income Losses

The model predicts no building damage for 10-year and 20-year return periods. For a 1000-year return period, Hazus estimates 4,215 structures would experience some type of damage (Table 4-114).

*Table 4-114 Number of Buildings Damaged from a Hurricane*

Return Period (years)	Minor	Moderate	Severe	Destruction	Total
10 or 20	0	0	0	0	0
50	43	0	0	0	43
100	97	1	0	0	98
200	371	10	0	0	381
500	1,376	65	1	0	1,442



# Hazard Identification and Risk Assessment

Return Period (years)	Minor	Moderate	Severe	Destruction	Total
1000	3,959	285	4	3	4,215

## 4.5.3.2.1 Direct Economic Losses for Buildings: Annualized Losses by Jurisdiction

Annualized loss is defined as the expected value of loss in any one year, and is developed by aggregating the losses and exceedance probabilities for the 10-, 20-, 50-, 100-, 200-, 500-, and 100- year return periods. Hazus estimates direct and indirect economic losses due to winds that include: damage to buildings and contents, economic loss, and social interruptions. The following tables (Table 4-115 and Table 4-116) show the direct economic losses for the individual localities.

*Table 4-115 Estimate of Potential Building Damage - Wind Only*

Locality	Capital Stock Losses (\$K)				Income Losses (\$K)				Total Loss (\$K)
	Cost of Building Damage	Cost of Contents Damage	Inventory Loss	Total	Relocation Loss	Capital Related Loss	Wage Losses	Rental Income Loss	
Amherst	55	10	0	65	2	0	0	1	67
Appomattox	46	17	0	63	1	0	0	0	65
Bedford	174	33	0	207	7	0	0	2	217
Town of Bedford	12	1	0	13	1	0	0	0	15
Campbell	123	22	0	145	5	0	0	2	152
Lynchburg	175	59	0	234	6	1	1	3	244

*Note: The hurricane wind damage for the Towns of Amherst, Appomattox, Altavista, and Brookneal are found in their respective county's totals.*

The annualized loss, or long-term average losses in a given year, is \$727,000 dollars for total building structures. More than 80% of the annualized capital loss results from damage to the buildings, while no loss is derived from inventory loss.

The annualized damages were developed from the results of the hurricane model. The impacts of these various events are combined to create a total annualized loss. Figure 4-98 illustrates the annualized damages from hurricane winds. It should be noted that these are climatologically trend tracks, and therefore the specified track, realistically, can vary significantly from what is shown.

*Table 4-116 Direct Economic Losses for Buildings in 1000-year Event*

Locality	Capital Stock Losses (\$K)				Income Losses (\$K)				Total Loss (\$K)
	Cost of Building Damage	Cost of Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wage Losses	Rental Income Loss	
Amherst	\$14,597	\$2,394	\$13	.43	\$551	\$0	\$0	\$224	\$17,778
Appomattox	\$6,233	\$1,957	\$1	.39	\$192	\$0	\$0	\$63	\$8,446
Bedford	\$21,744	\$3,078	\$6	.26	\$641	\$0	\$0	\$218	\$25,687
Town of Bedford	\$1,026	\$5	\$0	.11	\$6	\$0	\$0	\$3	\$1,039
Campbell	\$25,034	\$2,778	\$25	.42	\$969	\$17	\$7	\$352	\$29,181



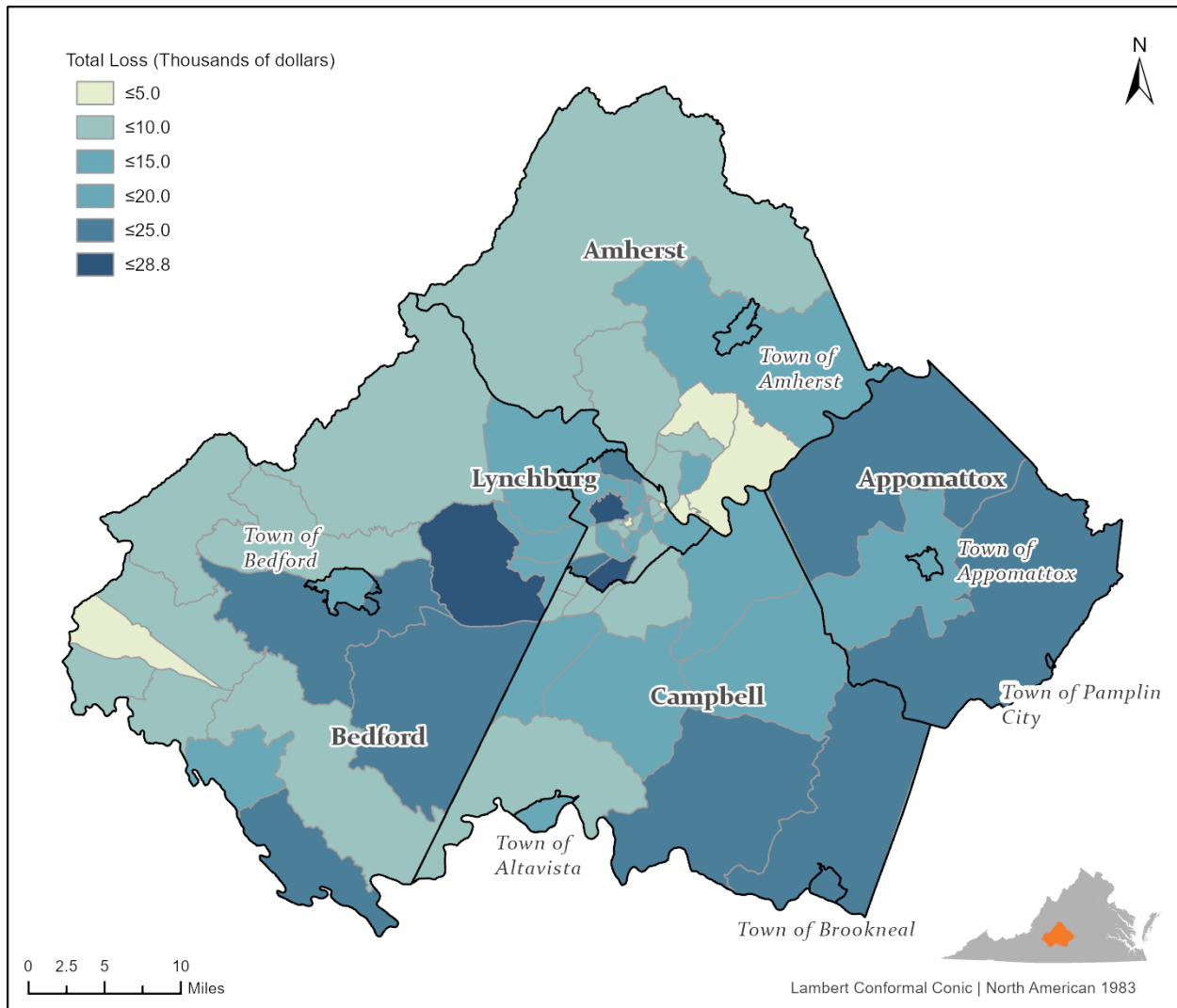
# Hazard Identification and Risk Assessment

Lynchburg	\$44,053	\$12,887	\$52	.45	\$1,430	\$66	\$25	\$831	\$59,345
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*Note: The hurricane wind damage for the Towns of Amherst, Appomattox, Altavista, and Brookneal are found in their respective county's totals.*

## Annualized Total Economic Loss Estimate for Hurricane Wind in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Annualized loss is the expected value of loss in any one year, and is developed by aggregating the losses and exceedance probabilities for the 10, 20, 50, 100, 200, 500, and 1000-year return periods. HAZUS estimates direct and indirect economic losses due to hurricane wind speeds that include: damage to buildings and contents, economic loss, and social impacts. All values are in thousands of dollars.

Data source: HAZUS; Census Bureau  
Center for Geospatial Information Technology at Virginia Tech. 04/2020



*Figure 4-98 Annualized Total Hurricane Loss Estimate in CVPDC Area*





# Hazard Identification and Risk Assessment

## 4.5.4 Probability of Future of Occurrences

It was agreed that there is no specific area in the CVPDC area that is more likely to experience a hurricane event. Thus, the entire region shares the same probability of a future hurricane event. According to the IPCC warming scenarios, it is likely that hurricane intensity will increase with stronger winds and heavier precipitation throughout the 21st century. The Geophysical Fluid Dynamics Laboratory (GFDL) from NOAA has developed and uses atmospheric and climate models for improving the understanding and prediction of hurricane behavior. They predict that while there may be less frequent, low-category storm events (Tropical Storms, Category 1 Hurricanes), there will be more high-category storm events (Category 4 and 5 Hurricanes) in the future. This means that there may be fewer hurricanes overall in any given year, but when hurricanes do form, it is more likely that they will become large storms that can create massive damage.

## 4.5.5 References

- Federal Emergency Management Agency. *Hazus Hurricane Model User Guidance (Hazus 4.2)*. Washington, D.C., 2018.
- Geophysical Fluid Dynamics Laboratory (GFDL), National Oceanic & Atmospheric Administration. Global Warming and Hurricanes: An Overview of Current Research Results. August, 15, 2019. <https://www.gfdl.noaa.gov/global-warming-and-hurricanes/> (Accessed September 25, 2019)
- *Northern Virginia Hazard Mitigation Plan*, 2017.
- Vickery, Peter J., et al. "HAZUS-MH hurricane model methodology. I: Hurricane hazard, terrain, and wind load modeling." *Natural Hazards Review* 7.2 (2006): 82-93. [https://ascelibrary.org/doi/pdf/10.1061/\(ASCE\)1527-6988\(2006\)7%3A2\(82\)](https://ascelibrary.org/doi/pdf/10.1061/(ASCE)1527-6988(2006)7%3A2(82))
- Virginia Department of Emergency Management, and Witt O'Brien's. *Commonwealth of Virginia Hazard Mitigation Plan*, 2018.



# Hazard Identification and Risk Assessment

## 4.6 Tornado

### 4.6.1 Hazard Profile

Damaging winds typically are associated with tornadoes or landfalling hurricanes. Isolated “downburst” or “straight-line” winds associated with any common thunderstorm can also cause extensive property damage. Tornadoes are classified as a rotating column of wind that extends between a thunderstorm cloud and the earth’s surface. Tornadoes are classified by their wind speed, which can range between 100 and 250 miles per hour. Tornadoes typically measure less than 200 feet wide, but in rare circumstances can be over a mile wide, and have wind speeds between 65 and 250 miles per hour. The rotating column of air often resembles a funnel-shaped cloud.

#### 4.6.1.1 *Geographical Location and Extent*

The United States averages 1,200 tornadoes per year, and 80% of those are either an F0/EF0 or F1/EF1 (see Table 4-117 for definition). In 2017, 25 tornadoes struck Virginia and caused \$10M in damage, but no deaths or injuries. In Virginia, most tornadoes are low-intensity, and tornadoes rated F2 or higher are rare. While tornadoes are most common in the central part of the US, Virginia has averaged 17.7 tornadoes per year during the 24 years between 1991 and 2015 (Figure 4-99), and increased to 24 tornadoes per year over the last decade. The total number may be higher, as incidents may occur over areas with sparse populations, or may not cause any property damage.

The Virginia Department of Emergency Management (VDEM) documents statewide annual tornado hazard frequency in the Commonwealth of Virginia Hazard Mitigation Plan. Annual tornado hazard frequency is an estimate of the frequency with which a point will experience a tornado. It is interpolated from neighboring tornado impact areas over a historical period.

The CVPDC area, as seen in Figure 4-100, is located in an area of low to medium risk for tornado strikes of magnitude F2 or larger. Please note that this map is Virginia-specific and “high frequency” in the Commonwealth is still relatively low frequency compared to the Midwest and Southern United States.

#### 4.6.1.2 *Magnitude or Severity*

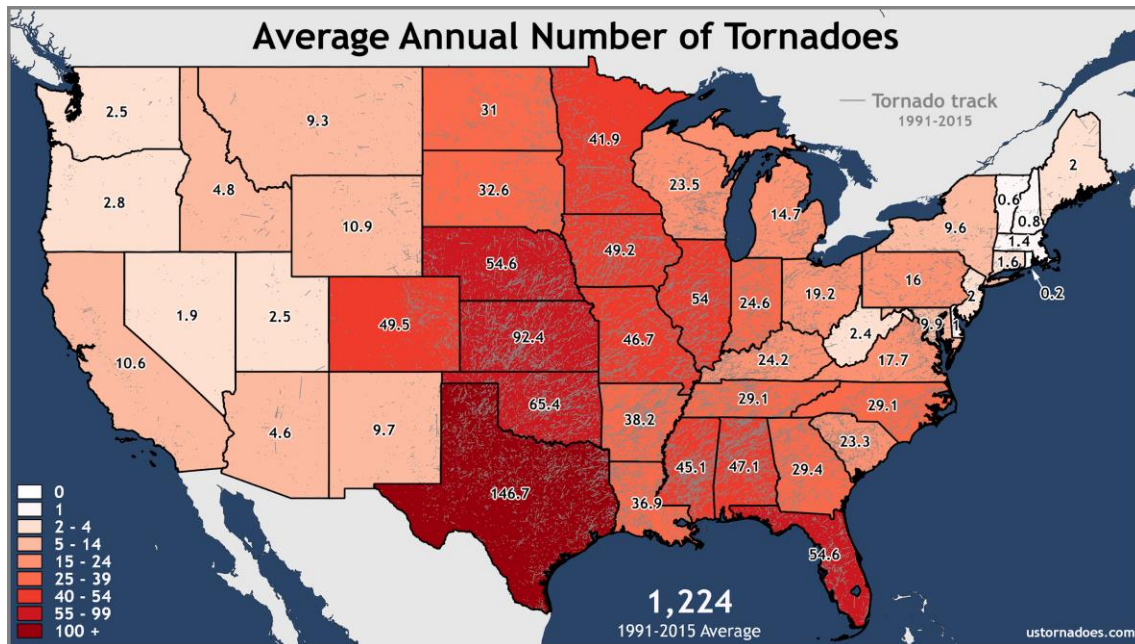
Tornadoes and their resultant damage can be classified into six categories using the Fujita Scale (see Table 4-117). This scale assigns numerical values (from zero to five) for wind speeds inside the tornado, according to the type of damage and intensity of the tornado. Starting in 2007, the original Fujita Scale was replaced with the Enhanced Fujita Scale (EF-Scale) to better align wind speeds more closely with associated storm damage. Most modern structures are designed to withstand tornadoes using the Enhanced Fujita Scale as reference.<sup>35</sup>

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<sup>35</sup> NWS. The Enhanced Fujita Scale (EF Scale). <https://www.weather.gov/oun/efscale>

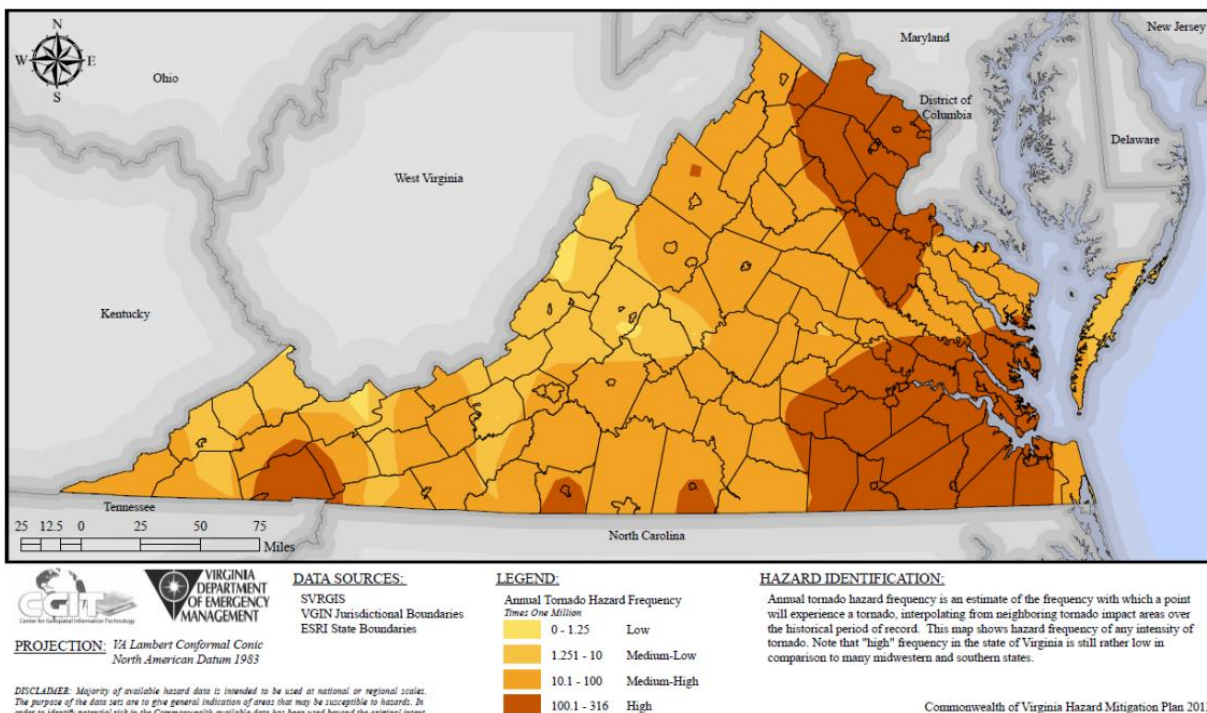


# Hazard Identification and Risk Assessment



(Source: USTornadoes.com)<sup>36</sup>

Figure 4-99 Average annual number of tornadoes



(Source: Commonwealth of Virginia Hazard Mitigation Plan 2013)

Figure 4-100 Annual Tornado Hazard Frequency

<sup>36</sup> <https://www.ustornadoes.com/2016/04/06/annual-and-monthly-tornado-averages-across-the-united-states/>



# Hazard Identification and Risk Assessment

Table 4-117 Fujita and Enhanced Fujita Scale

F-Scale	3-sec. gust speed (mph)	EF-Scale	3-sec. gust speed (mph)	Typical Damage
F0	45-78	EF0	65-86	Light damage. Some damage to chimneys. Branches broken off trees. Shallow-rooted trees pushed over; signboards damaged.
F1	79-117	EF1	86-109	Moderate damage. Peels surface off roofs. Mobile homes pushed off foundations or overturned. Moving autos blown off roads.
F2	118-161	EF2	110-137	Considerable damage. Roofs torn off frame houses. Mobile homes demolished. Boxcars overturned. Large trees snapped or uprooted. Light-object missiles generated. Cars lifted off ground.
F3	162-209	EF3	138-167	Severe damage. Roofs and some walls torn off well-constructed houses. Trains overturned. Most trees in forest uprooted. Heavy cars lifted off the ground and thrown.
F4	210-261	EF4	168-199	Devastating damage. Well-constructed houses leveled. Structures with weak foundations blown away some distance. Cars thrown and large missiles generated.
F5	262-317	EF5	200-234	Incredible damage. Strong frame houses leveled off foundations and swept away. Automobile-sized missiles fly through the air in excess of 100 meters (109 yards). Trees debarked. Incredible phenomena will occur

*The classification of the tornado provides an approximation of the corresponding damage.*

## 4.6.1.3 Previous Occurrences

Over the last decade, tornadoes have primarily occurred in May through September in Virginia, with peak activity in July.<sup>37</sup> However, a tornado can occur at any time throughout the year. Hot and humid conditions stimulate the tornado's frequency and growth. Strong tornadoes may be produced by thunderstorms and often associated with the passage of hurricanes.

<sup>37</sup> VDEM. 2018. Tornado preparedness. <https://www.vaemergency.gov/wp-content/uploads/2019/05/tornado-one-sheet-in-house-printing-and-digital-download.pdf>





# Hazard Identification and Risk Assessment

The NCEI Storm Event Database records tornado occurrences when the storm has sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce. According to the database, 29 tornado events occurred between 1950 and 2019 in the CVPDC area, including two severe tornado touchdowns rated EF3. Both touchdowns occurred after the last hazard mitigation plan update in 2012. On February 24, 2016, an EF3 tornado spanning a 16 mile stretch caused damage in Campbell and Appomattox counties (Figure 4-101). The tornado caused seven reported injuries and one fatality. On April 15, 2018, an EF3 tornado hit the community of Elon northwest of Lynchburg. It caused 12 injuries and damaged or destroyed dozens of homes. This is the first touchdown occurred within Lynchburg city limits, and the first EF3 tornado impact Amherst County.<sup>38</sup>

*Reporting of severe weather events (storms, tornado, hurricane, etc.) relies upon human observation, and therefore the NCEI storm event database, which is the best available data, exhibits a population bias. The degree of bias is related to the population density of a region, the terrain (i.e., observation distance; terrain blockage of the radar beam in mountainous areas), the existence or absence of organized storm-spotting organizations, and the road network of the region. Consequently, rural areas may be underrepresented in the data of spatial and temporal distributions of severe weather presented here.*



Figure 4-101 Damage from tornado in Appomattox County, 2016

The NOAA National Centers for Environmental Prediction publish Storm Prediction Center Severe Weather GIS (SVRGIS) data, including path and initial point of each tornado event between 1950 and 2018 (events in 2019 are currently unavailable). Figure 4-102 shows the historic tornado touchdowns and paths that have been published in the SVRGIS.

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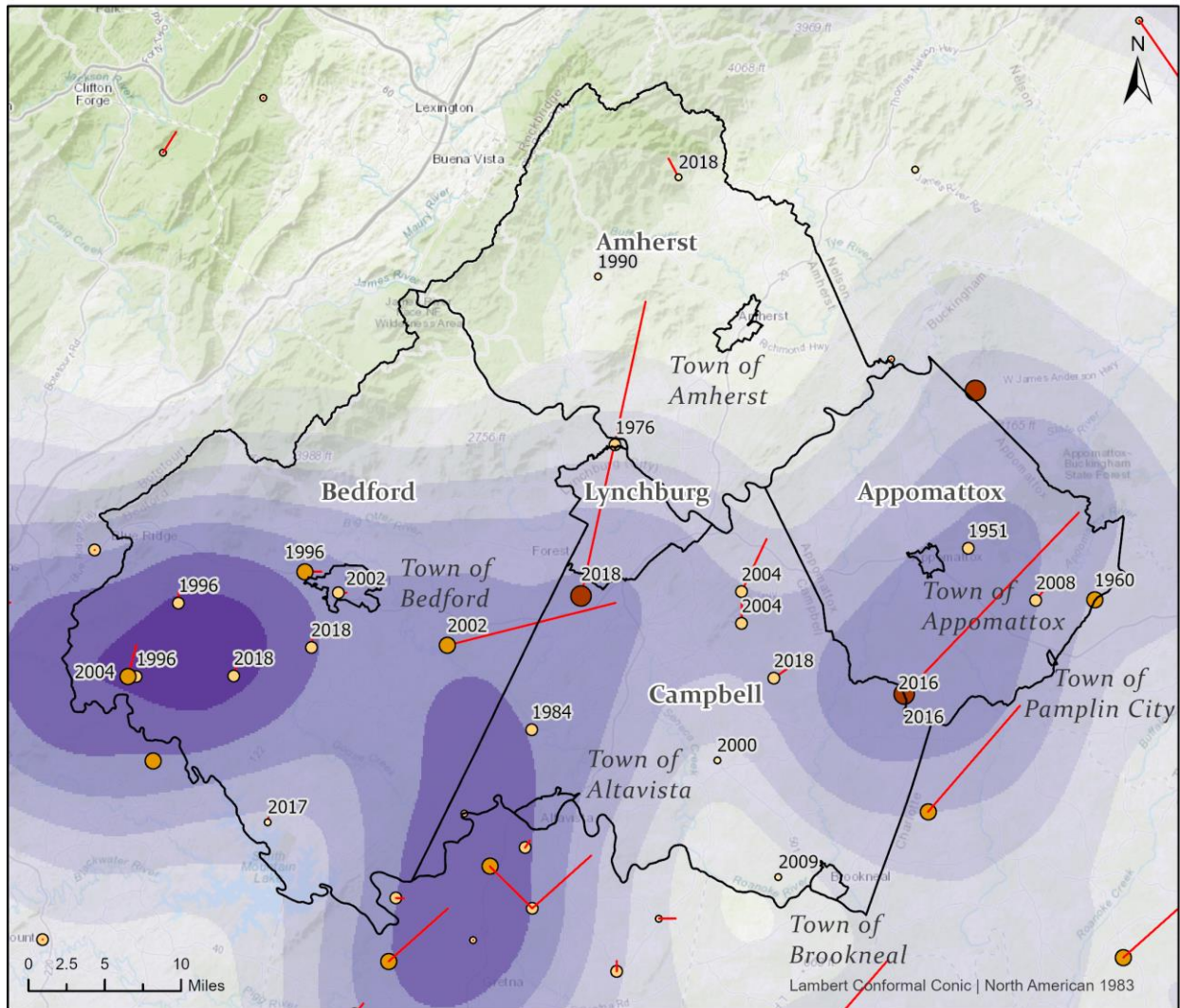
<sup>38</sup> National Weather Service. The April 15th, 2018 Tornadoes Event Summary. [https://www.weather.gov/rnk/2018\\_04\\_15\\_Tornado](https://www.weather.gov/rnk/2018_04_15_Tornado)



# Hazard Identification and Risk Assessment

## Tornado Touchdowns in Central Virginia PDC, 1950 - 2018

Central Virginia PDC Hazard Mitigation Plan Update 2020



○ EF0 ○ EF1 ○ EF2 ● EF3 — Tornado path

The color gradient represents a kernel density calculated using wind magnitudes of all historical tornadic events. The darker color represents areas that have experienced an increased number of events and severity. Labeled events occurred in Central Virginia PDC.

Data source: SRVGIS, Storm Prediction Center, NOAA  
Center for Geospatial Information Technology at Virginia Tech. 11/2019



(Source: SRVGIS, Storm Prediction Center, NOAA, 2019)

Figure 4-102 Tornado touchdowns in CVPDC Area, 1950 - 2018



# Hazard Identification and Risk Assessment

## 4.6.1.4 Relationship to Other Hazards

The following figure (Figure 4-103) shows the interrelationship (causation, concurrence, etc.) between this hazard and other hazards discussed in this plan update.

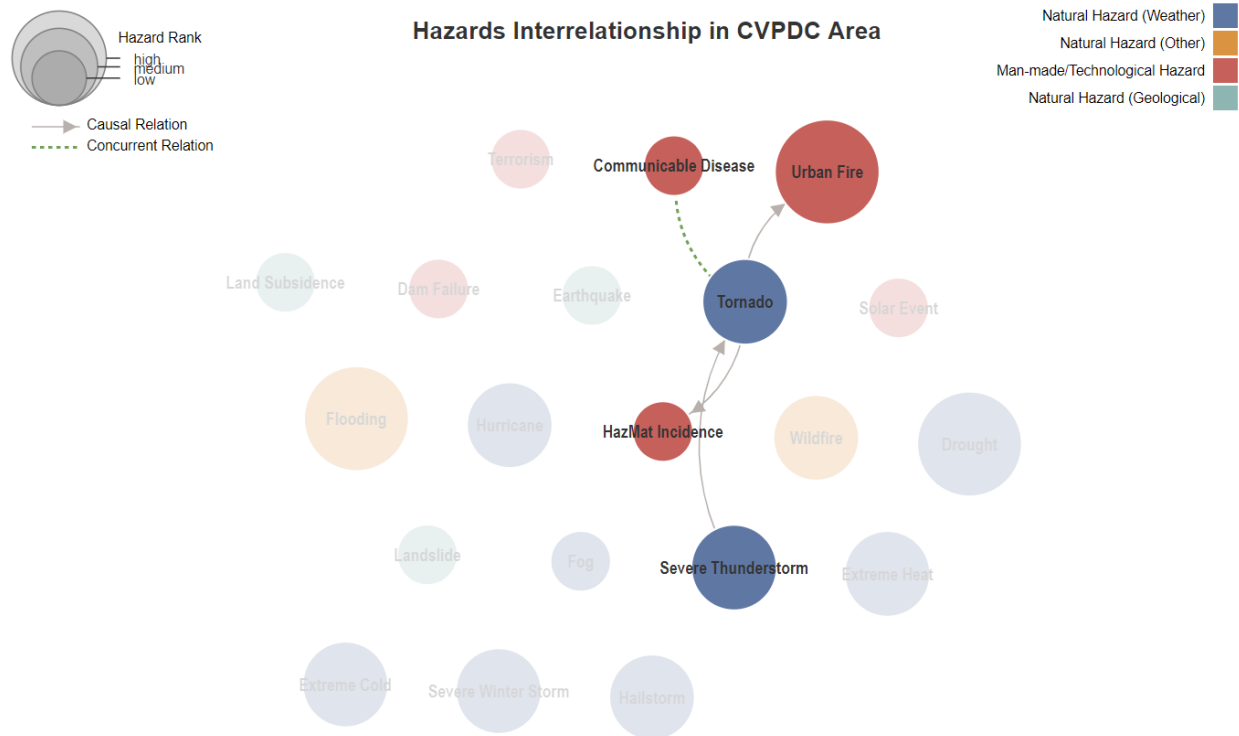


Figure 4-103 Hazards interrelationship

## 4.6.2 Impact and Vulnerability

Tornadoes are high-impact, low-probability hazards. The net impact of a tornado depends on the storm intensity and the vulnerability of development in its path. Tornado vulnerability is based on various factors, including building construction standards, availability of shelters or safe rooms, advanced warning capabilities, etc. Many variables need to be considered to establish an intensity-damage relationship.

Tornadoes with winds greater than 75 mph can cause significant structural damage to most buildings, but tornadoes with lower wind speeds can also cause damage, for example, by causing a tree to fall into a house. Most historical tornadoes in the CVPDC area are F0 and F1 on the Enhanced Fujita Scale. These cause minor to moderate damage. Damage that is likely to occur would be damage to trees, shrubbery, signs, antennas, with some damage to roofs and unanchored trailers. Higher wind events can pose a serious threat to people and infrastructure. The urban environment provides numerous objects that can become flying debris and severely injure people and damage structures.



# Hazard Identification and Risk Assessment

Numerous wind damage investigations have revealed that the building elements most commonly damaged by tornadoes or other high winds are: <sup>39</sup>

- Roof structure blow-off or collapse. This type of failure typically occurs in buildings constructed before approximately 1990 or in buildings struck by a tornado.
- Collapse of fire station apparatus bay doors in fire stations constructed before approximately 2000.
- Glazing breakage from wind-borne debris generated by hurricanes or tornadoes.
- Roof coverings. Roof coverings are the most commonly damaged building element.
- Rooftop equipment. Equipment that is blown off frequently leaves openings in the roof and often punctures the roof covering.

## 4.6.3 Risk Assessment and Jurisdictional Analysis

The tornado risk cannot be fully estimated due to lack of intensity-damage models for this hazard. Instead, estimates of the financial impacts of tornadoes can be developed based on historical data contained within the NCEI storm event data. Table 4-118 presents the tornado touchdown information acquired from the NOAA storm event database and breaks down by jurisdiction. It shows the total of 29 events in the CVPDC area caused 31 injuries and 1 death and brought property damages of about 39.5 million dollars. While Campbell County has experienced the most tornado events, Appomattox County has recorded more tornado damage than other jurisdictions. However, the normalized data by land area of jurisdiction indicates Lynchburg is also at higher risk.

*Table 4-118 Tornado touchdowns in CVPDC Area by jurisdiction, 1950 - 2019*

Jurisdiction	Number of events	Number of Deaths	Number of Injuries	Property damage (\$K)	Jurisdiction Size (Square Miles)	Events per Square Mile	Damage per Square Mile (\$K/mi <sup>2</sup> )
Amherst County	4	0	7	4,355.0	479	0.008	9.092
Appomattox County	3	1	7	11,227.5	334	0.009	33.615
Bedford County	10	0	1	4,745.0	769	0.013	6.170
Campbell County	11	0	14	9,545.0	507	0.022	18.826
Lynchburg City	1	0	2	9,600.0	50	0.020	192.000

*Note: If the path of a tornado on the ground occurred across jurisdictional boundaries, its occurrence could be counted in multiple jurisdictions. The tornado touchdowns for the Towns of Amherst, Appomattox, Altavista, and Brookneal are found in their respective county's totals.*

The type and age of construction plays a role in vulnerability of structures to tornadoes. Risk to existing structures is largely determined by building construction type: construction methods, materials, and roof span. In terms of building types, older wood-frame and manufactured housing are generally more vulnerable than concrete, brick, and steel-framed structures. In terms of occupancy types, mobile homes are at a higher risk than any others. According to a recent study, 39 percent of people killed by tornadoes

<sup>39</sup> Guidelines for Wind Vulnerability Assessments of Existing Critical Facilities. FEMA. 2019





# Hazard Identification and Risk Assessment

from 1985 to 2017 died in mobile homes.<sup>40</sup> That is especially significant considering only 6 percent lived in mobile homes during that period. Because mobile homes have no foundation or basement, they are more easily destroyed in a tornado. The risk increases when the mobile home isn't securely anchored to concrete slabs. Given the vulnerability of people living in mobile homes (including trailers and RVs), the owners of mobile home parks, trailer parks, RV parks, and campgrounds should strongly consider building storm shelters for their residents and campers.

Areas with tall buildings, such as downtown Lynchburg, are at a higher risk because of increased wind pressures at greater heights. A list of tall buildings in the CVPDC area can be found in the Earthquake hazard chapter. Open-air venues, including D-Day Memorial and Lynchburg City Stadium, are also particularly susceptible (Table 4-119).

Figure 4-104, Figure 4-105, Figure 4-106, Figure 4-107, and Figure 4-108 describe maps of geographic concentrations of mobile homes and wood structures for each jurisdiction. The building statistics derive from the building stock inventory data in the Hazus software (Version 4.2).<sup>41</sup> Table 4-120 lists RV parks and campgrounds in the CVPDC area by jurisdiction.

*Table 4-119 Open-air venues in CVPDC Area*

Facility Name	Location	Coordinates
National D-Day Memorial	3 Overlord Cir, Bedford	37.3305, -79.5360
City Stadium	3176 Fort Ave, Lynchburg	37.3924, -79.1664

*Table 4-120 RV parks and campground in CVPDC Area*

Locality	Facility Name	Location	Coordinates
Amherst	Otter Creek Campground	60851 Blue Ridge Pkwy, Monroe	37.5760, -79.3379
Amherst	Lynchburg/Blue Ridge Parkway KOA	6252 Elon Rd, Monroe	37.5744, -79.3247
Amherst	Shady Mountain Campground	Panther Falls Rd, Vesuvius	37.7170, -79.2893
Amherst	Oronoco Campground	Jordan Rd, Vesuvius	37.7488, -79.2653
Appomattox	Paradise Lake Family Campground	1105 W Lake Rd, Spout Spring	37.3372, -78.9372
Appomattox	Holliday Lake State Park Campground	2759 State Park Rd, Appomattox	37.3945, -78.6395
Bedford	Eagles Roost Campground	15335 Smith Mountain Lake Pkwy, Huddleston	37.0699, -79.5819
Bedford	Peaks of Otter Campground	10454 Peaks Rd, Bedford	37.4428, -79.6045
Bedford	Smith Mountain Lake State Park	1619 Overnight Rd, Huddleston	37.0834, -79.5951
Bedford	Mitchell's Point Marina & Campground	3553 Trading Post Rd, Huddleston	37.0622, -79.5601
Bedford	Moorman Marina	1510 Moorman Rd, Goodview	37.2232, -79.7753
Bedford	Waterfront Park Campground	1000 Waterfront Dr, Moneta	37.1397, -79.6464
Bedford	Hannabass-Crouch Campground	1241 Hannabass Dr, Goodview	37.1548, -79.6994

<sup>40</sup> Strader, et al. <https://doi.org/10.1175/WCAS-D-18-0060.1>

<sup>41</sup> In Hazus software, Mobile Home is coded as "RES2" occupancy class in building stock data.



# Hazard Identification and Risk Assessment

Locality	Facility Name	Location	Coordinates
Bedford	Tri-County Marina	1261 Sunrise Loop, Lynch Station	37.0595, -79.4468
Bedford	Isle of Pines Subdivision Campground	Across From 3930 Isle Of Pines Drive	37.0998, -79.6246
Bedford	Spring Valley Farm Campground	2077 Meadors Spur Rd, Moneta	37.2234, -79.6669
Bedford	Camp Lowman	11738 Leesville Rd, Lynch Station	37.1569, -79.4332
Bedford	Camp Sacajawea--Girl Scouts	2124 Fox Hill Rd, Lynchburg	37.4704, -79.1918
Bedford	Legacy International-Global Youth Village	1020 Legacy Dr, Bedford	37.2370, -79.4137
Bedford	The Woods Adventure & Conference Retreat (Leased)	1336 Simmons Mill Rd, Thaxton	37.3073, -79.6844
Bedford	Camp Karma	2058 Stone Mountain Rd, Bedford	37.1944, -79.5664
Bedford	Church of God In Virginia--Bedford Camp	1032 Cider Mill Rd, Bedford	37.2147, -79.4621
Bedford	Halesford Harbour RV Park Resort	1336 Campers Paradise Trl, Moneta	37.1583, -79.6617
Bedford	Sweetwater RV Park	4474 White House Road, Moneta	37.1417, -79.5865
Bedford	Thomas Road Outpost	7794 Sheep Creek Rd, Bedford	37.4505, -79.6346
Bedford	Tuck-A-Way Campground	1312 Sunrise Loop, Lynch Station	37.0605, -79.4484
Campbell	Lynchburg RV Resort	405 Mollies Creek Rd, Gladys	37.2108, -79.0496
Campbell	Hat Creek Camp	7145 Hat Creek Rd, Brookneal	37.1116, -78.9304

#### 4.6.4 Probability of Future Occurrences

The probability of future occurrences of tornadoes is definite; predicting the potential locations and costs for such events is nonviable given the scope of this analysis. According to the historic occurrence map, some areas in the CVPDC area appear to be slightly more prone to tornadoes than others, especially central Bedford County. This is caused by topographical influences on thunderstorms, such as the change in low-level wind flow and humidity caused by the orientation of the mountains.



# Hazard Identification and Risk Assessment

## Geographic Concentrations of Wood Structure and Mobile Home by Census Block in Amherst County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020

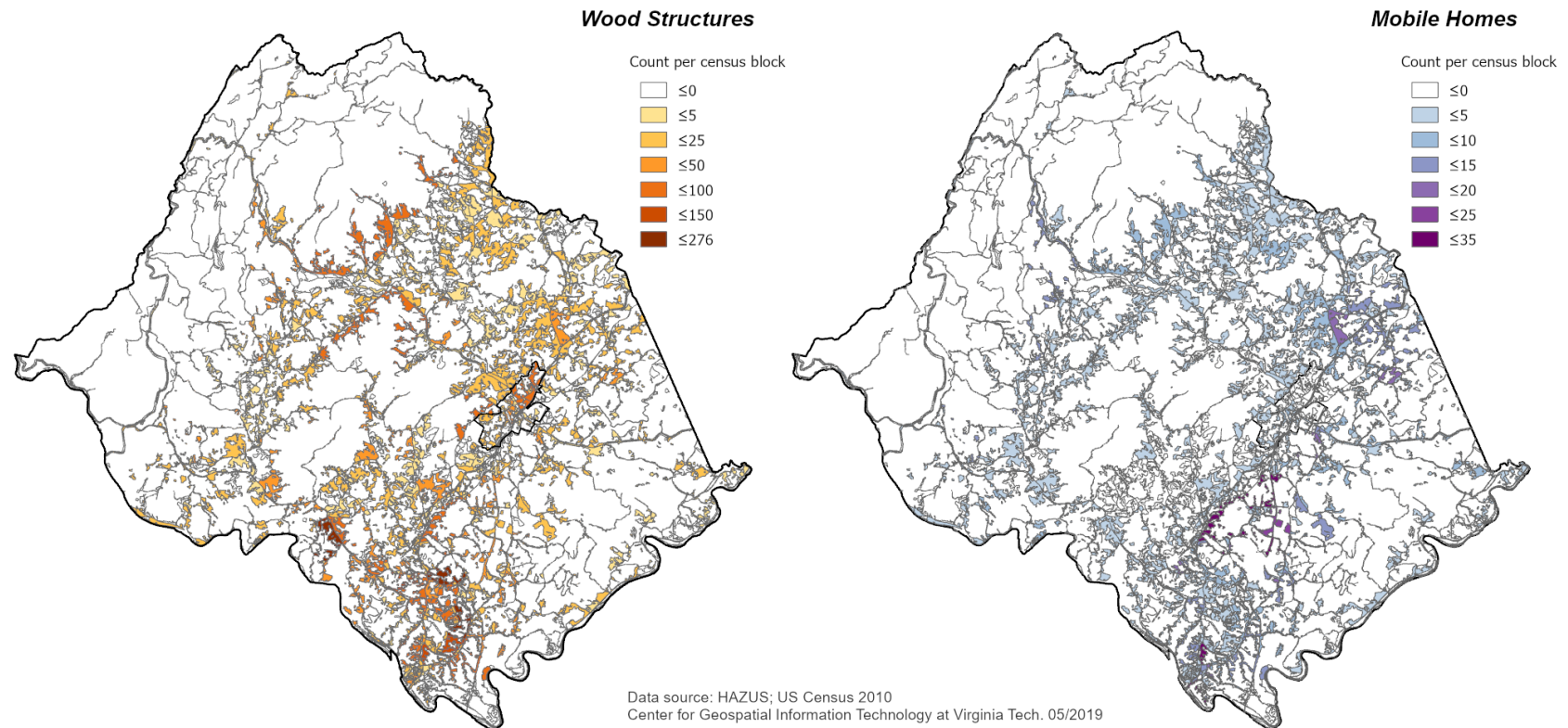


Figure 4-104 Geographic concentrations of wood structures and mobile home by census block in Amherst County, Virginia



# Hazard Identification and Risk Assessment

## Geographic Concentrations of Wood Structure and Mobile Home by Census Block in Appomattox County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020

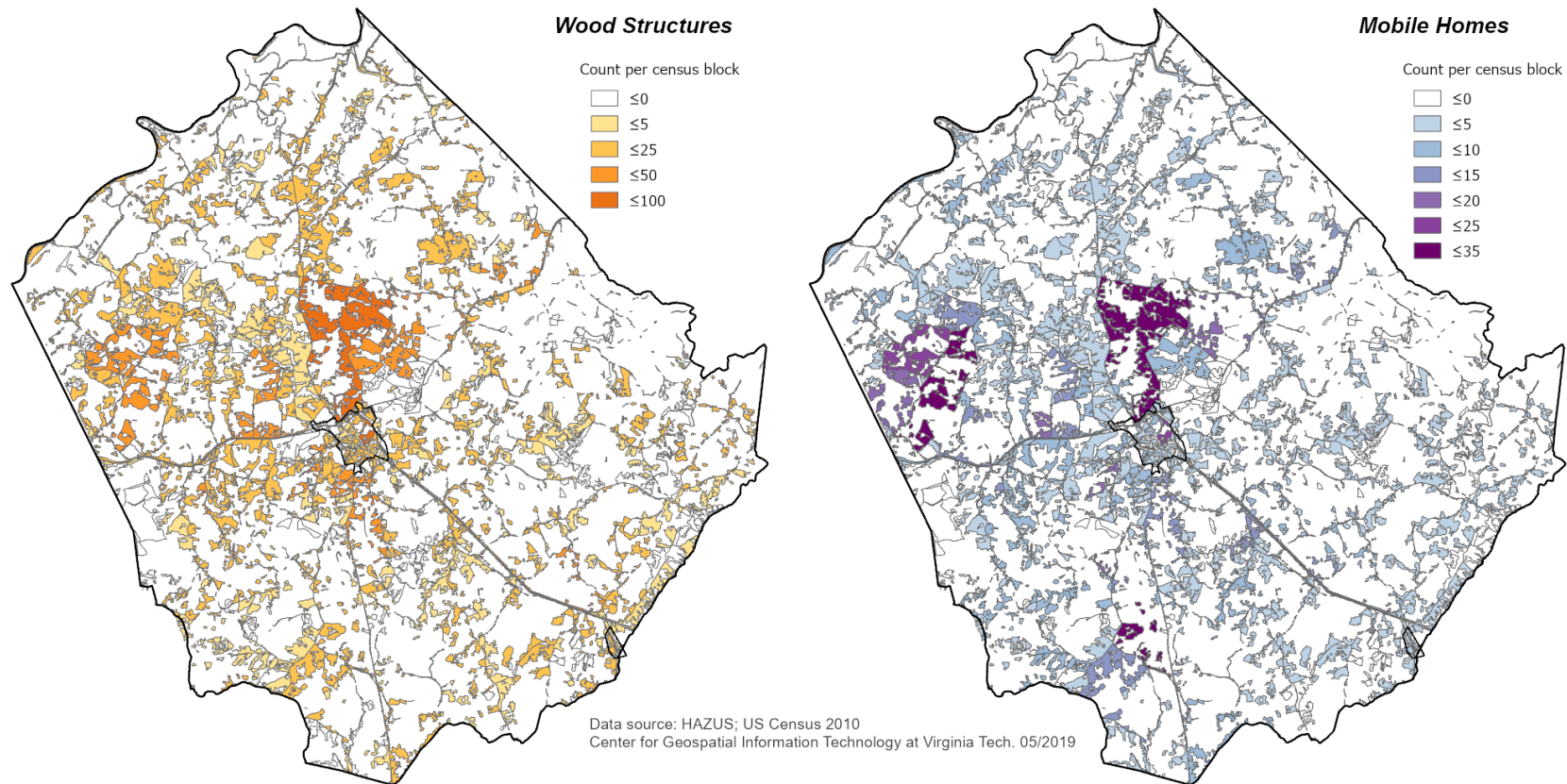


Figure 4-105 Geographic concentrations of wood structures and mobile home by census block in Appomattox County, Virginia





# Hazard Identification and Risk Assessment

## Geographic Concentrations of Wood Structure and Mobile Home by Census Block in Bedford County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020

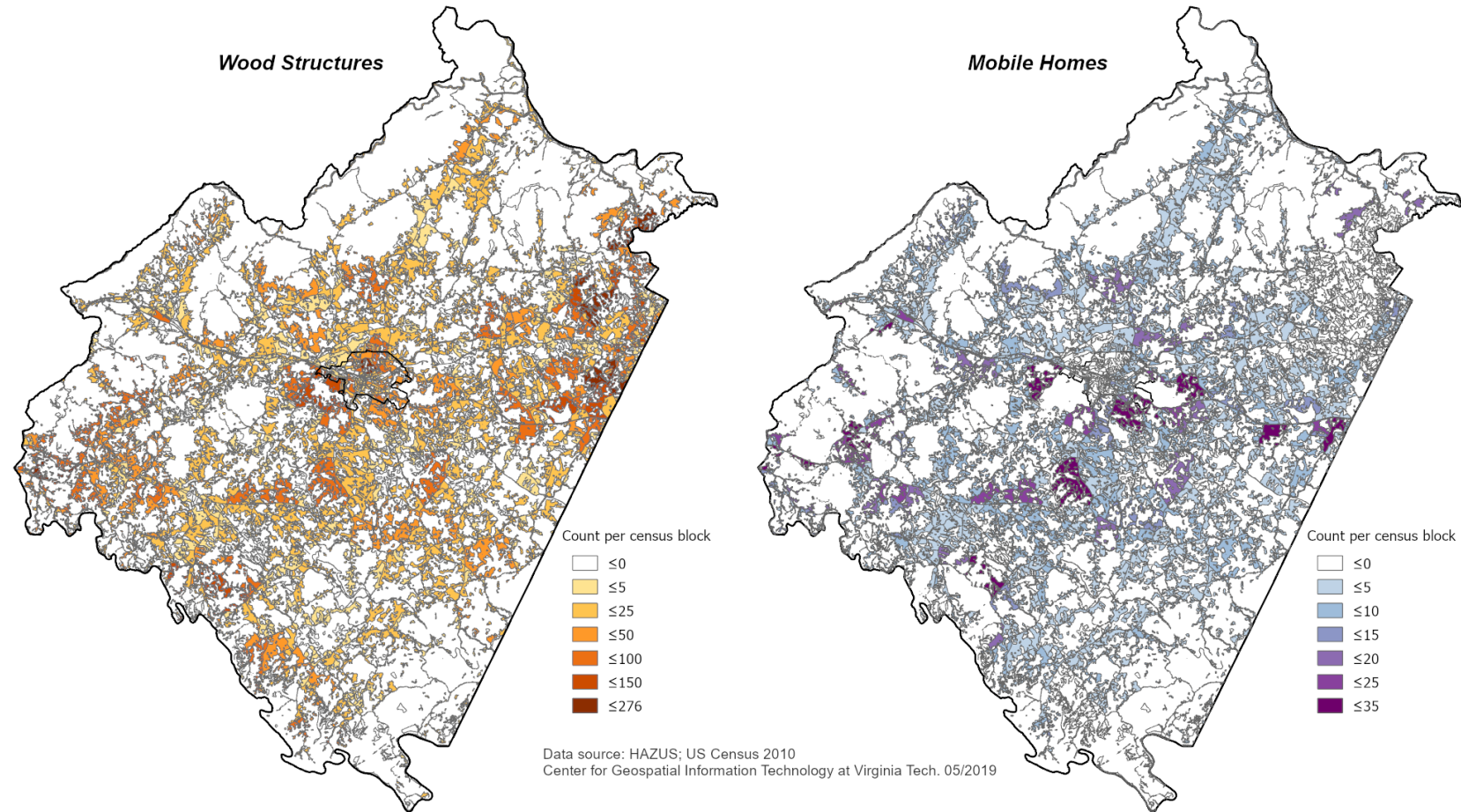


Figure 4-106 Geographic concentrations of wood structures and mobile home by census block in Bedford County, Virginia



# Hazard Identification and Risk Assessment

## Geographic Concentrations of Wood Structure and Mobile Home by Census Block in Campbell County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020

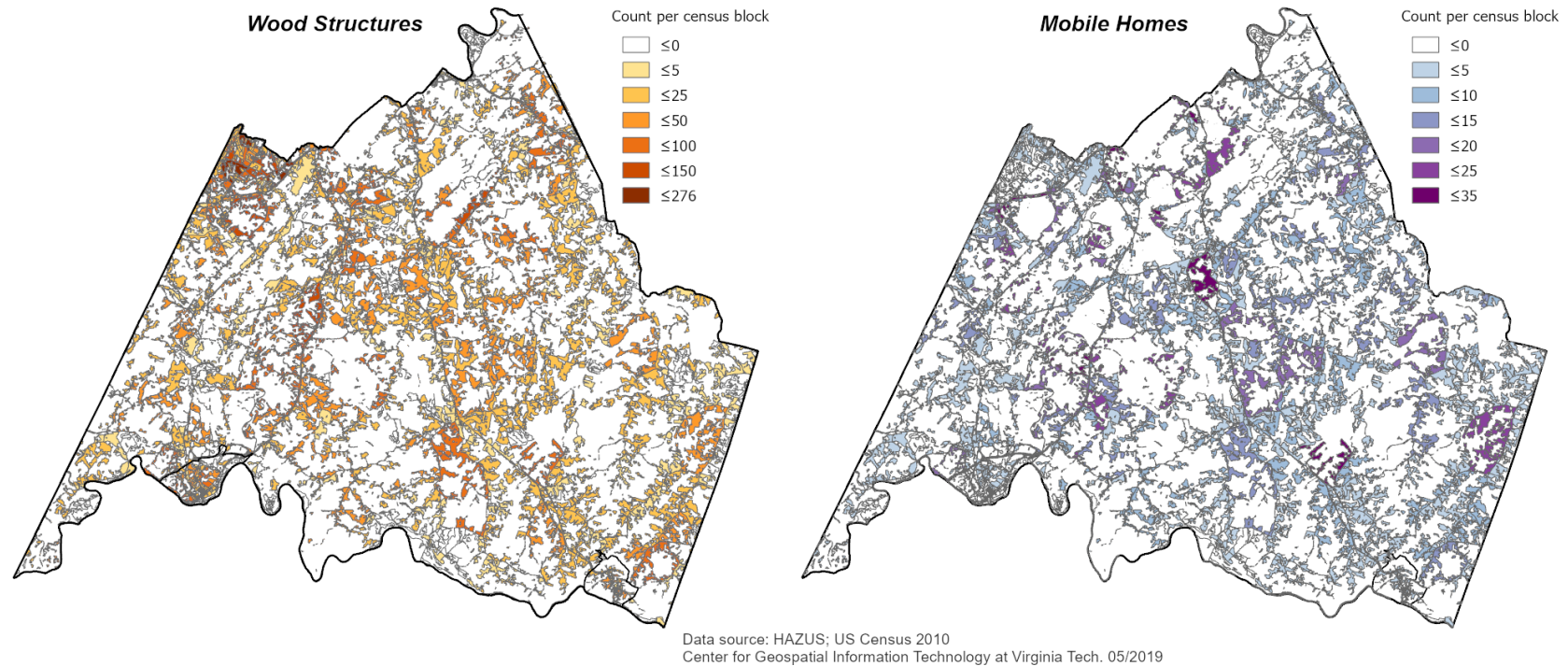


Figure 4-107 Geographic concentrations of wood structures and mobile home by census block in Campbell County, Virginia





# Hazard Identification and Risk Assessment

## Geographic Concentrations of Wood Structure and Mobile Home by Census Block in City of Lynchburg, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020

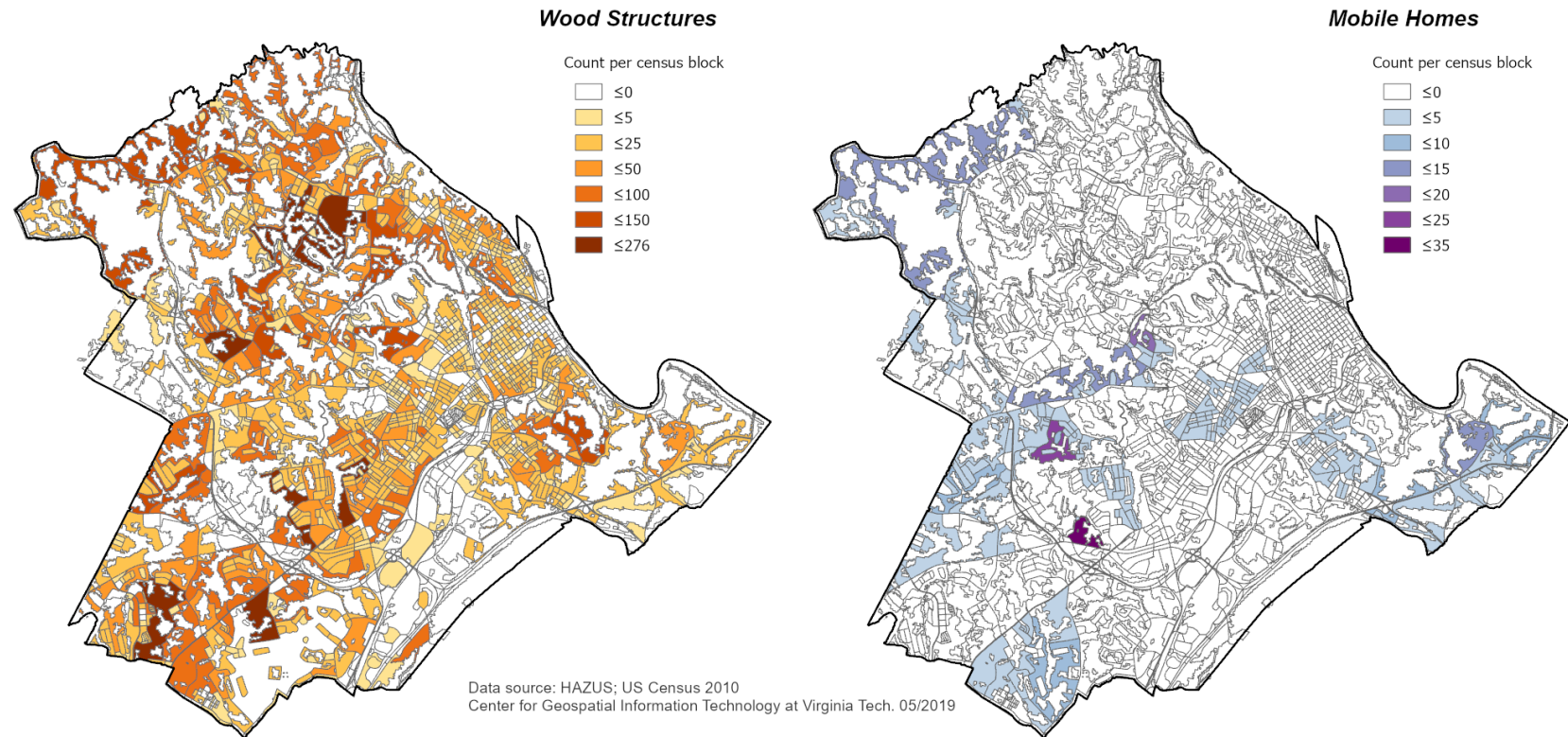


Figure 4-108 Geographic concentrations of wood structures and mobile home by census block in City of Lynchburg, Virginia



# Hazard Identification and Risk Assessment

## 4.6.5 References

- Federal Emergency Management Agency. *Guidelines for Wind Vulnerability Assessments of Existing Critical Facilities*. September 2019. <https://www.fema.gov/sites/default/files/2020-07/guidelines-wind-vulnerability.pdf>.
- National Weather Service. *The Enhanced Fujita Scale (EF Scale)*. <https://www.weather.gov/oun/efscale> (Accessed on Feb 1, 2019)
- National Weather Service. *The April 15th, 2018 Tornadoes Event Summary*. [https://www.weather.gov/rnk/2018\\_04\\_15\\_Tornado](https://www.weather.gov/rnk/2018_04_15_Tornado) (Accessed on May 20, 2019)
- Strader, Stephen M., and Walker S. Ashley. *Finescale Assessment of Mobile Home Tornado Vulnerability in the Central and Southeast United States*. *Weather, Climate, and Society* 10, no. 4 (October 2018): 797–812. <https://doi.org/10.1175/WCAS-D-18-0060.1>.
- Virginia Department of Emergency Management. *Tornado Preparedness*. 2019. <https://www.vaemergency.gov/wp-content/uploads/2019/05/tornado-one-sheet-in-house-printing-and-digital-download.pdf>





# Hazard Identification and Risk Assessment

## 4.7 Severe Thunderstorm

### 4.7.1 Hazard Profile

Thunderstorms are caused when air masses of varying temperatures and moisture content meet. Rapidly rising warm moist air serves as the driving force for thunderstorms. These storms can occur singularly, in lines, or in clusters. They can move through an area very quickly or linger for several hours.

Some storms produce a particular type of high wind called a *derecho*. Derechos are widespread, long-lived, straight-line wind storms associated with severe thunderstorms. They can cause hurricane-force winds, tornadoes, heavy rains, and flooding. Derechos travel quickly, with sustained winds that often exceed hurricane-force. They typically occur in the summer months, though they can occur any time of year and at any time of the day or night.

Although thunderstorms generally affect a small area when they occur, they can be very dangerous as, by definition, they contain lightning, and can also produce heavy rain, flash flooding, strong straight-line winds, large hail, and tornadoes.

#### 4.7.1.1 Magnitude / Severity

The National Weather Service (NWS) estimates that more than 100,000 thunderstorms occur each year across the United States, though only about 10 percent of these storms are classified as "severe". According to NWS, a typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. To be classified as a "severe thunderstorms", the storm must be capable of producing either a tornado, straight-line winds gust greater than 58 mph (50 knots)<sup>42</sup>, or hail greater than one inch in diameter.

The severity of a thunderstorm is usually measured based on the strength of the wind speeds or significant winds associated with the thunderstorm event. Table 4-121 depicts intensity for thunderstorms according to wind magnitude published by the World Meteorological Organization (WMO).

Table 4-121 Beaufort Wind Scale

Force	Wind (kts)*	Wind classification	Appearance of wind effects
0	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-7	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	8-12	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	13-18	Moderate Breeze	Dust, leaves, and loose paper lifted, small tree branches move
5	19-24	Fresh Breeze	Small trees in leaf begin to sway
6	25-31	Strong Breeze	Larger tree branches moving, whistling in wires
7	32-38	Near Gale	Whole trees moving, resistance felt walking against wind
8	39-46	Gale	Whole trees in motion, resistance felt walking against wind
9	47-54	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	55-63	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"

<sup>42</sup> <https://www.weather.gov/safety/thunderstorm>



# Hazard Identification and Risk Assessment

Force	Wind (kts)*	Wind classification	Appearance of wind effects
11	64-72	Violent Storm	If experienced on land, widespread damage
12	73+	Hurricane	Violence and destruction

\* 1 Knot (kts) = 1 Nautical Mile per hour, or approximately 1.15 miles per hour. Source: World Meteorological Organization

Figure 4-109 illustrates the typical distribution and frequency of derecho occurrence in the United States, as determined by the NWS.<sup>43</sup> Based on this data, the CVPDC area could expect to experience at least one derecho every 2-4 years, on average, especially during spring and early summer seasons.

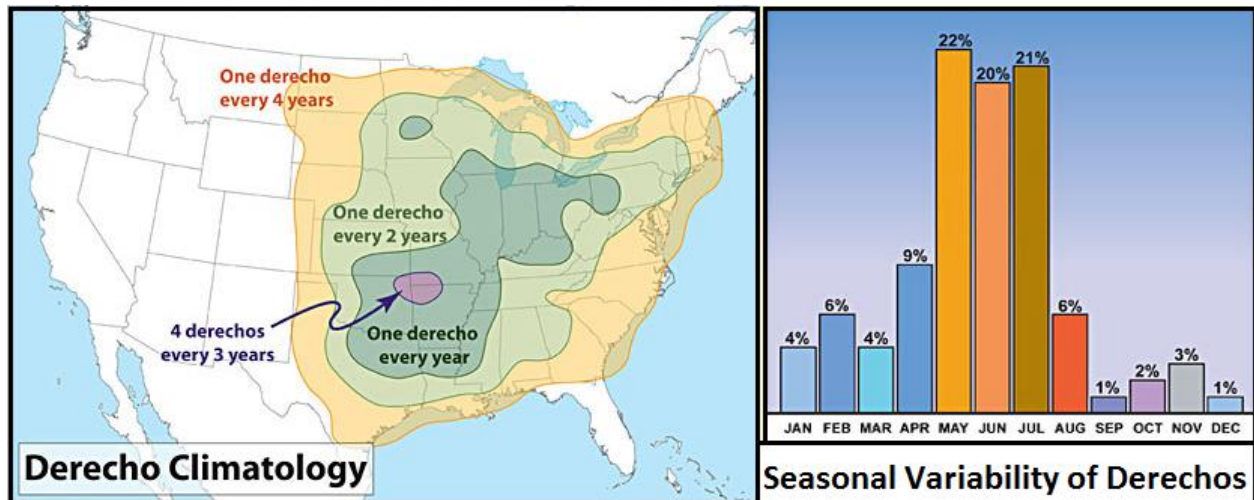


Figure 4-109 Derecho climatology and seasonal variability in the United States

## 4.7.1.2 Previous Occurrences

Although most frequent in the Southeast and parts of the Midwest, thunderstorms are a relatively common occurrence across Virginia. The CVPDC area is affected by thunderstorms each year, in almost all calendar months, and suffers damages caused by heavy rainfalls, lightning strikes or high winds. These severe weather reports associated with thunderstorms are recorded in the Storm Events Database at the National Center for Environmental Information (NCEI). Data has been collected in a consistent manner since 1996. It is important to note that this database covers only “reported” severe weather, and does not provide information on all the severe weather that may have occurred in a particular storm. The NOAA National Centers for Environmental Prediction (NCEP) publish Storm Prediction Center Severe Weather GIS (SVRGIS) data, including paths and initial points of thunderstorm wind events. Some historical events before 1996 may not have available wind paths information.

## 4.7.1.3 Thunderstorm Wind

NCEI Storm Events Database records 883 severe thunderstorm wind events between 1958 and 2019 for the CVPDC area. There are 507 recorded events that occurred in the past decade (2010 - 2019), most of them reaching 50 - 70 kts in magnitude (*i.e.* storm and violent storm conditions) and causing damages or injuries. Severe thunderstorm wind occurred every year, for example:

<sup>43</sup> <https://www.spc.noaa.gov/misc/AbtDerechos/derechofacts.htm>



# Hazard Identification and Risk Assessment

- On September 22, 2010, a very unstable atmosphere with plenty of potential for strong downdrafts of wind existed across the CVPDC region. Strong thunderstorms formed during the late afternoon and lasted into the early evening. Several of these storms realized the potential for damaging winds and resulted in the downing of numerous trees. In Bedford County, a severe thunderstorm uprooted many large trees, toppling them on lakefront homes, outbuildings, vehicles, and boats at Smith Mountain Lake. Also, the Smith Mountain Eagle reported numerous trees blown down at the Waterfront Park campground. Severe damage occurred to numerous recreational vehicles and campers at the park. In Campbell County, thunderstorm winds blew a tree down on a vehicle; one person in the vehicle was injured. In the City of Lynchburg, damaging winds blew multiple trees and power lines down. Some roads were blocked by debris.
- On June 29, 2012, a derecho of historic proportion rolled through the entire CVPDC region and caused widespread, significant damage. In Amherst County and Bedford County, severe thunderstorm winds that measured 66 mph blew several hundreds of trees down. Some of these trees brought down power lines and also fell onto houses. Many roads were blocked due to the downed trees. In Campbell County, hundreds of trees were blown down. The greatest concentration was over the northern half of the county. In the City of Lynchburg, over 1,000 trees were knocked down (Figure 4-110). Many power lines also came down as a direct result of the wind or trees and limbs falling on them. The winds damaged eight homes to the point of being deemed uninhabitable or destroyed. In Appomattox County, the thunderstorm winds brought down approximately 100 trees and many power lines across the county.



*Figure 4-110 Wind Damages in City of Lynchburg*

Figure 4-111 shows the initial points and paths of the damaging wind associated with thunderstorm events between 1958 and 2018 provided by SVRGIS (events in 2019 are currently unavailable in GIS data format). The color gradient represents a kernel density calculated using wind magnitudes of occurrence points of all historical wind events. The darker color represents areas that have experienced an increased number of



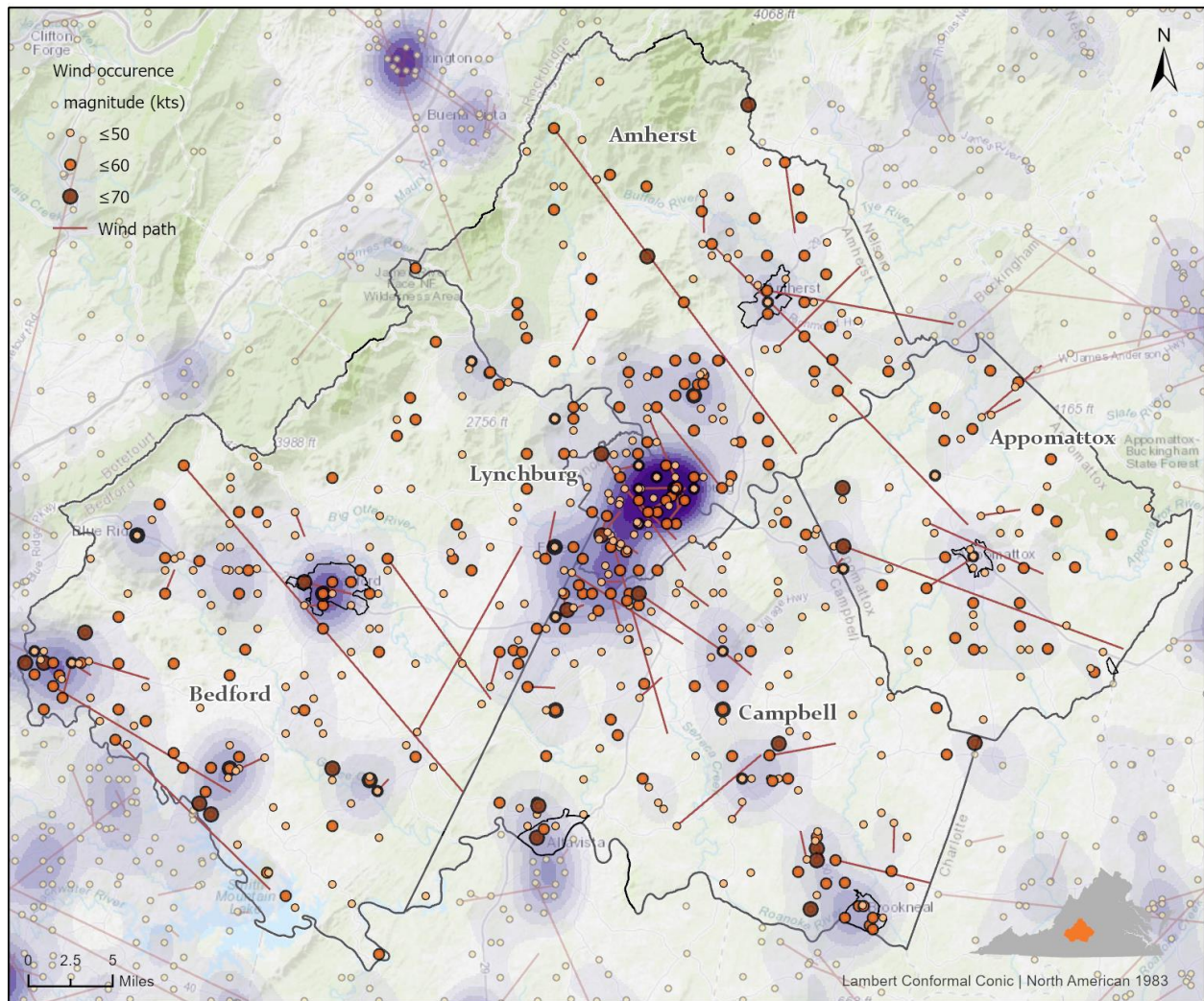


# Hazard Identification and Risk Assessment

reported events and severity. Highlighted points represent occurrence initiated within the PDC area. According to the map, many damaging winds occurred in and around the City of Lynchburg. Please note that the more rural parts of the CVPDC area may be underrepresented due to how the data is collected (using observations).

## Damaging Winds Associated with Severe Thunderstorms in Central Virginia PDC, 1958 - 2018

Central Virginia PDC Hazard Mitigation Plan Update 2020



The color gradient represents a kernel density calculated using occurrence points of all historical wind events. The darker color represents areas that have experienced an increased number of events and severity. Highlighted points represent occurrence in Central Virginia PDC.

Data source: SRVGIS, Storm Prediction Center, NOAA  
Center for Geospatial Information Technology at Virginia Tech. 04/2020



*Figure 4-111 Damaging Winds Associated with Severe Thunderstorms in CVPDC Area, 1958 - 2018*

### 4.7.1.4 Heavy Rain

There are 62 heavy rain events recorded in the NCEI Storm Events Database between 1996 and 2019 for the CVPDC area, including 26 events that occurred in the past decade (2010 - 2019). The events brought damages but no injuries or deaths. The following are most recent heavy rain occurrences:





# Hazard Identification and Risk Assessment

- On May 2, 2019, a few severe thunderstorms developed over the CVPDC area. The storms produced hail up to the size of quarters, damaging winds that blew down several trees, and lightning that set a house on fire and destroyed a transformer. Local, heavy rainfall caused some flooding in Bedford County.
- On August 1, 2019, very heavy rainfall occurred especially in parts of northeast Bedford County and the City of Lynchburg, where 3 to 4 inches of rain fell in several hours causing some flash flooding. It was estimated as roughly a 200-year rain event (0.5% annual chance occurrence).

## 4.7.1.5 Lightning

All thunderstorms contain lightning. A lightning strike is an electrical current between the cloud and ground. Each spark of lightning can reach over five miles in length, hit temperatures of approximately 50,000 degrees Fahrenheit, and contain 100 million electrical volts. There are about 25 million cloud-to-ground lightning flashes in the United States per year. According to the VAISALA Global Lightning Dataset, Virginia gets an average of 280,000 cloud-to-ground lightning flashes annually, and 6.9 flashes per square miles.<sup>44</sup> According to the National Weather Service, an average of 300 people are injured and 80 people are killed each year by lightning in the United States.<sup>45</sup>

According to the NCEI Storm Event database, there are 49 documented damaging lightning events for the CVPDC area between 1996 and 2019 which caused property damage, deaths, or injuries. In the past decade (2010 - 2019), 26 events have been reported. The PDC area experiences damaging lightning events every year. In the most recent events, lightning strikes from thunderstorms caused barns, outbuildings, homes, and a church to catch fire, brought down trees on homes and vehicles, and took down power lines across the CVPDC area.

## 4.7.1.6 1.4 Relationship to Other Hazards

Figure 4-112 shows the interrelationship (causation, concurrence, *etc.*) between this hazard and other hazards discussed in this plan update.

## 4.7.2 Impact and Vulnerability

Thunderstorms are one of the most common and most noticeable weather events of our atmosphere. Compared to other natural hazards, thunderstorms pose hazards and hazardous effects that most concern people throughout the CVPDC area. Severe thunderstorms contain multiple dangers that can threaten safety and personal property in any part of the region and at any time of the year, including flooding, tornadoes, high wind, hail, lightning, and lightning-induced fire (urban fires and wildfires). The impacts of severe thunderstorms would have many of the same impacts as hurricane, tornado, and flooding. For more information concerning those hazards, please refer to the corresponding chapters in this plan. Thunderstorms associated with large hail are discussed separately in the Hailstorm chapter.

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<sup>44</sup> Vaisala Global Lightning Dataset GLD360, 2018. <https://www.vaisala.com/en/products/data-subscriptions-and-reports/data-sets/gld360>

<sup>45</sup> <https://www.weather.gov/phi/ThunderstormDefinition>



# Hazard Identification and Risk Assessment

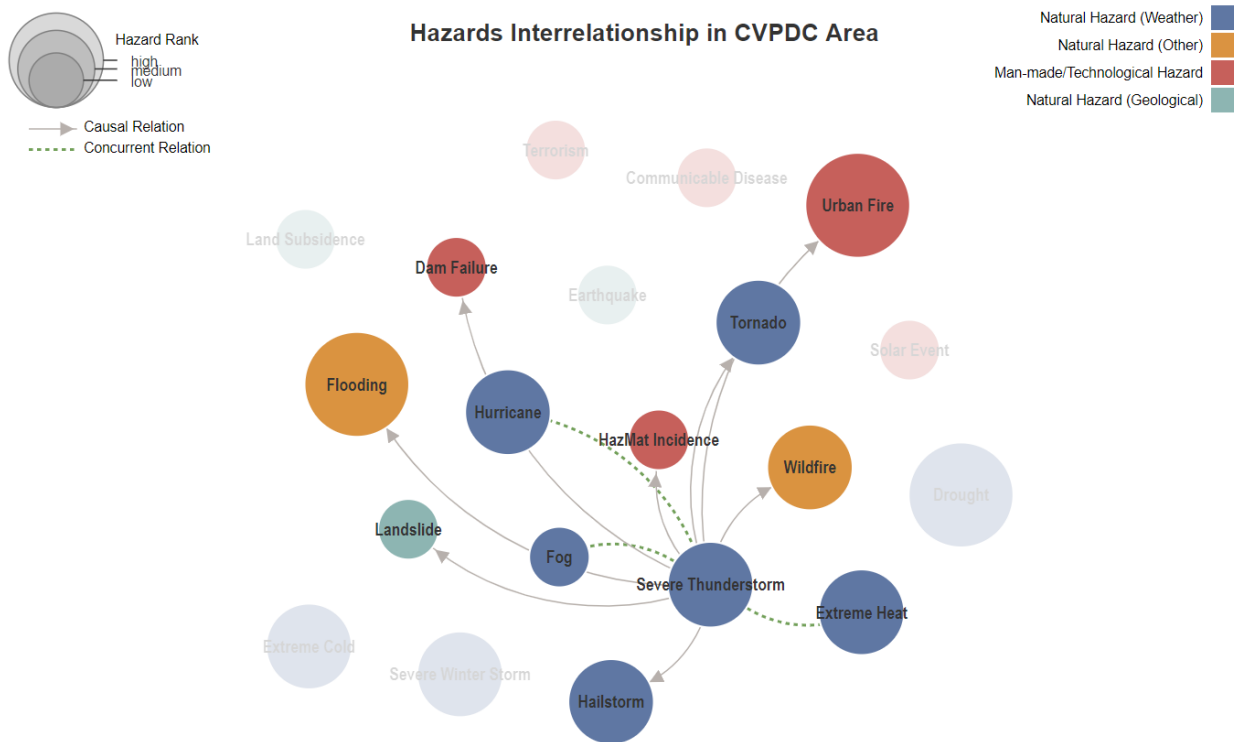


Figure 4-112 Hazards interrelationship

## 4.7.2.1 Thunderstorm Wind

According to NOAA National Severe Storms Laboratory, damage from severe thunderstorm winds account for half of all severe reports and is more common than damage from tornadoes.<sup>46</sup> The strong straight-line winds or derechos associated with thunderstorms knock down trees, power lines, and mobile homes.

## 4.7.2.2 Heavy Rainfall

Heavy rainfalls coupled with extreme temperatures or other severe weather conditions can result in increases in traffic accidents and disruptions in transportation, commerce, government, and education. Such severe weather incidents can also cause utility outages and injuries due to falling trees or other debris and flooding.

## 4.7.2.3 Flash Flooding

An associated danger of heavy rainfalls during the passage of thunderstorms is flash flooding. The NWS classifies flooding into two types: those that develop and crest over a period of approximately six hours (flooding) or more, and those that crest more quickly (flash flooding). Flash flooding is typically the result of intense rainfalls, possibly in conjunction with already saturated soils, though very sudden snow melts can also contribute to flash flooding. Flash flooding is difficult to distinguish and can be either riverine or stormwater flooding (overland flooding). Stormwater flooding events tend to strike and end swiftly. They occur when stormwater pools in normally dry depressions in the land. For more details, please refer to the Flood and Landslides chapters.

<sup>46</sup> <https://www.nssl.noaa.gov/education/svrwx101/wind/>



# Hazard Identification and Risk Assessment

## 4.7.2.4 Stormwater Runoff

Stormwater runoff is one of the largest sources of water pollution in urban and suburban areas. It presents many environmental, social, and economic challenges. Rainwater that flows over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, does not soak into the ground, resulting in stormwater runoff. The runoff picks up pollutants such as trash, chemicals, oils, and dirt/sediment that can harm rivers, streams, lakes, and coastal waters. These pollutants directly impact water quality. Increases in stormwater runoff are not only a concern for water quality, but also directly contribute to urban flooding. As high volumes of runoff enter local streams, there is also a rapid increase in the water levels in those streams. This increases the impacts of localized flooding, streambank erosion, destruction of property, and, in some cases, flash flooding.

Green infrastructure is a cost-effective, resilient approach to mitigate stormwater impacts and provide many community benefits.<sup>47</sup> See Mitigation chapter about examples of green infrastructure practices.

## 4.7.2.5 Lightning

Lightning has the ability to create wildfires as well as local and large-scale power outages that can be damaging to communication systems and electrical systems including computers. According to NWS, lightning kills an average of 47 people in the United States each year, and hundreds more are severely injured. Early detection, monitoring, and warning of lightning hazards, combined with prudent protective actions, can greatly reduce the likelihood of lightning injuries and deaths.

## 4.7.3 Risk Assessment and Jurisdictional Analysis

Although the thunderstorm risk cannot be fully estimated due to lack of intensity-damage models for this hazard, economic losses from historical events contained within the NCEI storm event data could provide insights.

### 4.7.3.1 Thunderstorm Wind

According to the NCEI Storm Events Database, the 883 severe thunderstorm wind events in the CVPDC area during 1958 and 2019 resulted in \$15,091,460 loss in property damage, \$40,500 loss in crop damage (mainly in Campbell County), and 4 injuries (Table 4-122). According to the data, over 80% of the thunderstorm wind occurred between May and August in the region. Bedford County and Campbell County experienced more than 60% of the total events. The City of Lynchburg had more economic losses than any other jurisdictions (Table 4-122 and Table 4-123).

Anyone living in thunderstorm-prone areas is at risk for experiencing this hazard. People living in mobile homes are especially at risk for injury and death. Even anchored mobile homes can be seriously damaged when high winds gust over 80 mph. Please refer to the Hurricane hazard chapter for more information.

Table 4-122 Occurrence of Thunderstorm Wind Events by Jurisdiction in CVPDC area, 1958 - 2019

Jurisdiction	Number of Events	Number of Deaths	Number of Injuries	Property damage (\$K)	Crop damage (\$K)
Amherst County	161	0	0	642.64	0
Appomattox County	98	0	0	405.20	0

<sup>47</sup> <https://www.epa.gov/green-infrastructure/what-green-infrastructure>



# Hazard Identification and Risk Assessment

Jurisdiction	Number of Events	Number of Deaths	Number of Injuries	Property damage (\$K)	Crop damage (\$K)
Bedford County	307	0	1	4,321.80	0
Campbell County	237	0	3	1,789.12	40.50
Lynchburg City	80	0	0	7,932.70	0
<b>Total</b>	<b>883</b>	<b>0</b>	<b>4</b>	<b>15,091.46</b>	<b>40.50</b>

Table 4-123 Occurrence of Thunderstorm Wind Events by Month in CVPDC Area, 1959 - 2019

Month	Number of Events	Number of Deaths	Number of Injuries	Property damage (\$K)	Crop damage (\$K)
January	5	0	0	7.00	0
February	6	0	0	9.50	0
March	14	0	0	108.10	0
April	51	0	0	437.90	0
May	132	0	2	378.46	0
June	223	0	1	10,086.40	0
July	218	0	0	984.90	0.50
August	158	0	0	312.70	40.00
September	50	0	1	2,633.20	0
October	6	0	0	43.50	0
November	17	0	0	28.00	0
December	3	0	0	61.80	0
<b>Total</b>	<b>883</b>	<b>0</b>	<b>4</b>	<b>15,091.46</b>	<b>40.50</b>

## 4.7.3.2 Heavy Rain

The NCEI Storm Events Database only recorded two damages associated with heavy rain events in the CVPDC area: one heavy rain in March 2010 caused about \$3000 damages in the Town of Brookneal; another event in June 2018 brought about one million dollars of loss in the City of Lynchburg.

## 4.7.3.3 Lightning

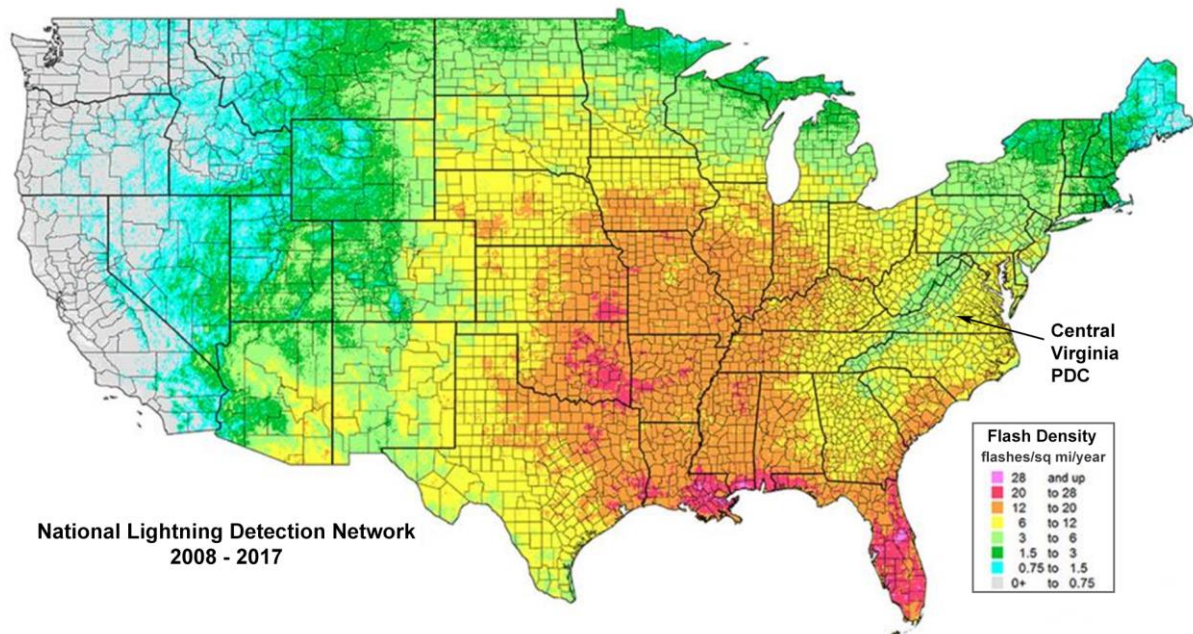
According to the NCEI Storm Events Database, during the period 1996 through 2019, there were 49 reported structural damage reports or injuries associated with lightning strikes across the CVPDC area. These events resulted in a reported loss of \$1,254,550 in property damage, 2 deaths, and 2 injuries during the 23-year period (Table 4-124). Bedford County and Campbell County experienced the most damaging lightning events. A majority of the events are concentrated in June and July for the CVPDC area (Table 4-125).

As indicated by Figure 4-113, the CVPDC area averages between 3 and 6 flashes of cloud-to-ground lightning per square mile per year. That equals a 0.8% to 1.6% chance of a cloud-to-ground lightning strike on any given day. This shows a much higher indication of lightning occurrences than has been reported to the NCEI Storm Database, which only records lightning events causing damage.





# Hazard Identification and Risk Assessment



(Source: VAISALA, 2018)

Figure 4-113 Occurrences density of cloud-to-ground lightning flashes in the United States.

Table 4-124 Occurrence of Damaging Lightning Events by Jurisdiction in CVPDC Area, 1996 - 2019

Jurisdiction	Number of Events	Number of Deaths	Number of Injuries	Property Damage (\$K)
Amherst County	6	0	1	320.40
Appomattox County	3	0	0	17.50
Bedford County	14	1	0	283.00
Campbell County	17	1	1	322.55
Lynchburg City	9	0	0	311.10
<b>Total</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1,254.55</b>

Table 4-125 Occurrence of Damaging Lightning Events by Month in CVPDC Area, 1996 - 2019

Month	Number of Events	Number of Deaths	Number of Injuries	Property Damage (\$K)
April	3	0	0	83.00
May	5	0	0	222.50
June	13	1	0	401.20
July	17	1	1	250.25
August	9	0	1	242.60
Sep	2	0	0	55.00
<b>Total</b>	<b>49</b>	<b>2</b>	<b>2</b>	<b>1,254.55</b>



# Hazard Identification and Risk Assessment

## 4.7.4 Probability of Future of Occurrences

Since severe storms are difficult to predict, it is extremely difficult to determine the probability of future occurrence with any degree of accuracy. Based on historical record, the CVPDC area is projected to continue to experience severe thunderstorms with great frequency; several times a year, in most cases.

Thunderstorms can be detected using a variety of tools. Radars depict where rain and hail are located in the storm. Doppler radars also allow us to visualize how the wind is blowing within and near the storm. Some features of thunderstorms, such as the anvil that spreads out at the top of the storm, can be seen from satellites. Flash flooding may be predicted with reasonable notice using meteorological techniques to determine likely rainfall, intensity, and duration.

Climate change is projected to increase the frequency and intensity of extreme weather events, including severe thunderstorms. Using global climate models and a high-resolution regional climate model, one study by Stanford University in 2013 that investigated the link between severe thunderstorms and global warming found a net increase in the number of days with environmental conditions that foster the development of severe thunderstorms.<sup>48</sup> This was true for much of the United States, including the CVPDC area.

## 4.7.5 References

- NOAA Storm Prediction Center. *SPC tornado, hail, and wind database format specification*. [https://www.spc.noaa.gov/wcm/data/SPC\\_severe\\_database\\_description.pdf](https://www.spc.noaa.gov/wcm/data/SPC_severe_database_description.pdf)
- Colorado hazard mitigation plan 2013. 2013. p.125
- Environmental Protection Agency. *Storm Smart Cities: Integrating Green Infrastructure into Local Hazard Mitigation Plans*. EPA 903-K-18-001. March, 2013. [https://www.epa.gov/sites/production/files/2018-04/documents/storm\\_smart\\_cities\\_508\\_final\\_document\\_3\\_26\\_18.pdf](https://www.epa.gov/sites/production/files/2018-04/documents/storm_smart_cities_508_final_document_3_26_18.pdf)
- National Weather service. *Lightning Safety Tips and Resources*. <https://www.weather.gov/safety/lightning> (Accessed on May 22, 2019)
- National Weather Service. *Understanding Lightning Science*. <https://www.weather.gov/safety/lightning-science-overview>
- National Centers for Environmental Information. Storm Events Database - Search Results. [https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=\(C\)+Lightning&beginDate\\_mm=01&beginDate\\_dd=01&beginDate\\_yyyy=1950&endDate\\_mm=10&endDate\\_dd=31&endDate\\_yyyy=2019&county=AMHERST:9&county=APPOMATTOX:11&county=BEDFORD:19&county=BEDFORD+\(C\):515&county=CAMPBELL:31&county=LYNCHBURG+\(C\):680&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=51,VIRGINIA](https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=(C)+Lightning&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=AMHERST:9&county=APPOMATTOX:11&county=BEDFORD:19&county=BEDFORD+(C):515&county=CAMPBELL:31&county=LYNCHBURG+(C):680&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=51,VIRGINIA)
- NOAA National Severe Storms Laboratory. Severe Weather 101: Damaging Winds Basics. <https://www.nssl.noaa.gov/education/svrwx101/wind/>
- Noah S. Diffenbaugh, Martin Scherer, and Robert J. Trapp. *Robust increases in severe thunderstorm environments in response to greenhouse forcing*. PNAS, September 23, 2013 DOI: 10.1073/pnas.1307758110

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<sup>48</sup> <https://www.sciencedaily.com/releases/2013/09/130923155542.htm>



# Hazard Identification and Risk Assessment

- VAISALA. *Number of Cloud-To-Ground Flashes by State from 2008 to 2017*. 2018.  
[https://www.weather.gov/media/safety/08-17Flash\\_Density\\_State.pdf](https://www.weather.gov/media/safety/08-17Flash_Density_State.pdf)
- NOAA Storm Prediction Center. *Annual Severe Weather Report Summary 2019*.  
[https://www.spc.noaa.gov/climo/online/monthly/2019\\_annual\\_summary.html](https://www.spc.noaa.gov/climo/online/monthly/2019_annual_summary.html) (Accessed on May 22, 2019)
- Stephen F. Corfidi, Jeffry S. Evans, and Robert H. Johns. *About Derechos*. NOAA-NWS-NCEP Storm Prediction Center website. May 15, 2018.  
<https://www.spc.noaa.gov/misc/AbtDerechos/derechofacts.htm>



# Hazard Identification and Risk Assessment

## 4.8 Severe Winter Storm

### 4.8.1 Hazard Profile

A severe winter storm is a prolonged storm event in which the varieties of precipitation are formed that only occur at low temperatures, such as snow or sleet, or a rainstorm where ground temperatures are low enough to allow ice to form (*i.e.* freezing rain). The characteristics of severe winter storms are determined by the amount and extent of snow or ice, air temperature, wind, and event duration (National Weather Service, 2009).

The common types of winter precipitation are snow, sleet, and freezing rain.<sup>49</sup>

- **Snow** is precipitation in the form of ice crystals, mainly of intricately branched, hexagonal form and often agglomerated into snowflakes, formed directly from the freezing of the water vapor in the air. There are different types of snow precipitation, including *snow showers*, *snow squalls*, and *blizzards*. Snow storms can amount to light flurries to blizzards with blinding wind driven snow. Blizzards are a combination of blowing snow and wind resulting in very low visibilities. While heavy snowfalls and severe cold often accompany blizzards, this is not always the case. Sometimes strong winds pick up snow that has already fallen, creating a ground blizzard.
- **Sleet** is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes before reaching the ground. It usually bounces when hitting a surface and does not stick to objects; however, sleet can accumulate like snow and cause a hazard to motorists.
- **Freezing rain** is precipitation that falls as rain, but freezes on contact with the surface, forming a glaze of ice. A significant accumulation of freezing rain lasting several hours or more is called an ice storm. Even small accumulations of ice can cause a significant hazard, especially on power lines and trees. An ice storm occurs when freezing rain falls and freezes immediately upon impact. Communications and power can be disrupted for days, and even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

#### 4.8.1.1 Geographic Location/ Extent

A winter storm is a combination of heavy snow, blowing snow, and/or dangerous wind chills. Winter weather generally impacts Virginia between the months of November and April, with varied intensities from east to west.

The CVPDC area's maximum 1-day snowfall of 21.8 inches on March 6, 1962 was recorded by Pedlar River Dam weather station in Amherst County. Table 4-126 lists the 1-, 2-, and 3-day snowfall maximums from each county in the region.

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<sup>49</sup> <https://www.nssl.noaa.gov/education/svrwx101/winter/types/>





# Hazard Identification and Risk Assessment

Table 4-126 Snowfall extremes in the CVPDC area

Locality	1-Day Extremes		2-Day Extremes		3-Day Extremes	
	Value	Date	Value	Date	Value	Date
Amherst County	21.8	1962/03/06	25.3	1962/03/06	28.3	1962/03/07
Appomattox County	18	1996/01/07	30	1996/01/07	30	1996/01/07
Bedford County	18	1996/01/07	25	1996/01/08	25	1996/01/09
Campbell County	16.4	1922/01/27	23	1987/01/23	23	1987/01/23
Lynchburg City	16.4	1922/01/27	21.4	1996/01/08	21.4	1996/01/08

(1-, 2-, and 3-day snowfall maximums from each county. Values are in inches. Data were last updated on October 22, 2018 to accommodate data through June 30, 2018.)<sup>50</sup>

## 4.8.1.2 Magnitude/Severity

The National Weather Service developed the *Northeast Snowfall Impact Scale* (NESIS) to characterize and rank high-impact snowstorms that impact the northeast corridor (Kocin and Uccellini, 2004) (Figure 4-114). NESIS provides a relative measure of Northeast winter storm impact based on total snowfall amount, its geographic distribution, and population density. The scale was developed because of the economic and transportation impact Northeast snowstorms can have on the rest of the country. The NESIS has five categories, ranging from Notable to Extreme (Table 4-127), and is frequently used to describe snowstorms with large areas of 10 inch snowfall accumulations. The index is unique in that it uses population information as well as meteorological measurements, which results in an indication of a storm's societal impacts.

The National Climatic Data Center (NCDC) computes NESIS values when a significant snowstorm hits the 13-state Northeast region—defined as West Virginia, Virginia, and northeastward through New York and the New England states. To capture the entire storm history, NESIS values are computed using total snowfall distributed east of the Rocky Mountains. The CVPDC area is part of the Northeast urban corridor and is therefore included in the NESIS ranking system. Please see Squires and Lawrimore (2006) for more information.

Table 4-127 NESIS Categories and Corresponding Value.

Category	NESIS Value	Descriptions
1	1 - 2.499	Notable
2	2.5 - 3.99	Significant
3	4 - 5.99	Major
4	6 - 9.99	Crippling
5	10.0+	Extreme

(Source: NOAA)

The NESIS scale was calibrated based on an analysis of thirty Northeast snowstorms that occurred from 1956 to 2000, using the average area covered by at least 10 inches or more of snowfall accumulation and the average population (as of the 2000 census) within the affected area. The mean NESIS value for these calibration events is 5.0 (Category 3). Table 4-128 shows the top ten most severe storms on record are ranked by NESIS value.

<sup>50</sup> <https://www.ncdc.noaa.gov/snow-and-ice/snowfall-extremes/VA/1>



# Hazard Identification and Risk Assessment

The highest snow storm impact that affected the Northeast urban corridor was recorded on March 12-14, 1993 (Figure 4-115).

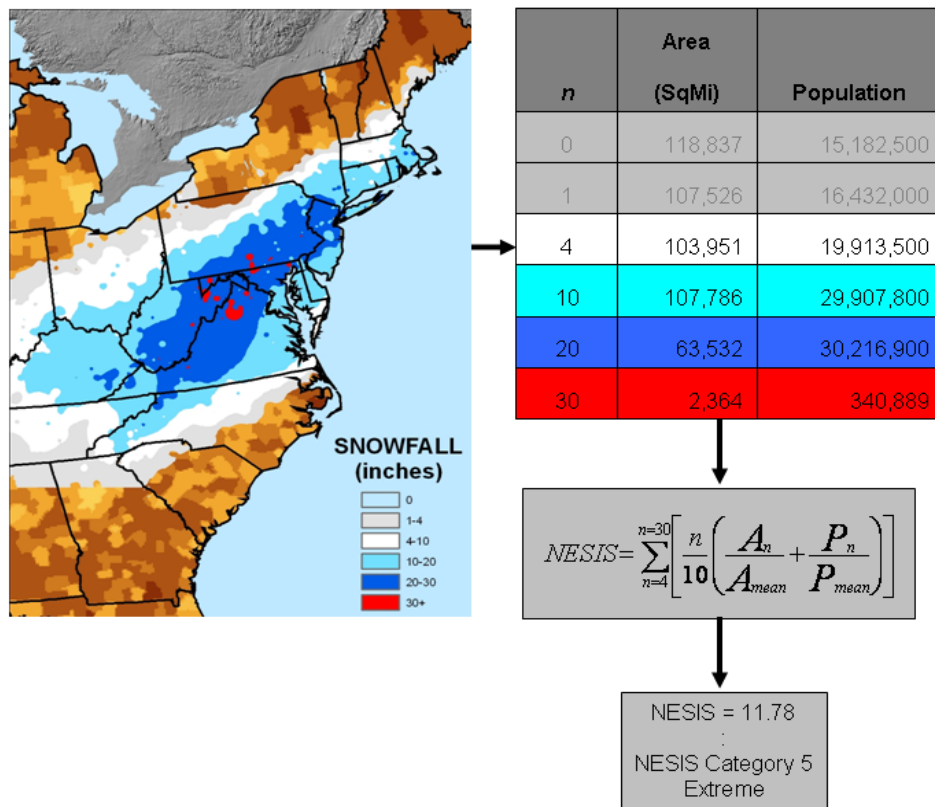


Figure 4-114 North Eastern Snowfall Impact Scale (NESIS)

Table 4-128 Ten highest-impact snowstorms that affected the Northeast urban corridor, ranked by severity

Rank	Start	End	NESIS	Category	Description
1	3/12/1993	3/14/1993	13.20	5	Extreme
2	1/6/1996	1/8/1996	11.78	5	Extreme
3	2/3/1960	3/5/1960	8.77	4	Crippling
4	1/22/2016	1/24/016	7.66	4	Crippling
5	2/15/2003	2/18/2003	7.50	4	Crippling
6	2/2/1961	2/5/1961	7.06	4	Crippling
7	1/11/1964	1/14/1964	6.91	4	Crippling
8	1/21/2005	1/24/2005	6.80	4	Crippling
9	1/19/1978	1/21/1978	6.53	4	Crippling
10	12/25/1969	12/28/1969	6.29	4	Crippling

(Source: NOAA) <sup>51</sup>

<sup>51</sup> <https://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis>



# Hazard Identification and Risk Assessment

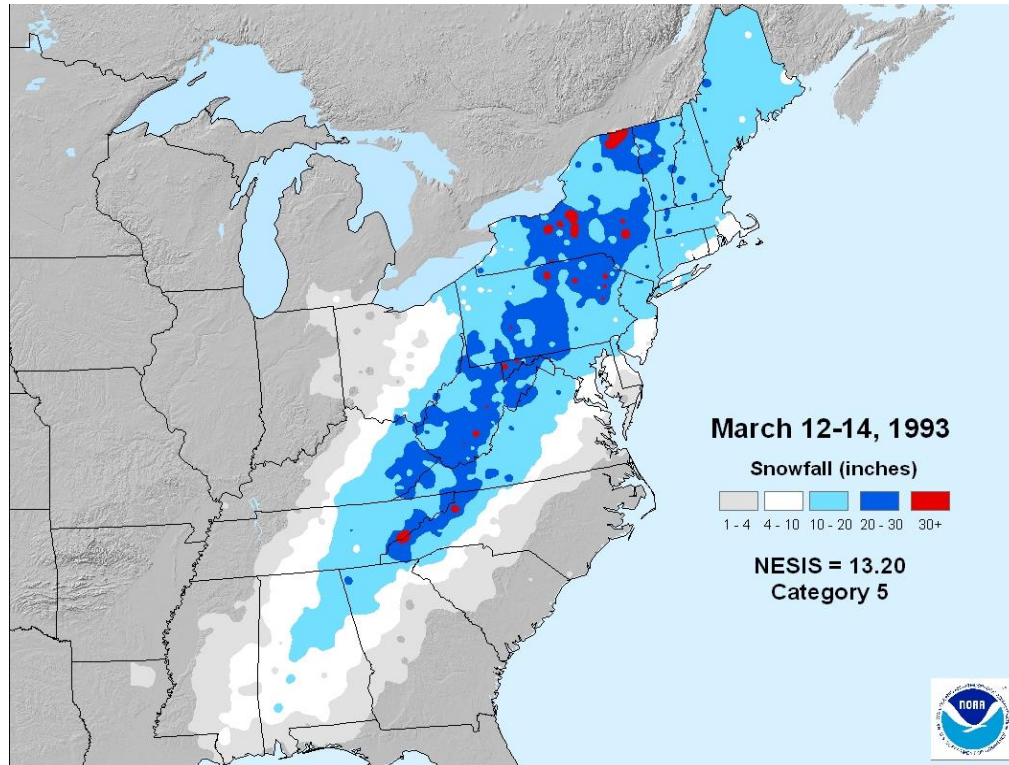


Figure 4-115 The Highest Impact Snow Storms that Affected the Northeast Urban Corridor, March 12-14, 1993

#### 4.8.1.3 Previous Occurrences

The hazard history of major winter storm events that have occurred in the CVPDC area can be found in Appendix H: Hazard Events. Events have been broken down by the date of occurrence and, when available, by individual community descriptions. A large percentage of the region's federal declared disasters were due to severe winter weather. When no community specific description is available, the general description should be used as representing the entire planning area.

#### 4.8.1.4 1.5 Relationship to Other Hazards

Figure 4-116 shows the interrelationship (causation, concurrence, *etc.*) between this hazard and other hazards discussed in this plan update.

#### 4.8.2 Impact and Vulnerability

Heavy snowfall, ice storms, and extreme cold can immobilize an entire region. Areas that normally experience mild winters can experience a major snowstorm or extreme cold. The four characteristics of a winter storm that occur separately or together are snow, wind, ice, and cold temperatures.



# Hazard Identification and Risk Assessment

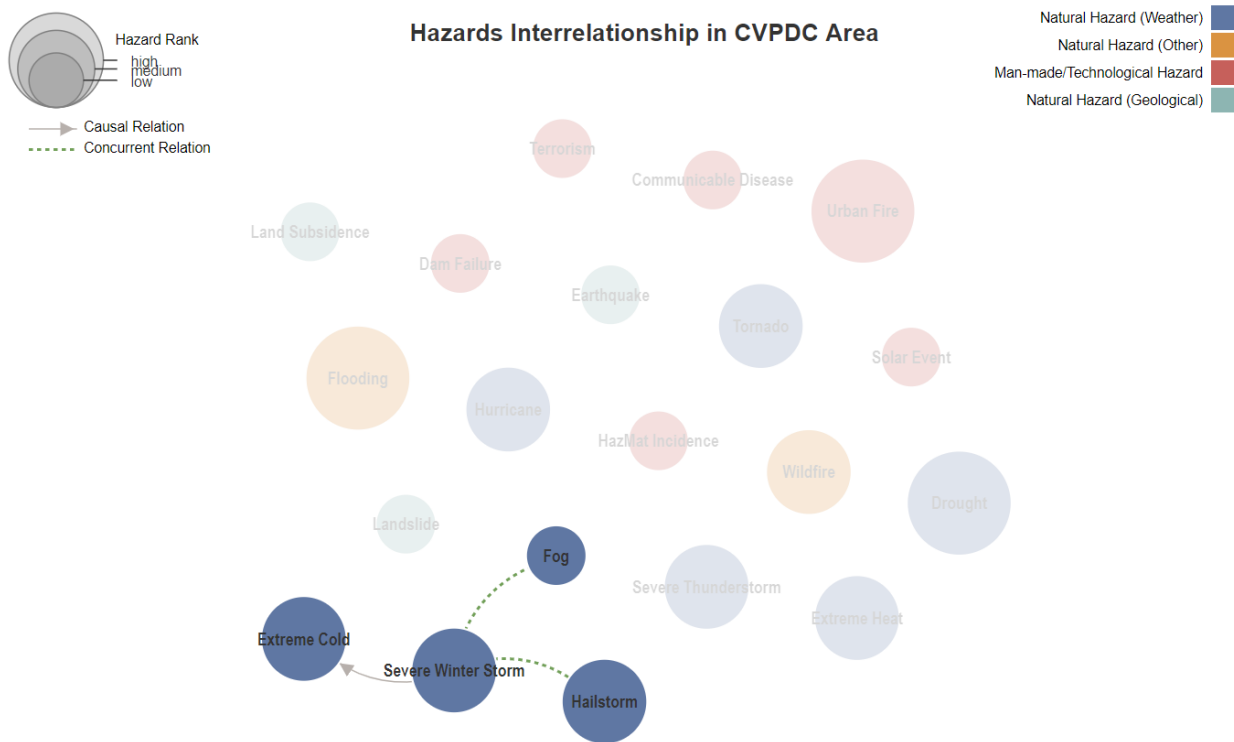


Figure 4-116 Hazards interrelationship

Biggest threats to the public:

- Critical facilities: loss of utilities due to power outages
- Transportation: icing conditions, vehicle crash, road blockage, and highway closure
- Property damage

The most notable impact from winter storms is the damage to power distribution networks and utilities. Ice storms pose particular danger, as the weight of the ice can knock down power lines and weaken telephone poles. The impacts of winter storms are minimal in terms of property damage and long-term effects. Power outages during the winter months can be dangerous if residents do not have an alternate heat source. Homes and businesses suffer damage when electric service is interrupted for long periods of time. Excessive snowfall can lead to roof collapses if roofs are not cleared of snow. As snow melts, an ice dam (a buildup of ice that typically forms along the eaves) prevents snow melt from flowing into the gutters and can eventually cause major damage to the roof and water leaks to the interior of homes.

Severe winter storms have the potential to inhibit normal functions of the community. Governmental costs for this type of event are a result of the needed personnel and equipment for clearing streets. Private sector losses are attributed to lost work when employees are unable to travel. All types of winter storms contribute to hazardous travel conditions, especially freezing rain, which is the most treacherous.

Health threats can become severe when frozen precipitation makes roadways and walkways very slippery, due to prolonged power outages, and if fuel supplies are jeopardized. Occasionally, buildings may be damaged





# Hazard Identification and Risk Assessment

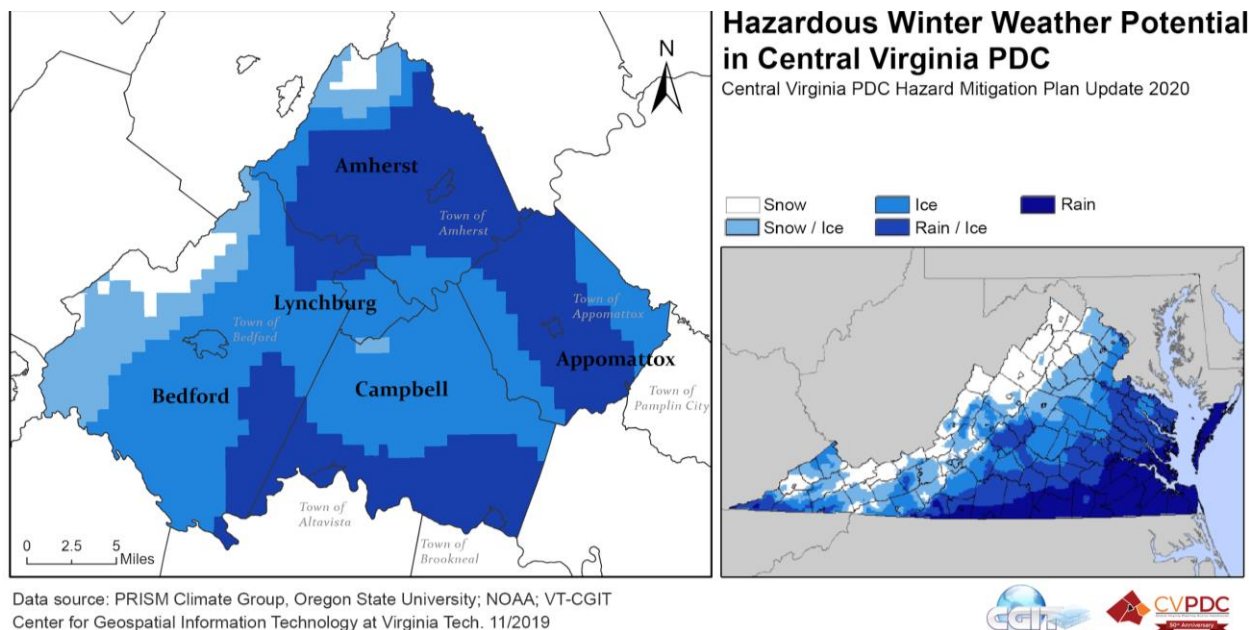
when snow loads exceed the design capacity of their roofs or when trees fall due to excessive ice accumulation on branches.

Another challenge with winter weather in Virginia and in the region is the amount of ice that often comes as part of winter weather. Snowfall and ice potential are generated based on the percentage difference between the total precipitation from November to April and the corresponding liquid equivalent snowfall depth. Since snow falls in a frozen state, it does not accumulate on the surface the same way as rainfall would. In order to account for this difference, there are characteristic snow/rain relationships that have been created.

For example, a value of 1 would mean that all of the precipitation at the location falls as liquid rainfall, and a value of 0.5 would mean that half of the precipitation falls as liquid rainfall and half falls as frozen precipitation. It is assumed that the lower the percentage, the greater potential that precipitation within these months is falling as snow. The values in the middle of the two extremes would represent regions that favor ice conditions over rain and snow. A five quintile distribution was applied to the output statewide grid to split the percentages into five characteristic climatological winter weather categories (snow, snow/ice, ice, rain/ice, and rain). (Source: PRISM Climate Group; Virginia Tech CGIT)

Figure 4-117 shows the statewide map of the CVPDC area for likelihood of future occurrences. The planning team agreed that these maps accurately depicted the level of risk of future events for their respective localities. The trend of ice potential in Virginia is highest in the area between the eastern edge of the Blue Ridge Mountains and the Piedmont Plateau, since it usually snows in the mountains and rains on the coast. (Source: PRISM Climate Group; Virginia Tech CGIT)

Figure 4-117 illustrates, the mountains in Amherst and Bedford Counties get a majority of the snow, while the southeast portion of the region receives a winter sleet mix.



(Source: PRISM Climate Group; Virginia Tech CGIT)

*Figure 4-117 Hazardous Winter Weather Potential Based on LEQ Precipitation in CVPDC Area*



# Hazard Identification and Risk Assessment

## 4.8.3 Risk Assessment and Jurisdictional Analysis

### 4.8.3.1 *Snowfall and Ice Risks*

The maps for the ice and snowfall risks from the previous Hazard Mitigation Plan are still viable. There has been no increasing or decreasing trend in snowfall amounts since the original plan was passed. (Source: PRISM Climate Group; Virginia Tech CGIT)

Figure 4-117 illustrates the overall winter weather and ice potential for the region. Figure 4-118 and Figure 4-119 show the relative risk or vulnerability based on these previous maps. These were developed by assigning a high risk to those census blocks within the regions with the greatest potential for snowy days (> 1 in of snow) or ice. Division into high, medium, and low were based on the levels predicted from potential maps. Table 4-129 and Table 4-130 show the population (from 2010 Census) in each locality impacted by the overall snowfall and ice risks.

Note that Table 4-129 and Table 4-130 indicate the town populations impacted; the county totals include the populations of the towns. Future revisions of this plan will need to develop a method to calculate the potential loss from these winter storms. Areas of high susceptibility for snowfall (Figure 4-118) are centralized around the foothills of the Blue Ridge Mountains, with the highest snowfall risk around the Peaks of Otter in Bedford County. Relative ice potential (Figure 4-119) for the region has a slightly different trend of potential risk. The northern portion of Amherst County follows a similar pattern as the snowfall risk. There is a band of high ice potential starting in Lynchburg City south into the majority of Campbell County and a southwest band of ice risk in Bedford County.

The winter weather mapping resolution does not support town based analysis, since most towns in the CVPDC area would be represented by one or two pixels at this resolution. As weather data has better spatial resolution in the future, the ability to create practical town based analysis will be improved. While Table 4-129 and Table 4-130 show town based vulnerability, the analysis method was designed to derive broad regional vulnerability comparisons, not pinpoint location comparisons. Also, the nature of winter storm preparedness and impact cannot be represented with snow or ice potential maps. Even though Bedford County may receive more snow than other localities, the county may have more VDOT and power company resources prepared to address winter weather than other communities.

The northern portion of Bedford County has the highest relative snowfall risk for the region. Relative ice risk for the region is scattered in each of the localities, with high potential being in the northern portion of Amherst County, Lynchburg City, northern Campbell County, and southeast Bedford County.

### 4.8.3.2 *Steep Slopes*

Lack of extensive GIS data throughout the region limited any other additional winter storm vulnerability assessment except in Lynchburg. The Lynchburg City GIS department was able to provide detailed streets and terrain data that could be used to identify streets that would be of a higher risk during ice storm events. A GIS analysis was performed to identify streets throughout with slopes greater than 15%, which would have vehicle traction issues during ice storms. Table 4-132 and Figure 4-120 illustrate selected roadways in the City of Lynchburg that have a slope greater than 15%. These areas should be identified as having a higher potential for accidents. The eastern portion of the city has several roads with a slope greater than 15%.



# Hazard Identification and Risk Assessment

## Snowfall Relative Risk in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020

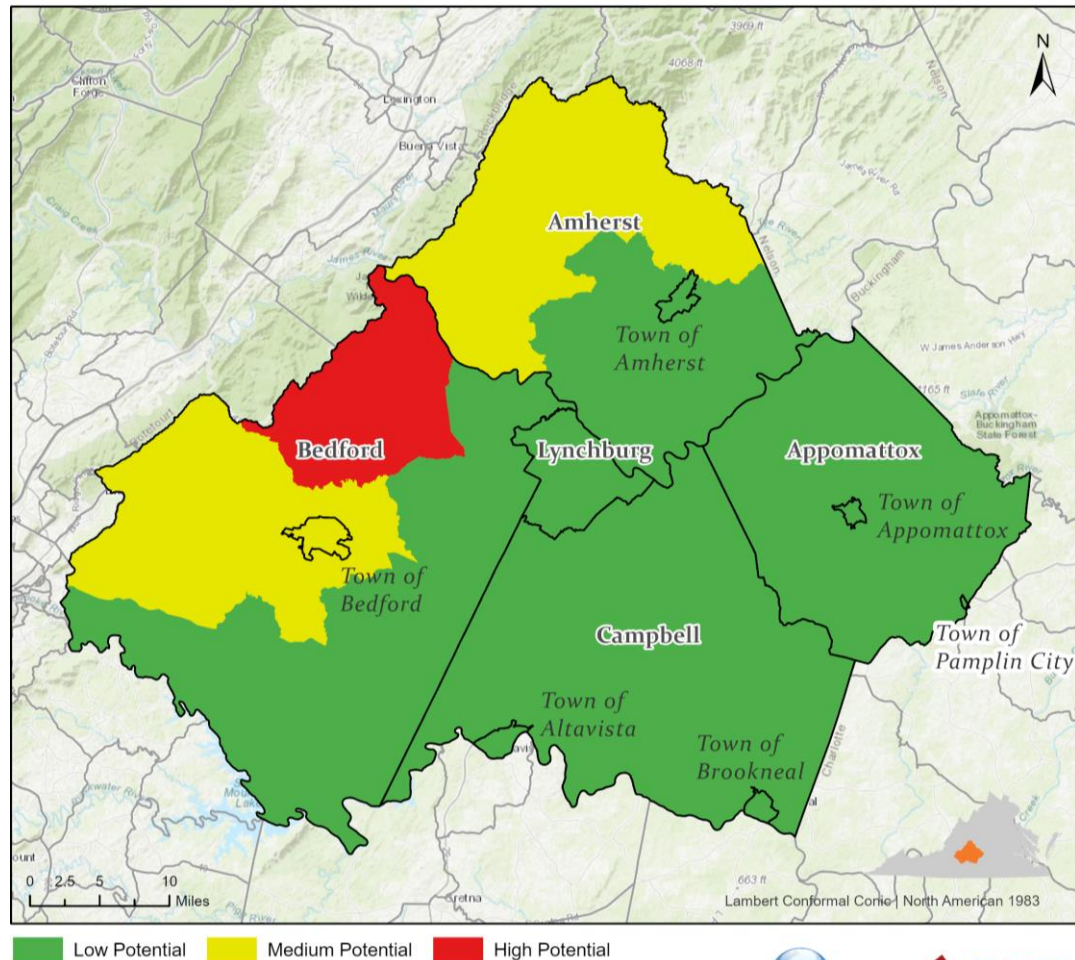


Figure 4-118 Snowfall Relative Risk in CVPDC Area

Table 4-129 Population in Snowfall Relative Risk in CVPDC Area

Community	Low	Medium	High	Total
Amherst County	27,065	5,288	-	32,353
*Town of Amherst	2,231	-	-	2,231
Appomattox County	14,973	-	-	14,973
*Town of Appomattox	1,733	-	-	1,733
*Town of Pamplin City	219	-	-	219
Bedford County	46,558	24,601	3,739	74,898
*Town of Bedford	-	6,222	-	6,222
Campbell County	54,842	-	-	54,842
*Town of Altavista	3,450	-	-	3,450
*Town of Brookneal	1,112	-	-	1,112





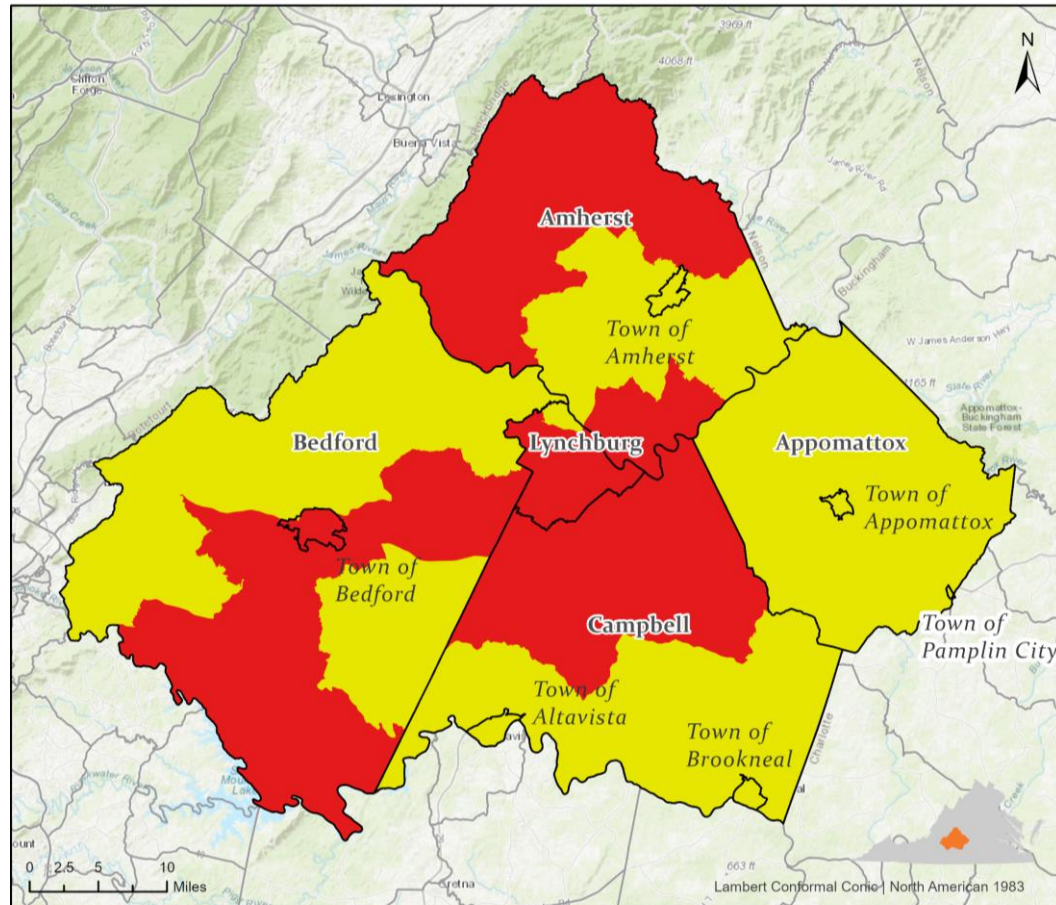
# Hazard Identification and Risk Assessment

Community	Low	Medium	High	Total
Lynchburg City	75,568		-	75,568
<b>Total</b>	<b>227,751</b>	<b>36,111</b>	<b>3,739</b>	<b>267,601</b>

(\*denotes town values that are also included in the totals for the perspective county.)

## Ice Relative Risk in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Medium Potential High Potential

Data source: PRISM Climate Group; Virginia Tech CGIT  
Center for Geospatial Information Technology at Virginia Tech. 11/2019



Figure 4-119 Ice Relative Risk in CVPDC Area

Table 4-130 Population in Ice Relative Risk in CVPDC Area

Community	Low	Medium	High	Total
Amherst County	-	14,090	18,263	32,353
*Town of Amherst	-	2,231	-	2,231
Appomattox County	-	14,973	-	14,973
*Town of Appomattox	-	1,733	-	1,733
*Town of Pamplin City	-	219	-	219
Bedford County	-	31,227	43,671	74,898
*Town of Bedford	-	-	6,222	6,222
Campbell County	-	14,608	40,234	54,842





# Hazard Identification and Risk Assessment

Community	Low	Medium	High	Total
*Town of Altavista	-	3,450	-	3,450
*Town of Brookneal	-	1,112	-	1,112
Lynchburg City	-	4,490	71,078	75,568
<b>Total</b>	-	<b>88,133</b>	<b>179,468</b>	<b>267,601</b>

(\*denotes town values that are also included in the totals for the perspective county.)

Table 4-131 Winter Weather Events Occurring during January 2000 and June 2018

	Winter Storm	Blizzard	Frost/ Freeze	Ice Storm	Winter Storm	Heavy Snow	Winter Weather
Amherst County	23	1	15	10	23	15	18
Appomattox County	15	0	3	7	15	14	1
Bedford County	0	0	6	11	17	14	7
Campbell County	20	0	7	5	18	10	2
Lynchburg City	2	0	0	2	2	3	0

(Source: NOAA Storm Event Database)

## Steep Slope Locations (>15%) in Lynchburg City

Central Virginia PDC Hazard Mitigation Plan Update 2020

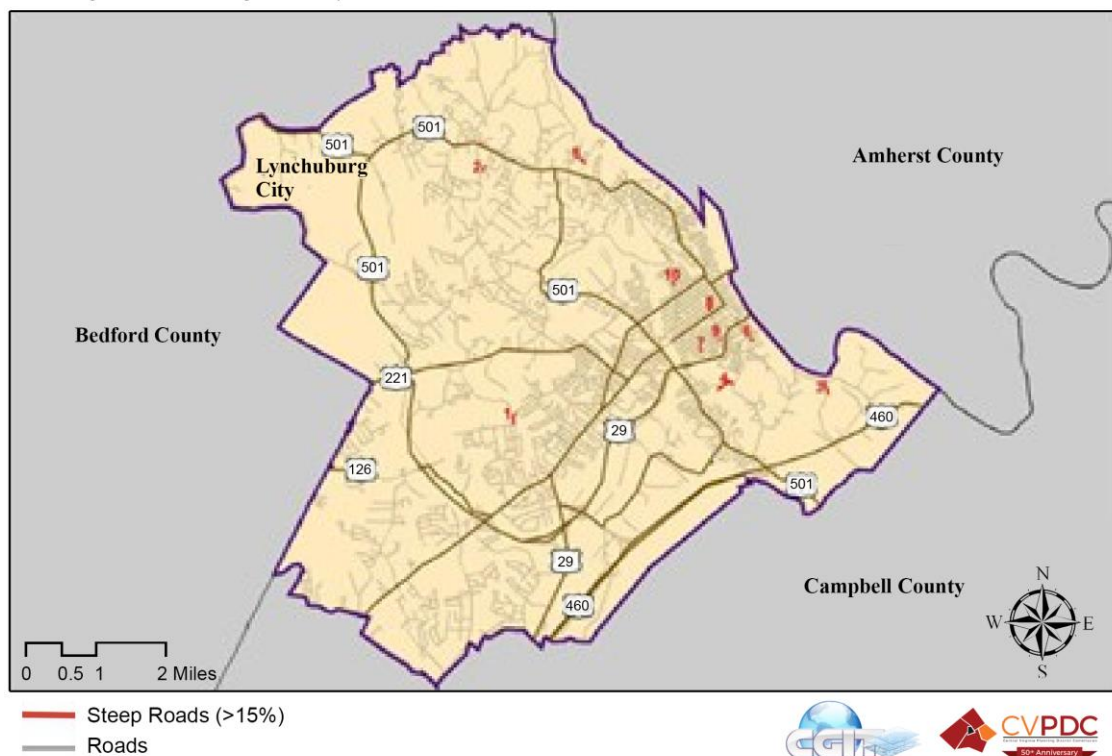


Figure 4-120 Steep Slope Locations (>15%) in Lynchburg City

Table 4-132 Lynchburg City Steep Slope Locations (>15%)

Ranking	Steep Slope Location	Slope
1	500 Sandusky Dr.	15%
2	1700 Clayton Ave.	15%



# Hazard Identification and Risk Assessment

Ranking	Steep Slope Location	Slope
3	130 Rockwell Rd.	15.3%
4	1400 Augusta St.	15.8%
5	N/A Paxton Ave.	16.8%
6	2000 Rose St.	17.3%
7	1220 17th St.	18.3%
8	600 11th St.	18.5%
9	1700 Locust St.	18.6%
10	200 Polk St.	19.2%

## 4.8.4 Probability of Future Occurrences

In order to create a statewide winter weather hazard potential map that captures this variability, gridded climate data was obtained from the Climate Source and through the VirginiaView program. This data was developed by the Oregon State University Spatial Climate Analysis Service (SCAS) using PRISM (Parameter-elevation Regressions on Independent Slopes Model). This climate mapping system is an analytical tool that uses point weather station observation data, a digital elevation model, and other spatial data sets to generate gridded estimates of monthly, yearly, and event-based climatic parameters. The project management team for the 2013 plan update agreed that this analysis would suffice for the update. There is no updated data for the 2020 update.

PRISM data was selected for this analysis because it is an interpolation system that incorporates elevation fluctuation into the regression equations that are used to predict the gridded variation of each climate parameter. This winter weather risk assessment uses monthly normal precipitation, mean annual days with snowfall greater than 1 inch, and mean monthly snowfall PRISM data to develop snow and ice potential maps for the state.

These datasets have been generated to incorporate topographic effects on precipitation, capture orographic rain shadows, and include coastal and lake effect influences on precipitation and snowfall. The monthly precipitation grid provides a 30-year climatological average of total precipitation in inches. The mean monthly snowfall grid provides a 30-year climatological average depth of freshly fallen snow in inches. The mean annual days map reveals the 30-year average of the number of days that a location will receive greater than 1 inch of snowfall in a 24-hour period in a given year.

A criterion of “greater than 1 inch” was selected for winter snowfall severity assessment because this depth will result in complete road coverage that can create extremely dangerous driving conditions that will require removal by the local community. This amount of snowfall in a 24-hour period can also lead to business closure and school delays or cancellations. (Source: PRISM Climate Group; Virginia Tech CGIT)

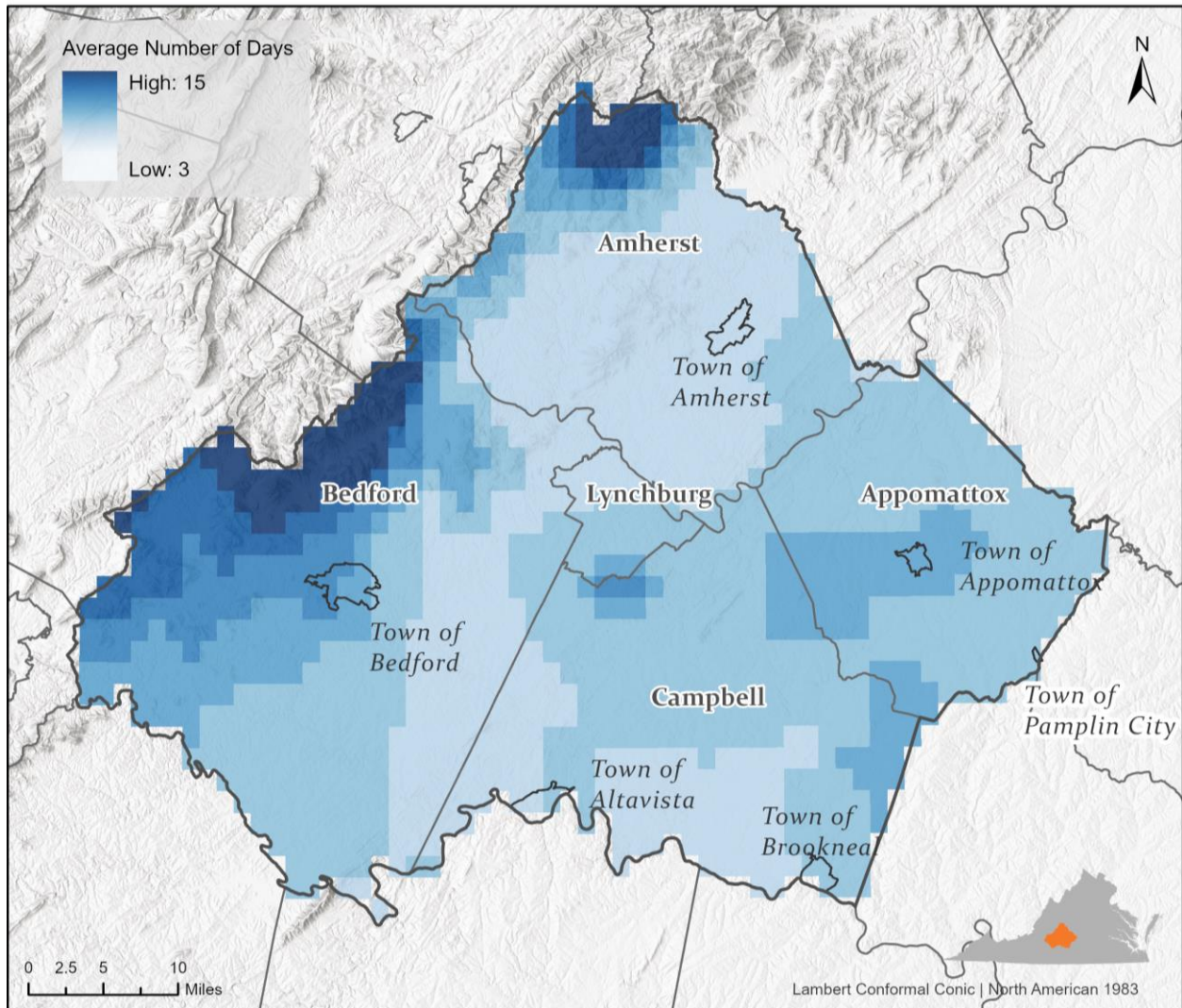
Figure 4-122 shows the average number of days with snowfall greater than one inch for the state and Figure 4-121 shows the average number of days with snowfall greater than one inch for the CVPDC area. These assessments can act as indicators of the likelihood of future occurrences. Average number of days with snowfall greater than one-inch increases dramatically near the mountain ranges. In the CVPDC area, the Blue Ridge Mountains in the northern portions of Amherst and Bedford counties receive the greatest amount of snowfall.



# Hazard Identification and Risk Assessment

## Average Number of Days with Snowfall > 1 inch in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: PRISM Climate Group; Virginia Tech CGIT  
Center for Geospatial Information Technology at Virginia Tech. 12/2019



(Source: PRISM Climate Group; Virginia Tech CGIT)

Figure 4-121 Average Number of Days with Snowfall > 1 inch in CVPDC Area

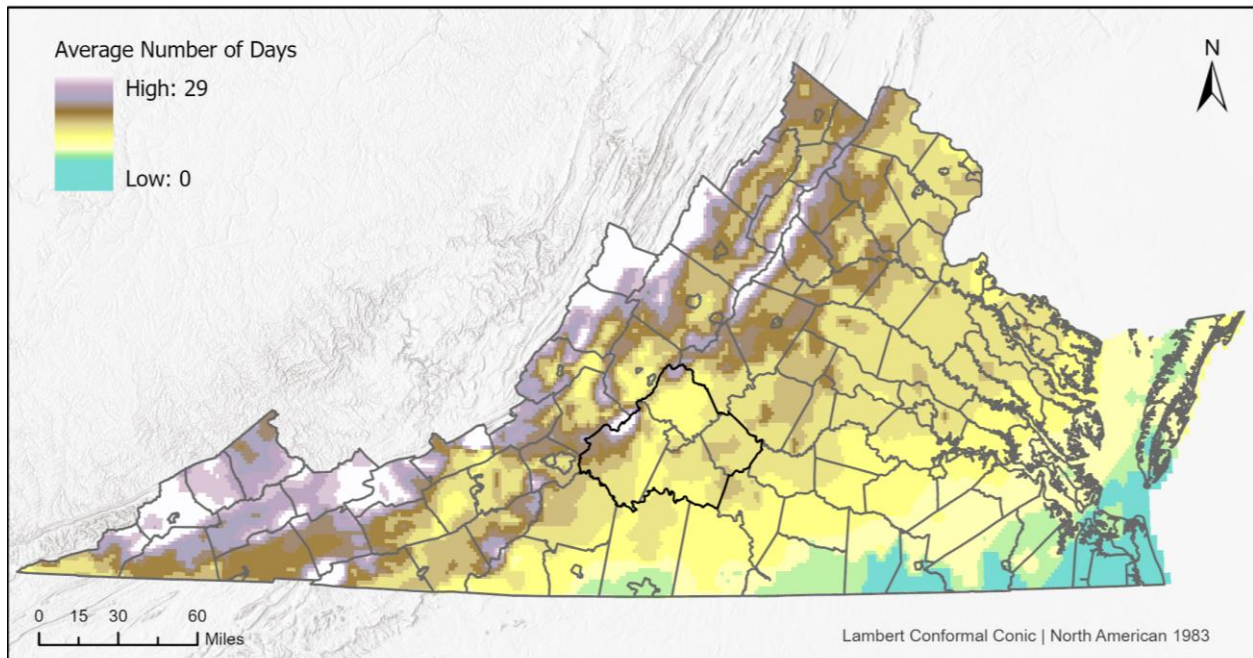




# Hazard Identification and Risk Assessment

## Average Number of Days with Snowfall > 1 inch in Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: PRISM Climate Group; Virginia Tech CGIT  
Center for Geospatial Information Technology at Virginia Tech. 12/2019



(Source: PRISM Climate Group; Virginia Tech CGIT)

Figure 4-122 Average Number of Days with Snowfall > 1 inch in Virginia

### 4.8.5 References

- New York City Hazard Mitigation Plan. 2014. p.292
- NOAA National Severe Storms Laboratory. *Severe weather 101*.  
<https://www.nssl.noaa.gov/education/svrwx101/winter/> (Accessed Feb 14 2019)
- Squires, Michael F., and Jay Lawrimore. *Development of an Operational Northeast Snowfall Impact Scale*. 22nd International Conference on Interactive Information Processing Systems for Meteorology, Oceanography, and Hydrology. Atlanta, Georgia, 2006.  
<https://ams.confex.com/ams/pdfpapers/100736.pdf>.
- Kocin, Paul J., and Louis W. Uccellini. *A Snowfall Impact Scale Derived from Northeast Storm Snowfall Distributions*. Bulletin of the American Meteorological Society 85, no. 2. February 2004: 177–94.  
<https://doi.org/10.1175/BAMS-85-2-177>.





# Hazard Identification and Risk Assessment

## 4.9 Hailstorm

### 4.9.1 Hazard Profile

Hailstorms are a potentially damaging outgrowth of severe thunderstorms. Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and subsequent cooling of the air mass. During summer months, when the difference between ground and upper-level temperatures is significant, hail may develop. The size of the hailstones is directly related to the severity and size of the storm. Hail is described as chunks of ice, often in a spherical or oblong shape, that is produced by thunderstorms. The size of the hail greatly affects the magnitude or severity of the damage.

#### 4.9.1.1 Geographic Location and Extent

Hailstorms are not confined to any specific geographic location and can vary greatly in terms of size, location, intensity, and duration. The entire CVPDC area is considered to be exposed to this hazard equally.

#### 4.9.1.2 Magnitude or Severity

The National Weather Service classifies a storm as “Severe” if hail of three-quarters of an inch in diameter (approximately the size of a penny) or greater is present. The size determination is based on radar intensity or as seen by observers. The intensity category of a hailstorm depends on its size and the potential damage it could cause, as depicted in the NCEI Intensity Scale (Table 4-133).<sup>52</sup>

#### 4.9.1.3 Previous Occurrences

NOAA releases monthly and annual severe weather report summaries about tornadoes, wind damage, and large hail (Figure 4-123). In 2019, among the 1,199 total severe weather reported in Virginia, there were 88 large hail events.<sup>53</sup> There were 167 hail events reported between 2009 and 2019 in the CVPDC area, including two occurrences of large hail with more than two inches in diameter.

On July 23, 2016, there were severe thunderstorms that impacted this area. A nearly stationary boundary over Bedford County interacted with a very warm and unstable air mass, triggering multiple rounds of severe storms. This prolonged severe weather event started in the morning and continued well into the evening. Multiple reports of hail ranging from a quarter to baseball-sized were reported. Some cars were damaged.<sup>54</sup>

Table 4-133 Hail Intensity and Magnitude

Size Code	Intensity Category	Size (Diameter Inches)	Descriptive Term	Typical Damage
H0	Hard Hail	Up to 0.33	Pea	No damage
H1	Potentially Damaging	0.33 - 0.60	Marble	Slight damage to plants and crops
H2	Potentially Damaging	0.60 - 0.80	Dime	Significant damage to plants and crops

<sup>52</sup> Since the 2013 plan, the National Climatic Data Center – NCDC – has been renamed as the National Centers for Environmental Information, or NCEI

<sup>53</sup> <https://www.spc.noaa.gov/climo/online/monthly/states.php?month=00&year=2019&state=VA>

<sup>54</sup> <https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=642765>



# Hazard Identification and Risk Assessment

Size Code	Intensity Category	Size (Diameter Inches)	Descriptive Term	Typical Damage
H3	Severe	0.80 - 1.20	Nickel	Severe damage to plants and crops
H4	Severe	1.2 - 1.6	Quarter	Widespread glass and auto damage
H5	Destructive	1.6 - 2.0	Half dollar	Widespread destruction of glass, roofs, and risk of injuries
H6	Destructive	2.0 - 2.4	Ping pong ball	Aircraft bodywork dented and brick walls pitted
H7	Very Destructive	2.4 - 3.0	Golf ball	Severe roof damage and risk of serious injuries
H8	Very Destructive	3.0 - 3.5	Hen egg	Severe damage to all structures
H9	Super Hailstorms	3.5 - 4.0	Tennis ball	Extensive structural damage could cause fatal injuries
H10	Super Hailstorms	4.0 +	Baseball	Extensive structural damage could cause fatal injuries

Figure 4-124, Figure 4-125, Figure 4-126, Figure 4-127, Figure 4-128, and Figure 4-129 are maps of recorded hail events between 1959 and 2018 provided by the Storm Prediction Center Severe Weather GIS (SVRGIS) for CVPDC area and each jurisdiction.<sup>55</sup> The color gradient represents a kernel density calculated using wind magnitudes of occurrence points of all historical hail events. The darker color represents areas that have experienced an increased number of events and severity. Highlighted points represent occurrence in the CVPDC area. Please note that the more rural parts of the CVPDC area may be underrepresented due to how the data is collected (using observations).

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<sup>55</sup> The latest SVRGIS data doesn't map the hail events for 2019.



# Hazard Identification and Risk Assessment

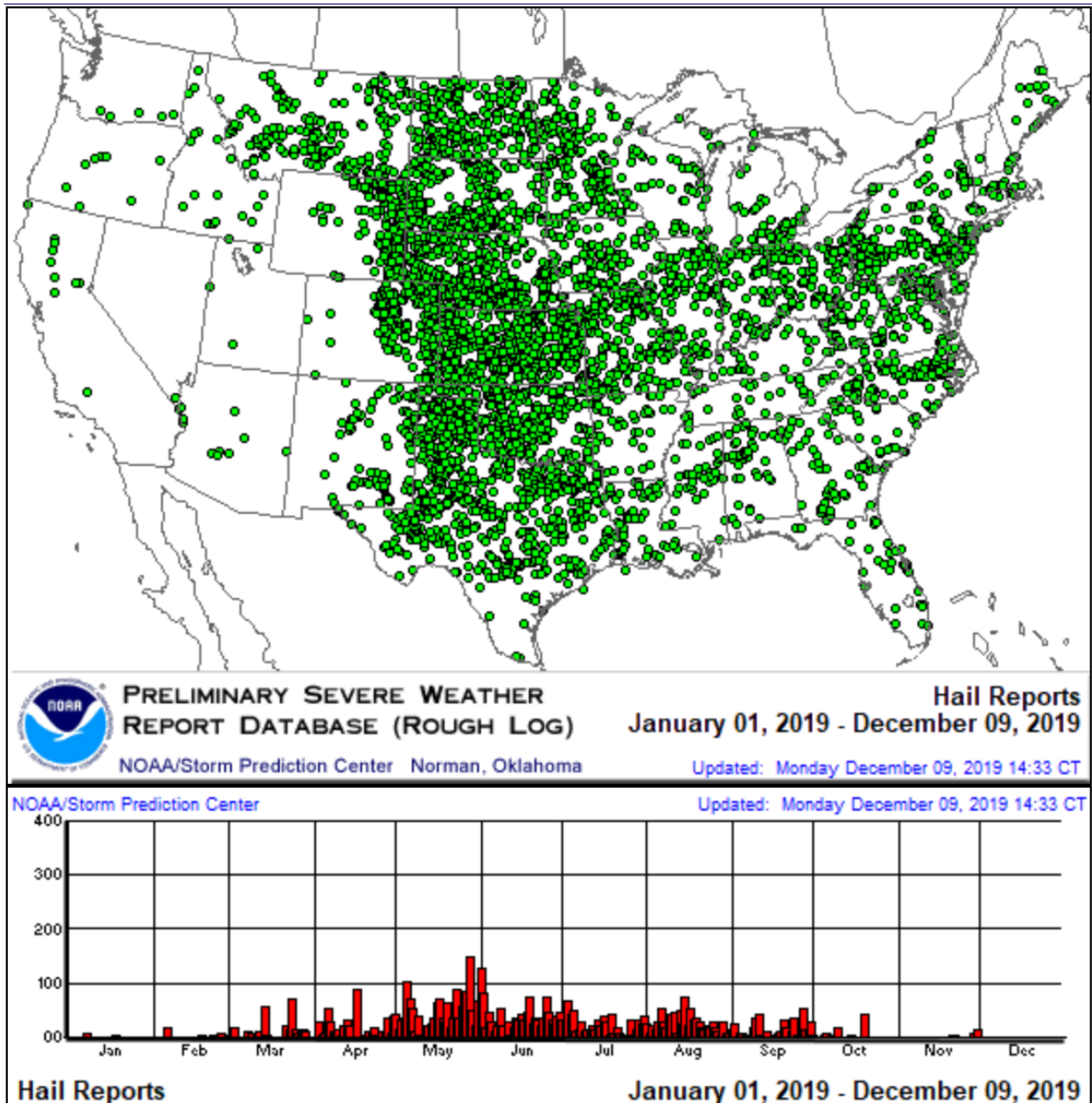


Figure 4-123 Large Hail Event in the United States in 2019.

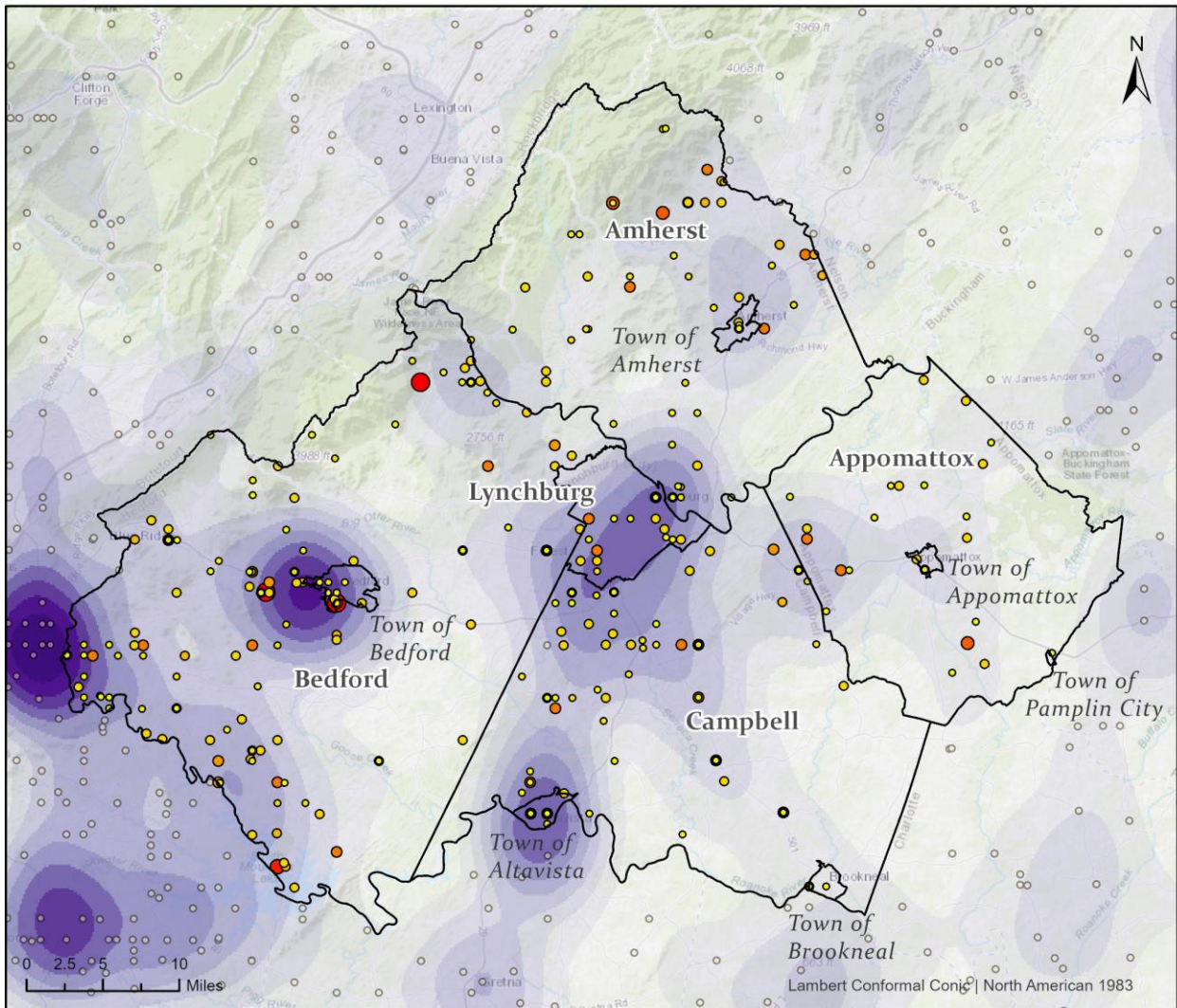
(Source: NOAA Annual Severe Weather Report Summary)



# Hazard Identification and Risk Assessment

## Hail Events in Central Virginia PDC, 1959 - 2018

Central Virginia PDC Hazard Mitigation Plan Update 2020



Magnitude (Diameter Inches): ○ ≤ 0.88 ○ ≤ 1.25 ○ ≤ 1.75 ○ ≤ 2.0 ○ ≤ 2.5 ○ ≤ 2.75

The color gradient represents a kernel density calculated using occurrence points of all historical hail events. The darker color represents areas that have experienced an increased number of events and severity. Highlighted points represent occurrence in Central Virginia PDC.

Data source: SRVGIS, Storm Prediction Center, NOAA  
Center for Geospatial Information Technology at Virginia Tech. 12/2019



Figure 4-124 Hail Events in CVPDC Area, 1959 - 2018

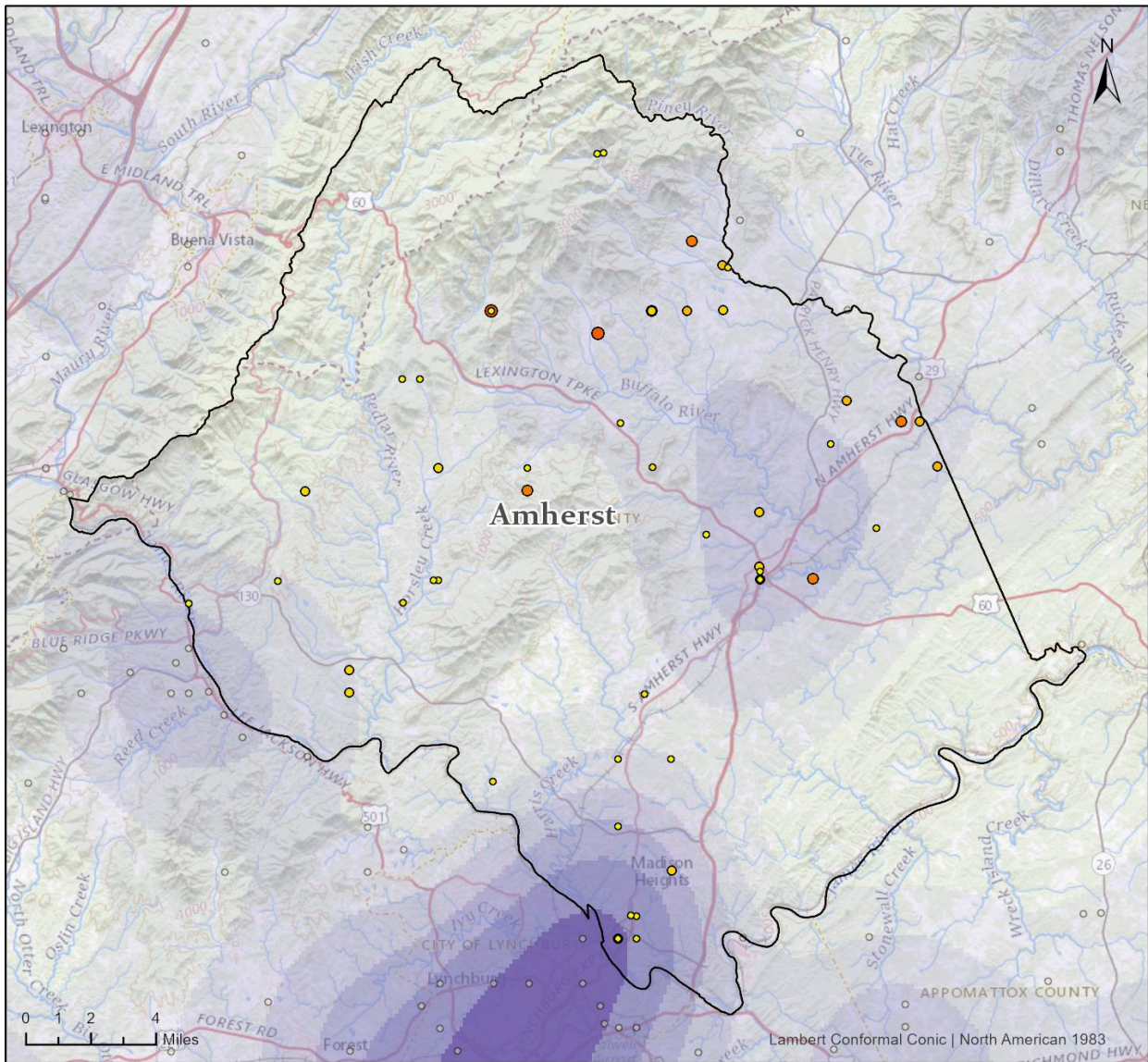




# Hazard Identification and Risk Assessment

## Hail Events in Amherst County in Central Virginia PDC, 1959 - 2018

Central Virginia PDC Hazard Mitigation Plan Update 2020



Magnitude (Diameter Inches): ○ ≤ 0.88 ○ ≤ 1.25 ○ ≤ 1.75 ○ ≤ 2.0 ○ ≤ 2.5 ○ ≤ 2.75

The color gradient represents a kernel density calculated using occurrence points of all historical hail events. The darker color represents areas that have experienced an increased number of events and severity. Highlighted points represent occurrence in Central Virginia PDC.

Data source: SRVGIS, Storm Prediction Center, NOAA  
Center for Geospatial Information Technology at Virginia Tech. 12/2019



Figure 4-125 Hail Events in Amherst County in CVPDC Area, 1959 - 2018

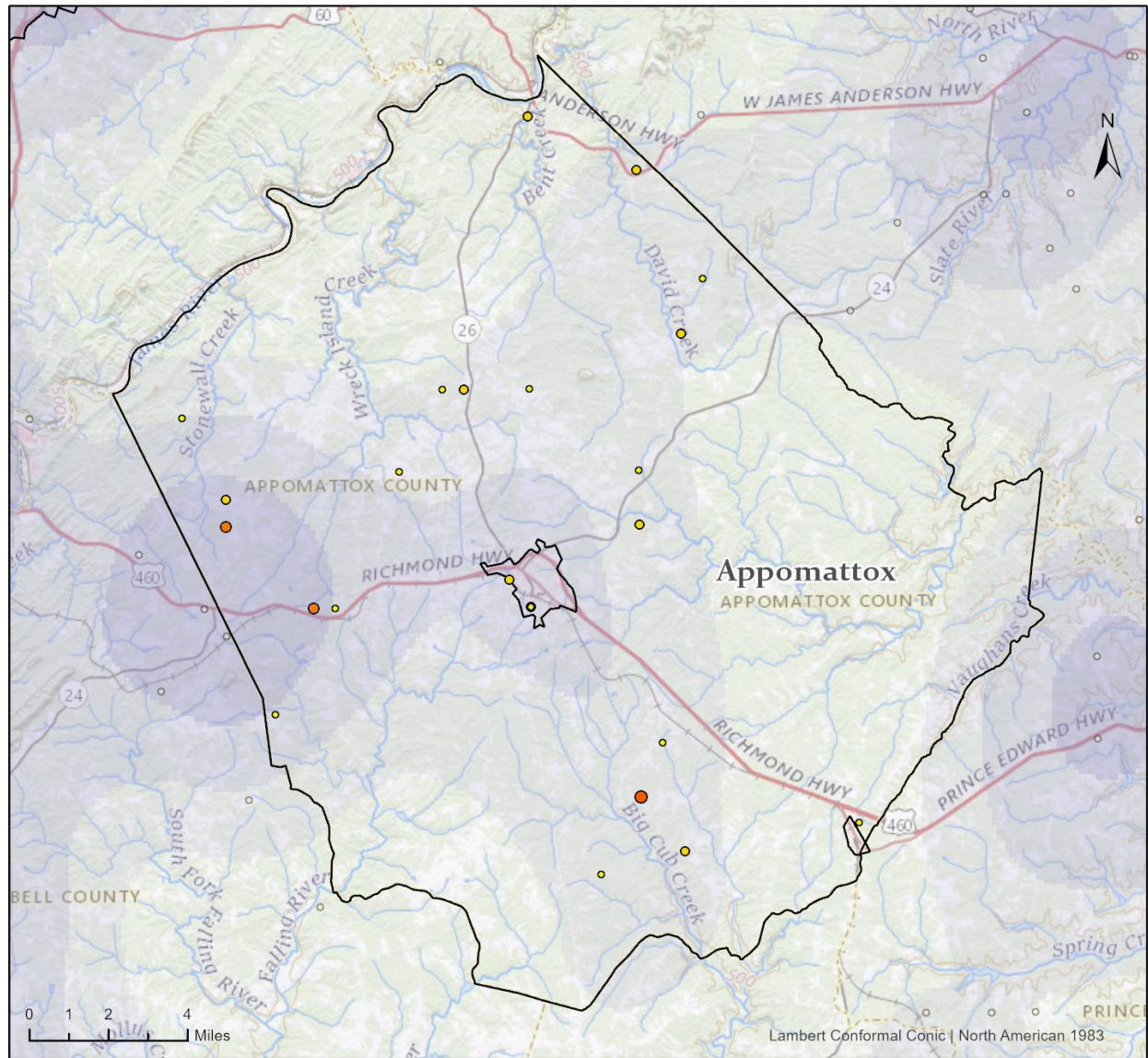




# Hazard Identification and Risk Assessment

## Hail Events in Appomattox County in Central Virginia PDC, 1959 - 2018

Central Virginia PDC Hazard Mitigation Plan Update 2020



Magnitude (Diameter Inches): ○ ≤ 0.88 ○ ≤ 1.25 ○ ≤ 1.75 ○ ≤ 2.0 ○ ≤ 2.5 ○ ≤ 2.75

The color gradient represents a kernel density calculated using occurrence points of all historical hail events. The darker color represents areas that have experienced an increased number of events and severity. Highlighted points represent occurrence in Central Virginia PDC.

Data source: SRVGIS, Storm Prediction Center, NOAA  
Center for Geospatial Information Technology at Virginia Tech. 12/2019



Figure 4-126 Hail Events in Appomattox County in CVPDC Area, 1959 - 2018

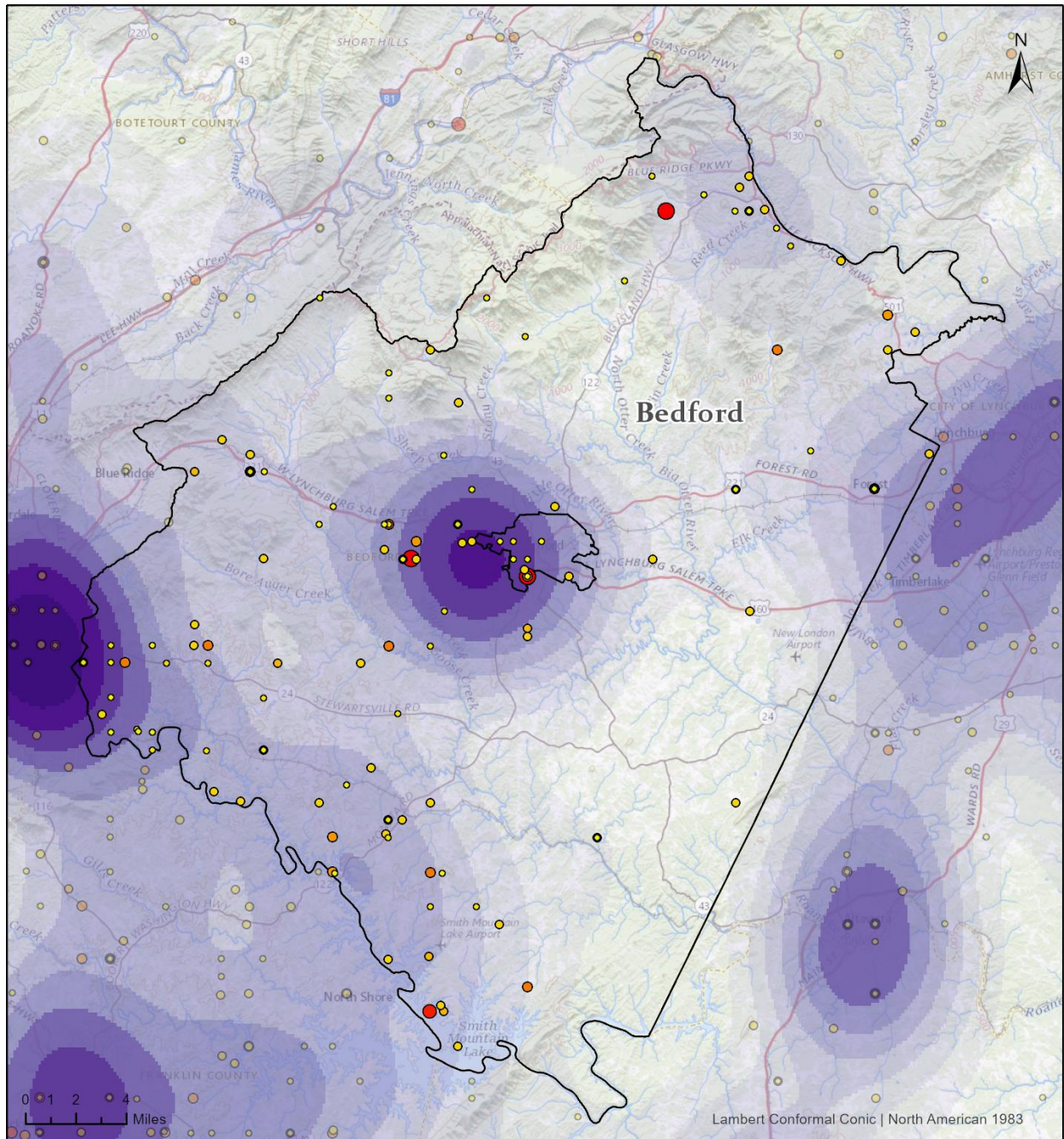




# Hazard Identification and Risk Assessment

## Hail Events in Bedford County in Central Virginia PDC, 1959 - 2018

Central Virginia PDC Hazard Mitigation Plan Update 2020



Magnitude (Diameter Inches): ○ ≤ 0.88 ○ ≤ 1.25 ○ ≤ 1.75 ○ ≤ 2.0 ○ ≤ 2.5 ○ ≤ 2.75

The color gradient represents a kernel density calculated using occurrence points of all historical hail events. The darker color represents areas that have experienced an increased number of events and severity. Highlighted points represent occurrence in Central Virginia PDC.

Data source: SRVGIS, Storm Prediction Center, NOAA  
Center for Geospatial Information Technology at Virginia Tech. 12/2019



Figure 4-127 Hail Events in Bedford County in CVPDC Area, 1959 - 2018

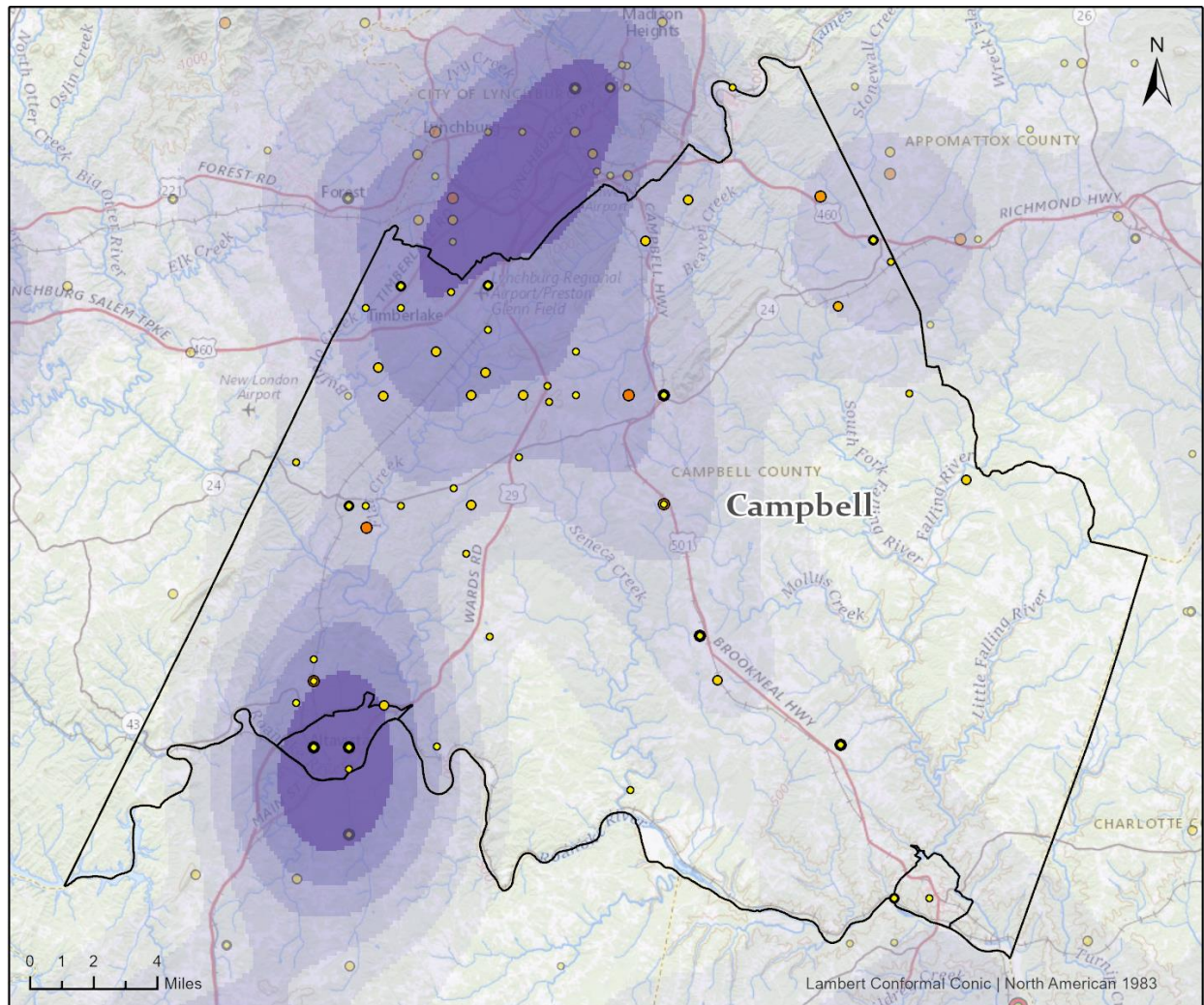




# Hazard Identification and Risk Assessment

## Hail Events in Campbell County in Central Virginia PDC, 1959 - 2018

Central Virginia PDC Hazard Mitigation Plan Update 2020



Magnitude (Diameter Inches): ○ ≤ 0.88 ○ ≤ 1.25 ○ ≤ 1.75 ○ ≤ 2.0 ○ ≤ 2.5 ○ ≤ 2.75

The color gradient represents a kernel density calculated using occurrence points of all historical hail events. The darker color represents areas that have experienced an increased number of events and severity. Highlighted points represent occurrence in Central Virginia PDC.

Data source: SRVGIS, Storm Prediction Center, NOAA  
Center for Geospatial Information Technology at Virginia Tech. 12/2019



*Figure 4-128 Hail Events in Campbell County in CVPDC Area, 1959 - 2018*

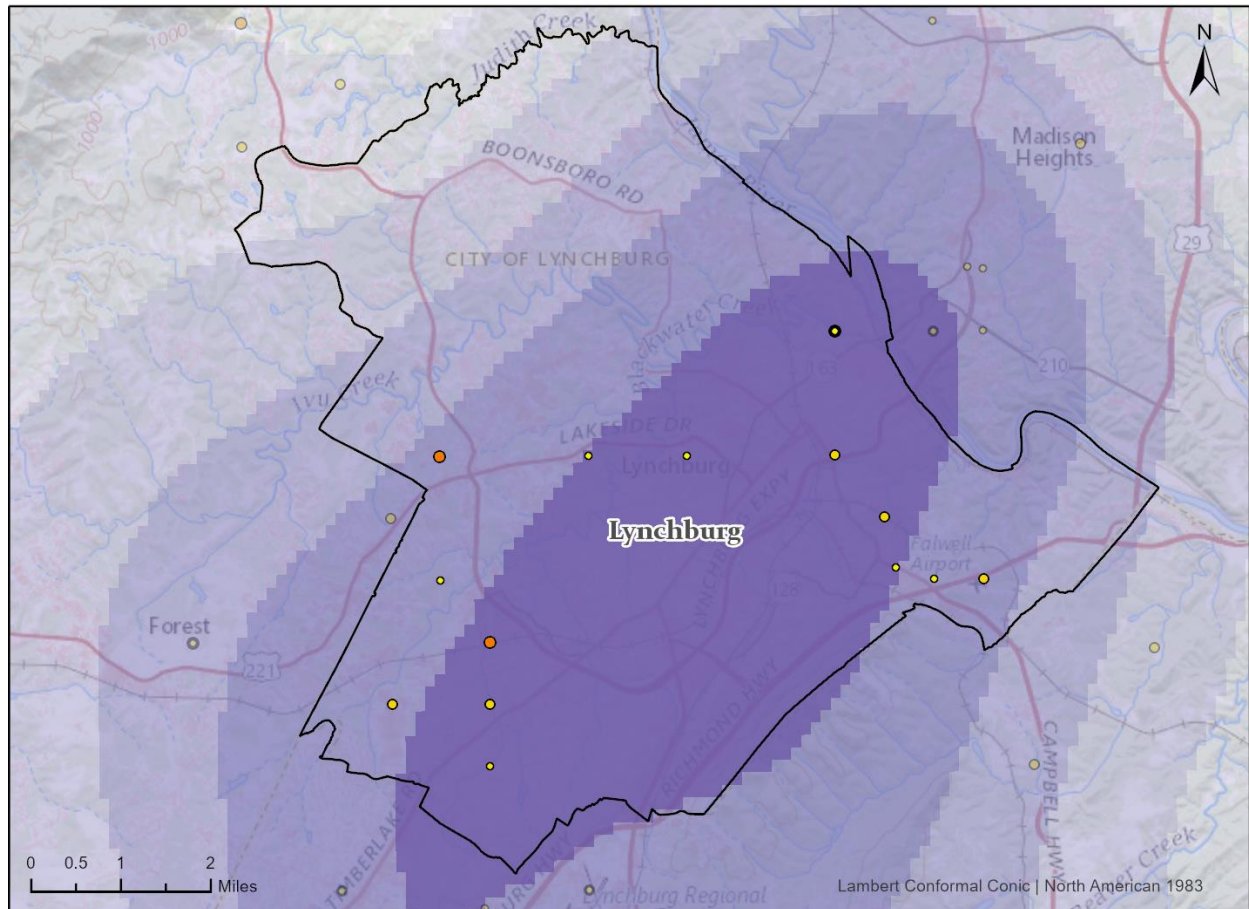




# Hazard Identification and Risk Assessment

## Hail Events in City of Lynchburg in Central Virginia PDC, 1959 - 2018

Central Virginia PDC Hazard Mitigation Plan Update 2020



Magnitude (Diameter Inches): ○ ≤ 0.88 ○ ≤ 1.25 ○ ≤ 1.75 ○ ≤ 2.0 ○ ≤ 2.5 ○ ≤ 2.75

The color gradient represents a kernel density calculated using occurrence points of all historical hail events. The darker color represents areas that have experienced an increased number of events and severity. Highlighted points represent occurrence in Central Virginia PDC.

Data source: SRVGIS, Storm Prediction Center, NOAA  
Center for Geospatial Information Technology at Virginia Tech. 12/2019



Figure 4-129 Hail Events in City of Lynchburg in CVPDC Area, 1959 - 2018



# Hazard Identification and Risk Assessment

## 4.9.1.4 Relationship to Other Hazards

Figure 4-130 shows the interrelationship (causation, concurrence, etc.) between this hazard and other hazards discussed in this plan update.

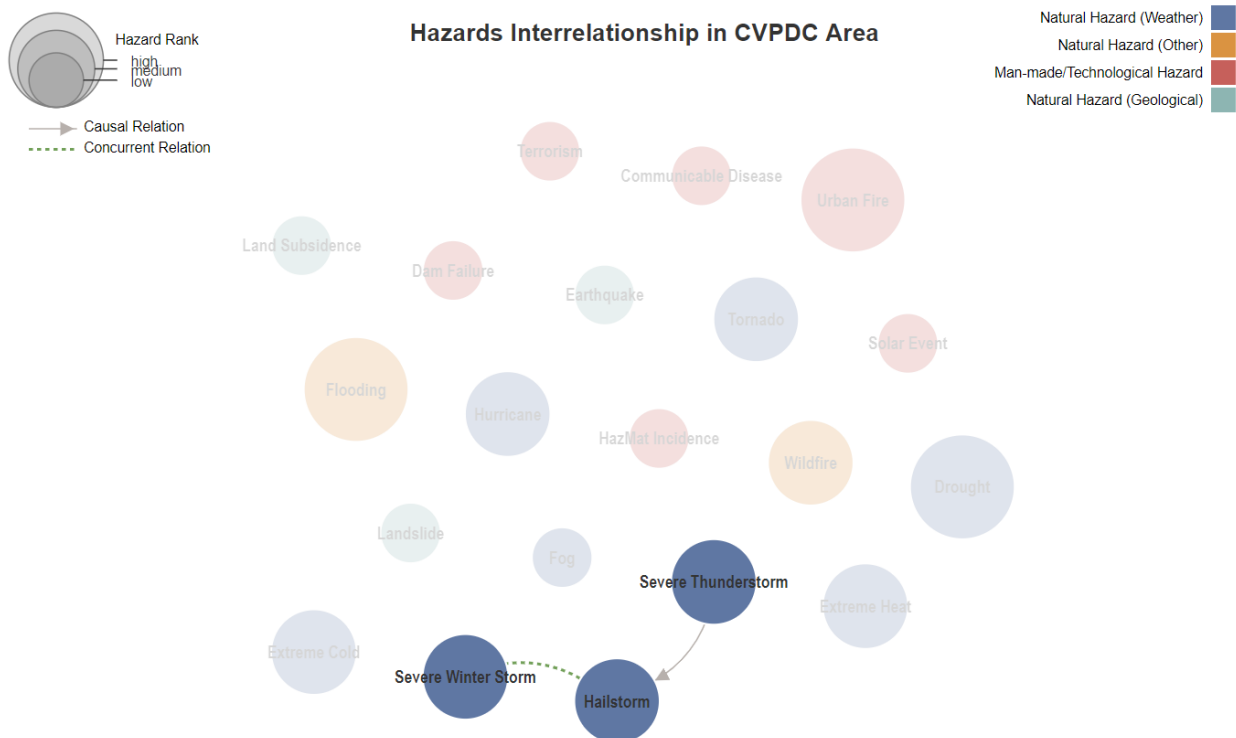


Figure 4-130 Hazards interrelationship

## 4.9.2 Impact and Vulnerability

Hail causes considerable damage to crops and property and occasionally causes death to farm animals, but seldom causes loss of human life in the United States. Hail causes billions of dollars in damage to crops and property each year (Table 4-134). In Virginia, there were approximately 400,529 properties experiencing damaging hail events in 2017.<sup>56</sup> The damaging aspects of hail include hailstone sizes (average and maximum), number of hailstones per unit area, and associated winds, and hail risk is a combination of these factors, plus the frequency of hail at a point or over an area.<sup>57</sup>

## 4.9.3 Risk Assessment and Jurisdictional Analysis

According to NCEI Storm database about hail events from 1959 to 2019, hail occurred every year in the past decade in the CVPDC area. There were 174 reports of on-the-ground hail events in which 10 events caused property damage. The magnitude of hail ranges from 0.75 to 2.75 (H2 - H7). Total property damage from hail events is 119,800 dollars.

<sup>56</sup> <https://www.iii.org/fact-statistic/facts-statistics-hail>

<sup>57</sup> <https://sciencepolicy.colorado.edu/socasp/weather1/changnon.html>



# Hazard Identification and Risk Assessment

Storms can produce hail from as small as a quarter inch in diameter to up to four and a half inches. The potential damage depends on the size of the hail stone. Table 4-135 shows total storms above 1 inch in the CVPDC area. Bedford County is by far the most at risk for heavy hail storms, totaling 19 since 2000 (Bedford County also recorded the most tornadoes). Campbell County follows with the second most hail storms, and tornado occurrences as well. However, the normalized data by land area of jurisdiction indicates Lynchburg is also at higher risk.

Table 4-134 Hail Fatalities, Injuries and Damage in U.S., 2014-2018

Year	Fatalities	Injuries	Property damage (\$ millions)	Crop damage (\$ millions)	Total damage (\$ millions)
2014	0	23	1,416.9	293.2	1,710.1
2015	0	0	586.0	133.0	719.0
2016	0	21	3,512.7	23.7	3,536.4
2017	0	14	1,722.2	59.5	1,781.8
2018	0	11	722.8	87.4	810.2

Data includes the 50 states, Puerto Rico, Guam and the U.S. Virgin Islands. Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.

Table 4-135 Total Storms Events above 1 inch, 2000 - 2019

County	Total Storms Above 1 Inch	Jurisdiction Size (Square Miles)	Events per Square Mile
Amherst	7	479	0.015
Appomattox	0	334	0
Bedford	19	769	0.025
Campbell	10	507	0.020
Lynchburg	2	50	0.040

Note: The hailstorm events for the Towns of Amherst, Appomattox, Altavista, and Brookneal are found in their respective county's totals.

## 4.9.4 Probability of Future Occurrences

Based on the reported past history over the last 60 years (1959-2019) for the CVPDC area, hail events are highly likely, meaning that an event is probable due within the next year.

## 4.9.5 References

- Insurance Information Institute. *Facts + Statistics: Hail*. 2019. <https://www.iii.org/fact-statistic/facts-statistics-hail>. (Accessed on December 9, 2019)
- National Centers for Environmental Information. Storm Events Database. [https://www.ncdc.noaa.gov/stormevents/listevents.jsp?hailfilter=0.00&sort=DT&statefips=51%2CVIRGINIA&county=AMHERST%3A9&county=APPOMATTOX%3A11&county=BEDFORD%3A19&county=BEDFORD+%28C%29%3A515&county=CAMPBELL%3A31&county=LYNCHBURG+%28C%29%3A680&eventType=%28C%29+Hail&beginDate\\_yyyy=2009&beginDate\\_mm=05&beginDate\\_dd=01&endDate\\_yyyy=2019&endDate\\_mm=05&endDate\\_dd=31](https://www.ncdc.noaa.gov/stormevents/listevents.jsp?hailfilter=0.00&sort=DT&statefips=51%2CVIRGINIA&county=AMHERST%3A9&county=APPOMATTOX%3A11&county=BEDFORD%3A19&county=BEDFORD+%28C%29%3A515&county=CAMPBELL%3A31&county=LYNCHBURG+%28C%29%3A680&eventType=%28C%29+Hail&beginDate_yyyy=2009&beginDate_mm=05&beginDate_dd=01&endDate_yyyy=2019&endDate_mm=05&endDate_dd=31)
- Stanley Changnon. *Trends in Hail in the United States*. <https://sciencepolicy.colorado.edu/socasp/weather1/changnon.html>. (Accessed on December 9, 2019)



# Hazard Identification and Risk Assessment

## 4.10 Extreme Temperatures: Cold / Wind Chill

### 4.10.1 Hazard Profile

Extreme cold/wind chill temperature is the temperature that people and animals feel when outside and it is based on the rate of heat loss from exposed skin by the effects of wind and cold. What is considered an excessively cold temperature varies according to the normal climate for that area. Whenever temperature drops decidedly below normal and wind speed increases, heat leaves the human body more rapidly, increasing the possibility of negative effects of the extreme cold temperatures. When cold temperatures and wind combine, dangerous wind chills can develop.

Wind chill is how cold it feels when outside. Wind chill is based on the rate of heat loss on exposed skin from wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature, and eventually the internal body temperature. Therefore, the wind makes it feel much colder than the actual temperature. For example, if the temperature is 0°F and the wind is blowing at 15 mph, the wind chill is -19°F.<sup>58</sup> At this wind chill, exposed skin can freeze in 30 minutes.

#### 4.10.1.1 Geographic Location/Extent

Extreme cold temperature is not a hazard with a defined geographic boundary. All localities within the CVPDC area are exposed to this hazard.

#### 4.10.1.2 Magnitude or Severity

Extreme cold weather has a wide range of extent and severity markers and characteristics. The NWS created a wind chill chart that measures the apparent temperature felt on exposed skin due to the combination of air temperature and wind speed (Figure 4-131). While wind chill is not necessarily related to extreme cold as a single cause, the advisory system that the NWS currently uses relies on wind chill to relay warning and advisory information to the public. Extreme cold severity is a function of wind chill and other factors, such as precipitation amount (rain, sleet, ice, and/or snow).

#### 4.10.1.3 Previous occurrences

##### 4.10.1.3.1 Cold/Wind Chill

In 1996, the NCEI began keeping records of occurrences of extreme temperatures. The most reliable records are found at the county level because of the widespread spatial nature of the hazard.

From 1996 to 2018, there have been at least 20 cold/wind chill event reports recorded by NCEI for the CVPDC area. Approximately \$539,000 in crop damages were recorded in the CVPDC area.

#### *Warming Center*

*A warming center is a short-term emergency heated facility that operates when temperatures or a combination of precipitation, wind chill, wind and temperature become dangerously inclement. Its paramount purpose is the prevention of death and injury from exposure to the elements.*

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<sup>58</sup> <http://www.skyviewweather.com/learning/wind-chill-questions-and-answers/>





# Hazard Identification and Risk Assessment

## 4.10.1.3.2 Frost/ Freeze

Typically, frost can occur when the temperature falls below 36°F, especially in rural areas. The National Weather Service does not keep track of "frost" in observations per se. It is a localized phenomenon and can be quite variable across a small area. Frost becomes more widespread when the temperature falls below 32°F with some freeze possible. A hard freeze is possible when temperatures fall below 28°F.

From 2005 to 2018, there have been at least 17 frost/freeze days, and 2 days resulted in crop damage were recorded by NCEI for the CVPDC area. Approximately \$1,388,000 in crop damages were recorded in this area.

### **4.10.1.4 Relationship to Other Hazards**

Figure 4-132 shows the interrelationship (causation, concurrence, etc.) between this hazard and other hazards discussed in this plan update.

## **4.10.2 Impact and Vulnerability**

### **4.10.2.1 Human Health**

The greatest danger from extreme cold is to people, as prolonged exposure can cause frostbite or hypothermia, and can become life threatening. Body temperatures that are too low affect the brain, making it difficult for the victim to think clearly or move well. This makes hypothermia particularly dangerous for those suffering from it, as they may not understand what is happening to them or what to do about it. Hypothermia is most likely at very cold temperatures, but can occur at higher temperatures (above 40 degrees Fahrenheit) if the person exposed is also wet from rain, sweat, or submersion. Warning signs of hypothermia include shivering, exhaustion, confusion, fumbling hands, memory loss, slurred speech, or drowsiness. In infants, symptoms include bright red, cold skin and very low energy. A person with hypothermia should receive medical attention as soon as possible, as delays in medical treatment may result in death. There is no designated warming center/community shelter facility under operation in the CVPDC area.

### **4.10.2.2 Critical facility**

In addition to the threat posed to humans, extreme cold weather poses a significant threat to utility production, which in turn threatens facilities and operations that rely on utilities, specifically climate stabilization. As temperatures drop and stay low, increased demand for heating places a strain on the electrical grid, which can lead to temporary outages. These outages can impact operations throughout the campus, which can result in interruptions and delays in services. Broken pipes may cause flooding in buildings, causing property damage and loss of utility service. Some of the secondary effects presented by extreme/excessive cold include dangerous conditions to livestock and pets.



# Hazard Identification and Risk Assessment

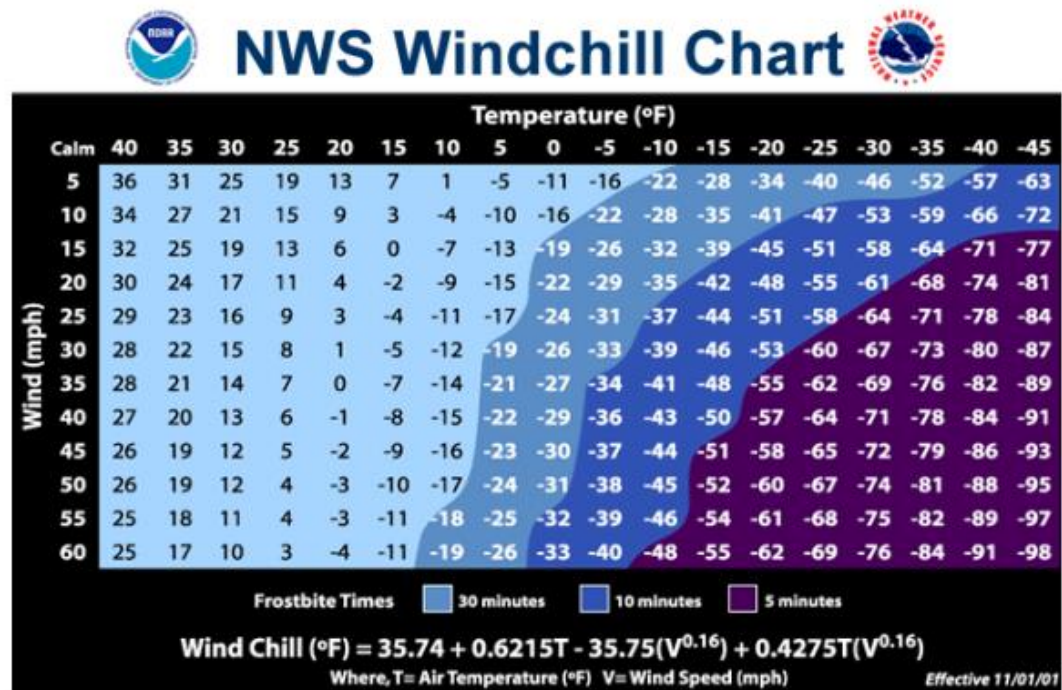


Figure 4-131 National Weather Service Wind Chill Chart

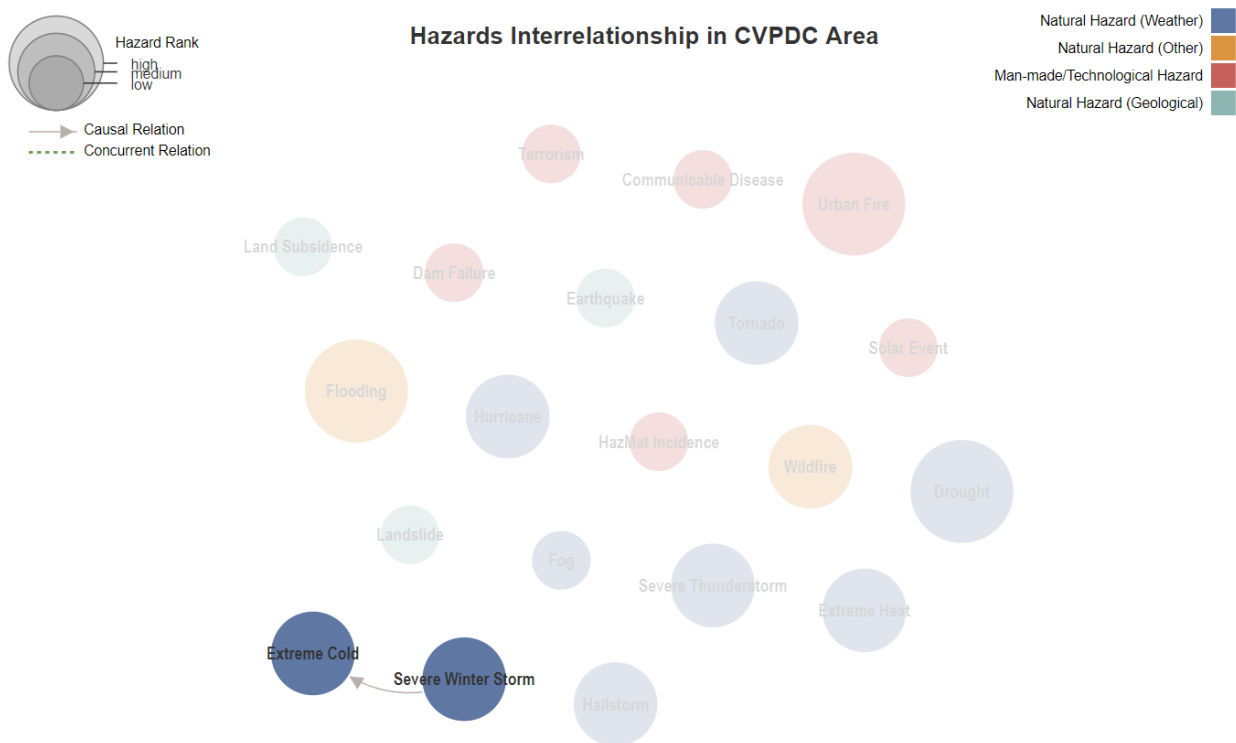


Figure 4-132 Hazards interrelationship



# Hazard Identification and Risk Assessment

## 4.10.3 Risk Assessment

Manufactured homes (mobile homes) and antiquated or poorly constructed facilities may have inadequate capabilities to withstand extreme temperatures due to lack of insulation and poor heating and cooling systems. Please refer to the Tornado chapter about geographic concentrations of mobile homes in the CVPDC area.

## 4.10.4 Probability of Future Occurrences

The likelihood or future probability of occurrence of excessive cold / wind chill in the CVPDC area is occasional. Future extreme weather conditions are difficult to predict, as the climate warms, extreme cold events may decrease in frequency.

## 4.10.5 References

- National Weather Service. *NWS Products and Information Guide*. 2011. [https://www.weather.gov/media/gjt/services/GJT\\_Service\\_Guide.pdf](https://www.weather.gov/media/gjt/services/GJT_Service_Guide.pdf)
- National Weather Service. *Frost and Freeze Information*. <https://www.weather.gov/iwx/fallfrostinfo>
- National Centers for Environmental Information. *Storm Events Database - Cold/Wind Chill and Extreme Cold/ Wind Chill*
- National Centers for Environmental Information. *Storm Events Database - Frost/ Freeze*



# Hazard Identification and Risk Assessment

## 4.11 Extreme Temperatures: Excessive Heat

### 4.11.1 Hazard Profile

A heat wave is a prolonged period of excessive heat, often combined with high humidity. These conditions can be dangerous and even life-threatening without proper precautions (VDEM). Heat-related illnesses, like heat exhaustion or heat stroke, happen when the body is not able to properly cool itself. Extreme heat can cause injury or death to humans and animals and can increase the risk of wildfire due to drought.

#### 4.11.1.1 Geographic Location/Extent

Extreme heat is not a hazard with a defined geographic boundary. All localities within the CVPDC area are exposed to the hazard. Urban areas within the CVPDC such as Lynchburg are at a higher risk of excessive heat due to the “Heat Island” effect. Excessive heat can occur at any time during the year, but is most dangerous during the summer between June and August when average temperatures are at their highest.

#### 4.11.1.2 Magnitude / Severity

Heat is more harmful to human health when humidity is high because humid air hinders the evaporation of sweat, and thus reduces the body’s ability to cool itself. To determine the effect of both heat and humidity, the National Weather Service formulated the Heat Index based on the range of warm-season conditions typically seen on Earth (Figure 4-133). These Heat Index thresholds were utilized as criteria for the issuance of heat advisories and excessive heat warnings.<sup>59</sup> This index is a measure of how hot it really feels when relative humidity is factored in with the actual air temperature. The danger an individual experiences is highly dependent on age, with the elderly and the very young at a higher risk of a heat disorder or death than an average adult.

#### 4.11.1.3 Previous occurrences

According to the CDC WONDER (Wide-ranging Online Data for Epidemiologic Research) data from 1979 to 2011, the CVPDC area has experienced 3659 total days on the NWS Heat Index. Of those 3659 days, 2603 were rated at a level of caution, 1024 were rated at extreme caution, and 32 were rated at danger. There were no days of extreme danger reported. The record high temperature in Lynchburg is 103°F on June 29, 2012, recorded at Lynchburg Regional Airport Meteorological Station.

A widespread and dangerous heat wave swept through the Eastern United States in July 2019. The city of Lynchburg opened two cooling centers on July 20-21 for residents: College Hill in 811 Jackson Street, and the Salvation Army in 2215 Park Avenue. In addition, the Miller Park Pool and Riverside Park Sprayground were also opened to provide relief to the vulnerable community. Other residents used the Lynchburg bus system to stay cool and residents in other CVPDC jurisdictions found relief in commercial buildings.

#### **Cooling Center**

*A Cooling Center is a facility that has been opened for short term operations due to a specific emergency or event. It is normally opened when temperatures have or may become dangerous. Its paramount purpose is the prevention of death and injury related to exposure to the elements. Cooling Centers can help stranded motorists or residents that have lost critical services or just need somewhere to escape the heat.*

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<sup>59</sup> Heat Index. National Weather Service. <https://www.weather.gov/safety/heat-index>





# Hazard Identification and Risk Assessment

## **4.11.1.4 Relationship to Other Hazards**

Depending on severity, duration, and location; extreme heat events can create or provoke secondary hazards such as droughts, wildfires, or urban fires. This could result in a broad and far-reaching set of impacts throughout a jurisdiction or the entire CVPDC area. Impacts could include significant loss of life and illness; economic costs in transportation, agriculture, production, energy and infrastructure; and losses of ecosystems, wildlife habitats and water resources. Figure 4-134 shows the interrelationship (causation, concurrence, *etc.*) between this hazard and other hazards discussed in this plan update.

## **4.11.2 Impact and Vulnerability**

### **4.11.2.1 Human Health**

Extreme heat can pose severe and life-threatening problems for people. According to the NWS, it is one of the leading weather-related killers in the United States, resulting in hundreds of fatalities each year and even more heat-related illnesses. Health risks to residents in the region exposed to extreme heat include dehydration, heat cramps, fainting, heat exhaustion, and heat stroke (Table 4-136). Extreme heat has a special impact on the most vulnerable segments of the population - the elderly, young children and infants, impoverished individuals, and persons who are in poor health. The high-risk population groups with specific physical, social, and economic factors that make them vulnerable include:

- Older persons (age > 65)
- Infants (age < 1)
- Homeless population
- Very low and low income persons
- People who are socially isolated
- People with mobility restrictions or mental impairments
- People taking certain medications (e.g., for high blood pressure, depression, insomnia)
- People engaged in vigorous outdoor exercise or work or those under the influence of drugs or alcohol.



# Hazard Identification and Risk Assessment

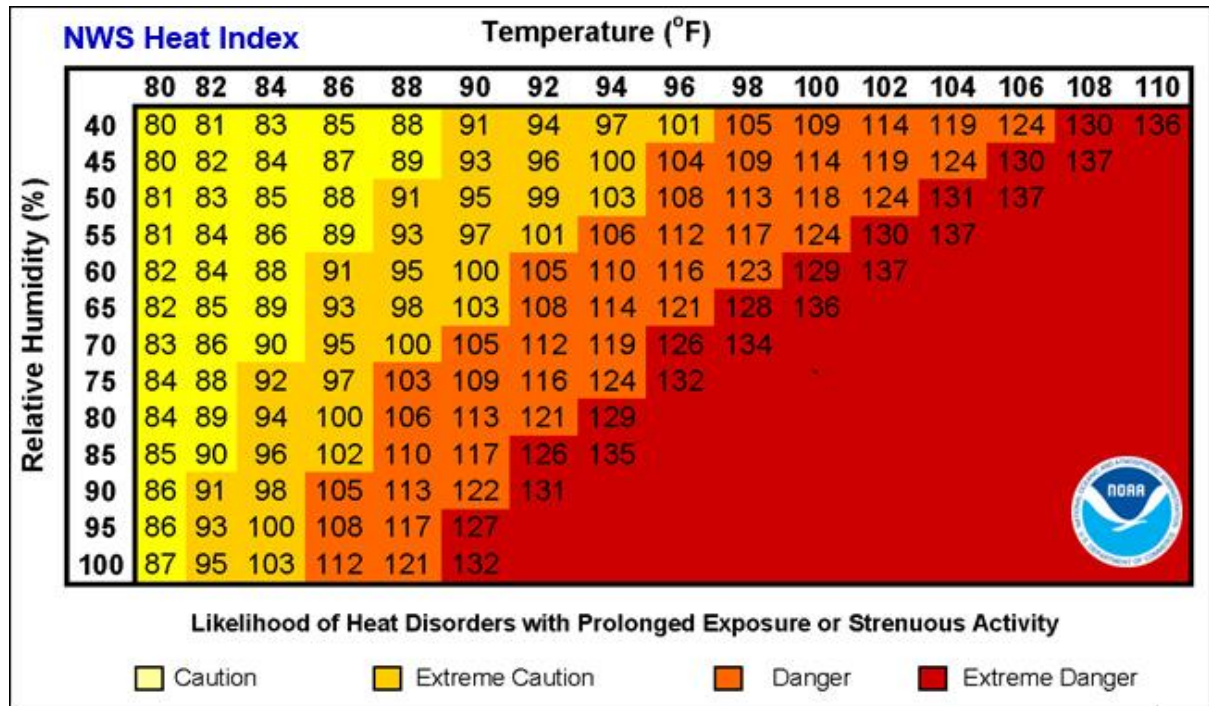


Figure 4-133 National Weather Service Heat Index

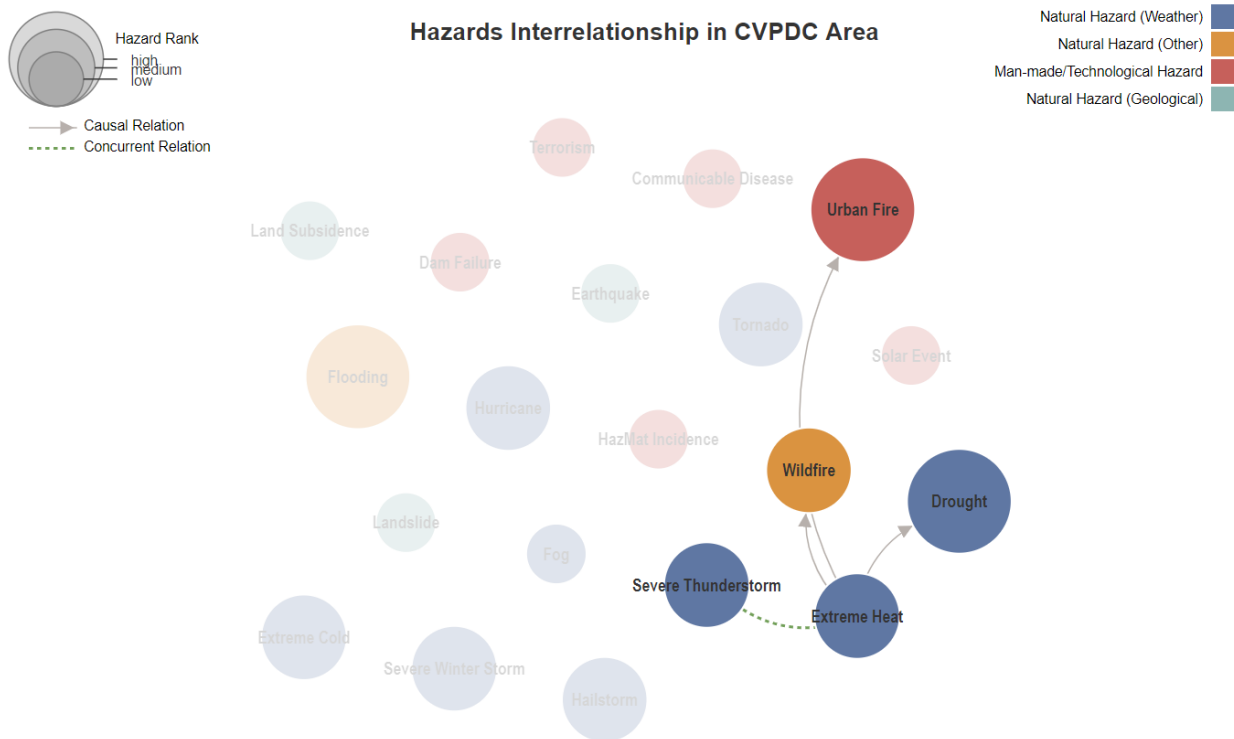


Figure 4-134 Hazards interrelationship



# Hazard Identification and Risk Assessment

Table 4-136 Health Hazards Associated with Heat Index Values

Category	Heat Index	Health Hazards
Extreme Danger	130°F- Higher	Heat Stroke/ Sunstroke is likely with continued exposure
Danger	105°F - 129°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/ or physical activity
Extreme Caution	90°F - 105°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged and/or physical activity
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity

## 4.11.2.2 Urban / building / infrastructure / transportation

The impact of excessive heat is most prevalent in urban areas, where urban heat island effects prevent inner-city buildings from releasing heat built up during the daylight hours. Secondary impacts of excessive heat are severe strain on the electrical power system and potential brownouts or blackouts.

Extreme heat can have a negative impact on transportation. Highways and roads are damaged by excessive heat as asphalt roads soften and concrete roads expand and can buckle, crack, or shatter. Moreover, concrete has been known to "explode," lifting chunks of concrete and putting those nearby at serious risk. Stress is also placed on automobile cooling systems, diesel trucks, and railroad locomotives which lead to an increase in mechanical failures. Steel rails are at risk of overheating and warping which can lead to train derailments.

## 4.11.2.3 Agriculture

In the agriculture community, livestock, such as rabbits, poultry, pigs, and cows are severely impacted by heat waves. Ill-timed high temperatures inhibit crop yields and wheat, corn, and grape yields can all be significantly reduced by extreme high temperatures at key development stages.

## 4.11.3 Risk Assessment

Except the two cooling center shelters in the City of Lynchburg, no cooling shelter was set up in other jurisdictions in the CVPDC area as of this plan update. Figure 4-135 shows the location of the two shelters (*i.e.*, College Hill center and Salvation Army center) and the surrounding geographic patterns (*i.e.*, young, old, and poor populations).

## 4.11.4 Probability of Future Occurrences

The likelihood or future probability of occurrence of excessive summer heat in the CVPDC area is occasional. Future extreme heatwave conditions are difficult to predict, but expected to increase. Some climate models indicate by 2050, the typical number of heat wave days in Virginia is projected to increase from more than 10 to nearly 60 days a year.<sup>60</sup> According to a report by EPA in 2016 (EPA 430-F-16-048), in the coming decades, Virginia's changing climate is likely to "increase the number of unpleasantly hot days, increase the risk of heat stroke and other heat-related illnesses, reduce crop yields, and harm livestock".<sup>61</sup> In the past, multiple localities throughout the region have issued burn bans to prevent the occurrence of wildfires due to extreme heat and

<sup>60</sup> <https://statesatrisk.org/virginia/all>

<sup>61</sup> <https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-va.pdf>



# Hazard Identification and Risk Assessment

dry conditions. Mitigation activities should be tailored towards protecting lives and preventing injury from extreme temperature events, such as issuing advisories and warnings, and identifying the location of vulnerable populations.

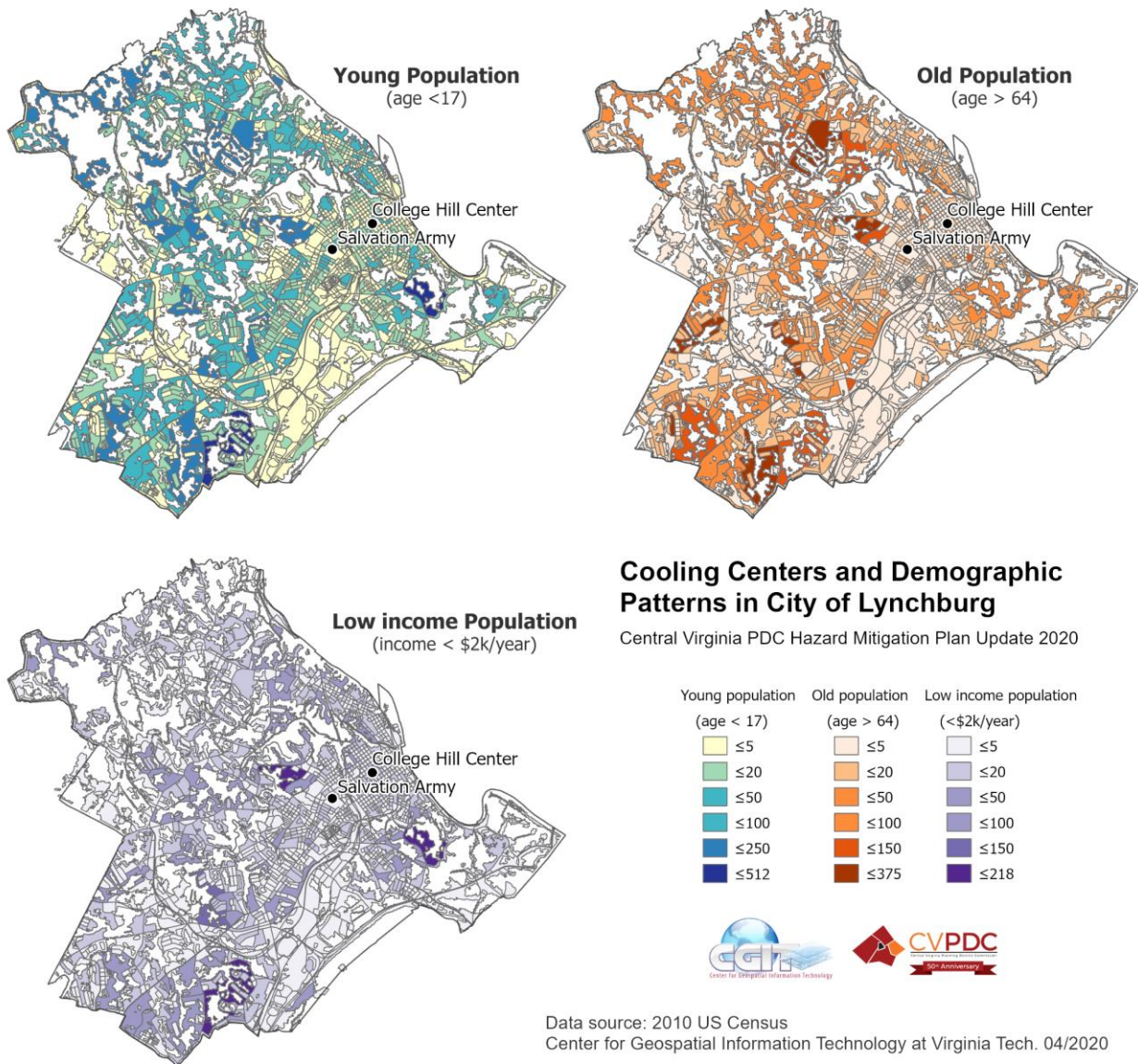


Figure 4-135 Cooling center shelters and demographic patterns in City of Lynchburg

## 4.11.5 References

- Better Institutions. *Extreme temperatures are affecting every mode of transportation*. July 2013. <http://www.betterinstitutions.com/blog/2013/07/extreme-temperatures-are-affecting>
- CDC Wonder Database - North America Land Data Assimilation System (NLDAS) Daily Air Temperatures and Heat Index (1979-2011). <https://wonder.cdc.gov/NASA-NLDAS.html>





# Hazard Identification and Risk Assessment

- Environmental Protection Agency. *What Climate Change Means for Virginia*". Report No. EPA 430-F-16-048. August 2016. <https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-va.pdf>
- Kristina Dahl, Erika Spanger-Siegfried, Rachel Licker, Astrid Caldas, John Abatzoglou, Nicholas Mailloux, Rachel Cleetus, Shana Udvardy, Juan Declet-Barreto, and Pamela Worth. *Killer Heat in the United States: Climate Choices and the Future of Dangerously Hot Days*. Cambridge MA: Union of Concerned Scientists, July 2019. <https://www.ucsusa.org/sites/default/files/attach/2019/07/killer-heat-analysis-full-report.pdf>.
- National Weather Service. *NWS Heat Index*. <https://www.weather.gov/safety/heat-index>
- Plantmaps.com. *Virginia Record High and Low Temperatures Map*. <https://www.plantmaps.com/virginia-record-high-and-low-temperature-map.php>
- United States Environmental Protection Agency. *Smart Growth and Urban Heat Islands*. <https://www.epa.gov/sites/production/files/2014-06/documents/smartgrowthheatislands.pdf>
- Virginia Department of Emergency Management (VDEM). *Extreme heat safety*. <https://www.vaemergency.gov/threats/extreme-heat/>



# Hazard Identification and Risk Assessment

## 4.12 Drought

### 4.12.1 Hazard Profile

Drought refers to an extended period of deficient rainfall relative to the statistical mean established for a region. A drought can be characterized in several different ways depending on the impact. The National Weather Service (NWS) describes four types of drought: meteorological, agricultural, hydrological, and socioeconomic.

- **Agricultural** drought is the most common form of drought. It is characterized by unusually dry conditions during the growing season. It occurs when there is insufficient soil moisture to satisfy the water budget of a specific crop, leading to destroyed or underdeveloped crops, with greatly depleted yields.
- **Meteorological** drought is an extended period of time (6 or more months) with precipitation less than 75 percent of the normal precipitation.
- **Hydrological** drought is based on the impact of rainfall deficits on the water supply such as stream flow, reservoir and lake levels, and ground water table decline.
- **Socioeconomic** drought considers the impact of drought conditions (meteorological, agricultural, or hydrological drought) on supply and demand of some economic goods such as fruits, vegetables, grains, and meat. Socioeconomic drought occurs when the demand for an economic good exceeds supply as a result of weather-related deficits in the water supply.

#### 4.12.1.1 Geographic Location/ Extent

Drought is a gradual phenomenon, and its condition occurs naturally in a broad geographic area. Since 2000, the longest duration of drought (D1-D4, See Table 4-137 for descriptions) in Virginia lasted 103 weeks beginning in May, 2007 and ending in April, 2009 (Figure 4-136). The most intense period of drought occurred the week of August 20, 2002 where D4 affected 30.53% of Virginia land (National Integrated Drought Information System, 2019).<sup>62</sup>

#### 4.12.1.2 Magnitude/ Severity

The U.S. Drought Monitor (USDM)'s drought intensity scale is composed of five different levels: D0, D1, D2, D3, and D4. The USDM's weekly report uses this classification scale in combination with a color-coded map to provide a tool for decision making and drought planning. It also plays a key role in heightening awareness of drought as a hazard through dissemination by various media sources and state and federal agencies. Linking indices, such as the USDM, to impacts also allows decision makers to subsequently develop threshold alerts for communities to take action in response to drought conditions. Figure 4-137 presents the drought condition across the Commonwealth in September 2019.






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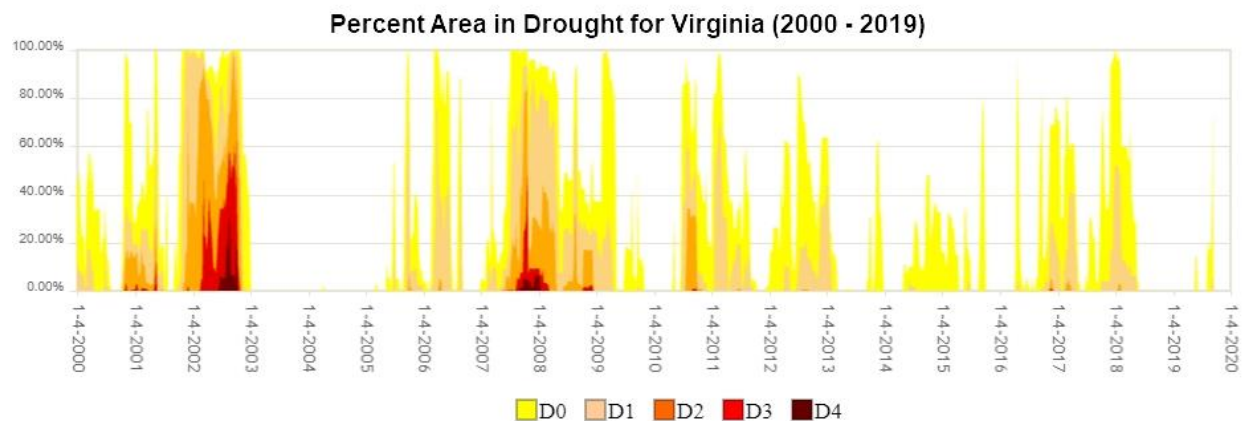
<sup>62</sup> <https://www.drought.gov/drought/states/virginia>



# Hazard Identification and Risk Assessment

Table 4-137 Drought Severity Classification

Drought Scale	Impacts
 <b>D0</b> Abnormally Dry	<ul style="list-style-type: none"> <li>Short-term dryness slowing planting, growth of crops</li> <li>Some lingering water deficits</li> <li>Pastures or crops not fully recovered</li> </ul>
 <b>D1</b> Moderate Drought	<ul style="list-style-type: none"> <li>Some damage to crops, pastures</li> <li>Some water shortages developing</li> <li>Stream, reservoir, or well levels are low</li> <li>Voluntary water-use restrictions requested</li> </ul>
 <b>D2</b> Severe Drought	<ul style="list-style-type: none"> <li>Crop or pasture losses are likely</li> <li>Water shortages are common</li> <li>Fire risk is very high</li> <li>Water restrictions are typically voluntary or mandated</li> </ul>
 <b>D3</b> Extreme Drought	<ul style="list-style-type: none"> <li>Major crop/pasture losses</li> <li>Fire risk is extreme</li> <li>Widespread water shortages or restrictions</li> </ul>
 <b>D4</b> Exceptional Drought	<ul style="list-style-type: none"> <li>Exceptional and widespread crop/pasture losses</li> <li>Exceptional fire risk</li> <li>Shortages of water creating water emergencies</li> </ul>



(Source: U.S. Drought Monitor)

Figure 4-136 Percent Area in Drought for Virginia, 2000 - 2019



# Hazard Identification and Risk Assessment

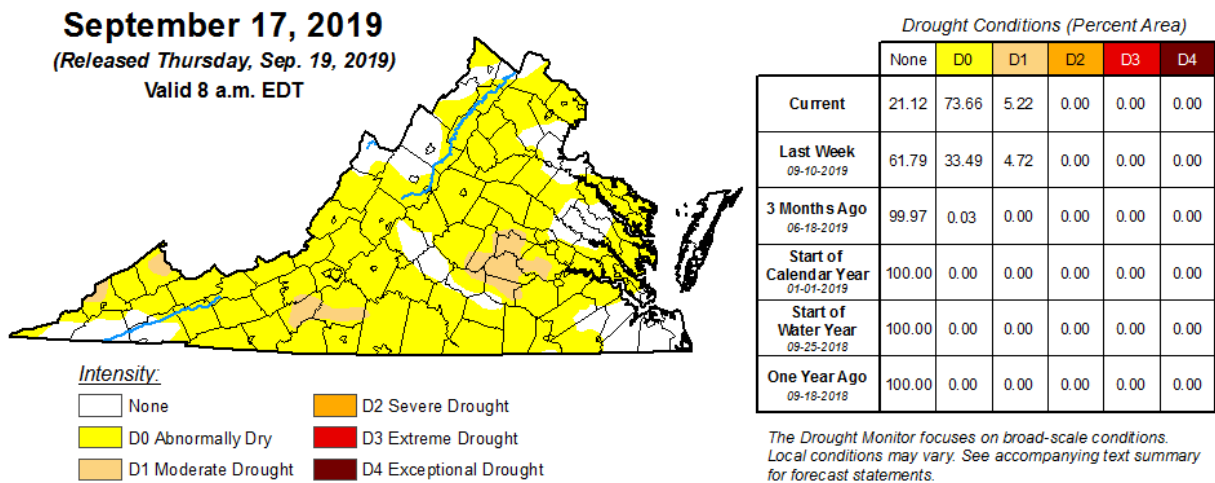


Figure 4-137 Drought Condition in Virginia from U.S. Drought Monitor (on September 17, 2019)

The responsibility for monitoring drought conditions rests with the Virginia Drought Monitoring Task Force (DMTF). The DMTF is activated with the first occurrence of moderate drought conditions (D1) in the Commonwealth or the occurrence of smaller scale moisture deficits that may fall beneath the level of resolution of the U.S. Drought Monitor. DMTF uses four hydrologic indicators across thirteen Drought Evaluation Regions to gauge the presence and severity of hydrological drought<sup>63</sup>. The indicators are based on the amount of precipitation and the effect of the precipitation (or lack of precipitation) on the hydrologic system.

- **Groundwater levels** are monitored at key shallow water-table observation wells that are part of the Virginia Climate Response Network.
- **Precipitation deficits** are monitored by comparing current precipitation amounts with historical precipitation values as a percent of normal long-term values.
- **Streamflow** is monitored at real-time stations with a long-term period of record on streams that have moderately large drainage areas and no significant regulation of flow by dams or impoundments.
- **Reservoir storage** is monitored at large multi-purpose reservoirs or at water-supply reservoirs.

The CVPDC area is covered by two Drought Evaluation Regions: the Roanoke region and Middle James region (Figure 4-138). The current drought condition for these evaluation regions can be found at the Virginia DEQ website.<sup>64</sup>

<sup>63</sup> <https://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/Drought/DroughtMonitoring.aspx>

<sup>64</sup> <https://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/Drought/CurrentDroughtConditionsMap.aspx>





# Hazard Identification and Risk Assessment

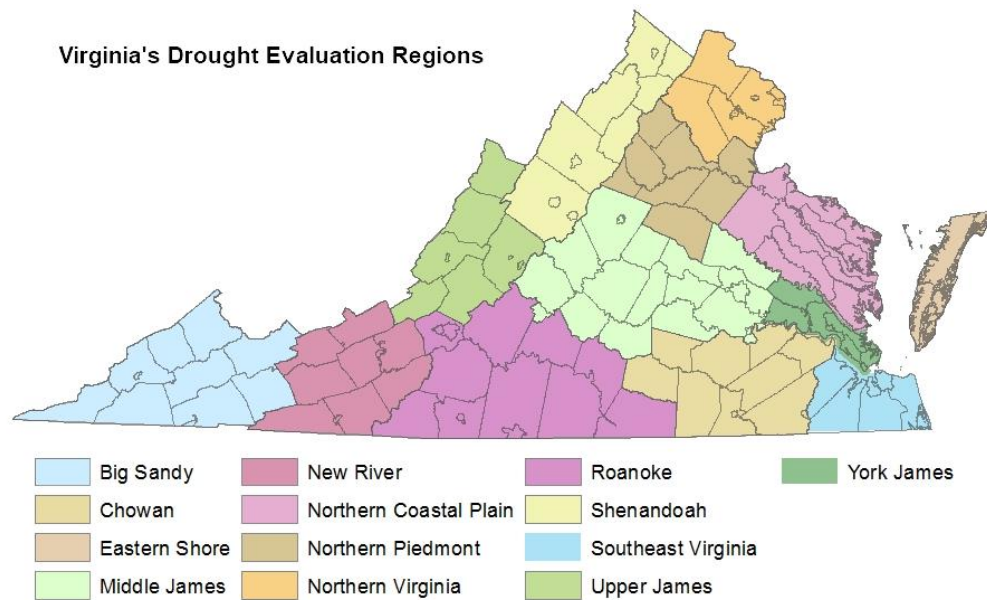


Figure 4-138 Virginia's Drought Evaluation Regions

The DMTF monitors the advance of drought conditions in the Commonwealth, not only using the drought indicators, but also other indicators such as the Standardized Precipitation Index, Palmer Drought Severity Index, Crop Moisture Index, Keetch-Byrum Drought Index, and NOAA monthly and seasonal precipitation outlooks. There is no single definition of drought and it is difficult to determine when a drought begins and ends. There are various tools developed by the researchers to help define the onset, severity, and end of droughts. Drought indices take thousands of bits of data on rainfall, snowpack, streamflow, etc., analyze the data over various time frames, and turn the data into a comprehensible big picture (National Drought Mitigation Center).<sup>65</sup>

Recently, the USDM created a Drought Severity and Coverage Index (DSCI) for converting drought levels (D0 to D4) from the U.S. Drought Monitor map to a single value for an area by a weighted sum:

$$1(D0) + 2(D1) + 3(D2) + 4(D3) + 5(D4) = DSCI$$

The DSCI provides a convenient way to convert USDM data from categorical to continuous, and to aggregate from spatially specific to geopolitical boundaries. Figure 4-139 shows Virginia's DSCI during 2000 to 2019.

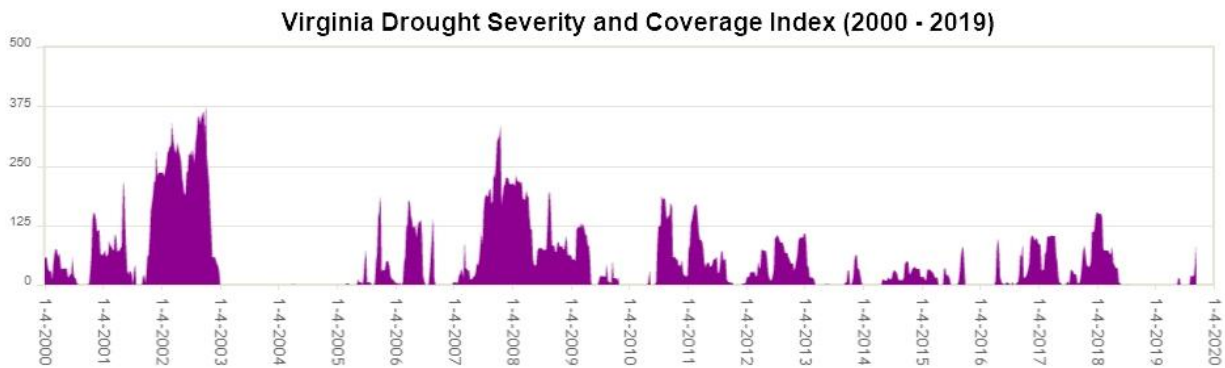
#### 4.12.1.3 Previous Occurrences

Table 4-138 includes descriptions of major droughts that have occurred in CVPDC jurisdictions. Events have been broken down by the date of occurrence and when available, by individual community descriptions. When no community specific description is available, the general description should be used as representing the entire planning area. According to NCEI storm events database, there were 39 drought events reported in the CVPDC area from 1994 to 2019, resulting in about \$13.4 million agricultural damage (Figure 4-140, Figure 4-141). There was no new drought event reported since the last plan.

<sup>65</sup> <https://drought.unl.edu/ranchplan/DroughtBasics/WeatherandDrought/MeasuringDrought.aspx>



# Hazard Identification and Risk Assessment



(Source: U.S. Drought Monitor) <sup>66</sup>

Figure 4-139 Virginia Drought Severity and Coverage Index, 2000 - 2019

Table 4-138 Drought Hazard History

Date	Damages
1976-1977	Ten months of below average precipitation. The drought began in November of 1976 when rainfall totaled to only 50% to 75% of normal.
1985-1986	Very little rainfall began in December and the trend continued throughout the summer. Total precipitation January and February was 2 inches.
2001-2002	Stream levels were below normal with record lows observed at gages for the York, James, and Roanoke River Basins. By November of 2002, the US Secretary of Agriculture had approved 45 counties for primary disaster designation, while 36 requests remained pending.
2007-2008	Drought conditions were observed by the NOAA drought monitor throughout the commonwealth and remained stable in 2007. Drought conditions showed minor improvement in March of 2008, but statewide precipitation was below normal for the 2 year span (81% of normal).

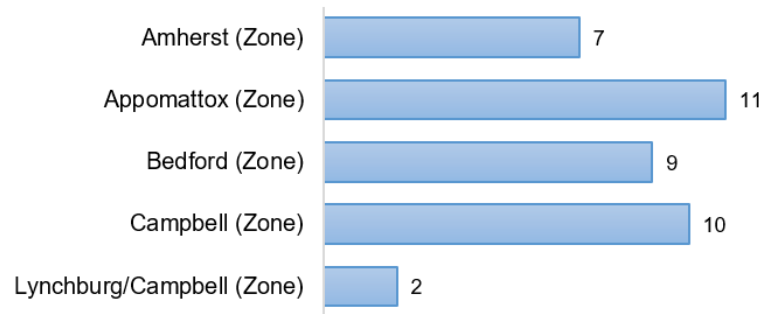
(Source: FEMA)

<sup>66</sup> <https://droughtmonitor.unl.edu/Data/Timeseries.aspx>



# Hazard Identification and Risk Assessment

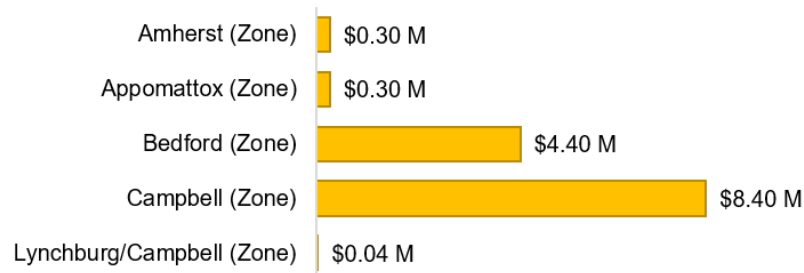
## Droughts Occurrence in CVPDC, 1994 - 2019



(Source: NCEI storm events database) <sup>67</sup>

Figure 4-140 Droughts Occurrence in CVPDC, 1994 – 2019

## Agriculture Damage Estimates from Drought in CVPDC, 1994 - 2019 (in Million Dollars)



(Source: NCEI storm events database)

Figure 4-141 Agriculture damage estimates from drought period in CVPDC, 1994-2019

The worst drought of the 20th century in Virginia occurred in 1930. Other less severe droughts occurred in 1954, 1963, 1966, and 1977. In 2002, Virginia experienced another record-setting drought. During this drought of record, Amherst County's reservoir went nearly dry; Amherst County Services Authority had to put an emergency water intake on James River to keep its customers in water. According to NCEI, the most recent large single drought event occurred on September 1, 2007, as Bedford and Campbell fell into a one month Severe Drought (D2). In total, this drought event affected 17 counties across southwestern Virginia, and led to \$12 million in crop losses across Bedford/Campbell.

<sup>67</sup> <https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=51%2CVIRGINIA>



#### 4.12.1.4 Relationship to Other Hazards

#### 4.12.2 Impact and Vulnerability

In addition to the primary impacts of drought, there are also secondary impacts that can increase the potential for other hazards to occur. Extended periods of drought can increase the risk of wildfire occurrences. Wildfire occurrences can lead to an increase of burned woody debris that could increase the potential for landslides or mudflows.



CVPDC Hazard Mitigation Plan 2020 Update





# Hazard Identification and Risk Assessment

pumping of groundwater occurs in both drought and non-drought years to support urban, rural, and agricultural water needs, it is greatly increased during dry years. Land subsidence due to groundwater pumping can permanently damage or collapse underground aquifers, increase flood risk in low-lying areas, and pose hazards to buildings, critical infrastructure, and water storage facilities.

Drought also amplifies the risk of loss of biodiversity and affects animal and plant species. Economic impacts include reductions of income to farmers, and higher food and lumber prices. Drought can shrink the food supplies of animals and plants dependent on water and damage their habitats. Sometimes the environmental damage caused by a drought is temporary, and other times it is irreversible. Socioeconomic impacts of the drought may include anxiety and depression about economic impacts of drought, health problems associated with poor water quality, fewer recreational activities, higher incidents of heat stroke, and even loss of human life.<sup>68</sup>

Table 4-137 provides a summary of USDM's drought categories and impacts. Notice that water restrictions start off as voluntary and then become required. For excessive heat, the National Weather Service utilizes heat index thresholds as criteria for the issuance of heat advisories and excessive heat warnings.

Drought response plans have been prepared for the region which contain pertinent information on how the region responds on the eve and during drought conditions.

During long periods of drought, each locality can impose restrictions on water use. Some mitigation actions detail voluntary restrictions, community education, and developing and maintaining secondary water supplies on a regional basis.

## 4.12.3 Risk Assessment and Jurisdictional Analysis

The U.S. Geological Survey's National Water Use Science Project produced an estimated use of water at the county level in the United States. The latest dataset contains total population data and water-use estimates for 2015 for the following categories: public supply, domestic, irrigation, thermoelectric power, industrial, mining, livestock, and aquaculture. Table 4-139 is an excerpt of the dataset, showing the population served by the Community Water System for 2015 in the CVPDC area.

U.S. Census data contains detailed information about the source of water per census block group. For purposes of this analysis, it was assumed that areas with populations having less than 25% of public or private water

***Public supply** refers to water withdrawn by public and private water suppliers that provide water to at least 25 people or have a minimum of 15 connections. Public-supply water is delivered to users for domestic, commercial, and industrial purposes. Community water system is a public water system that supplies water to the same population year-round.*

***Domestic water** use includes indoor and outdoor uses at residences, and includes uses such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, watering lawns and gardens, and maintaining pools. Domestic water use includes potable and non-potable water provided to households by a public water supplier (domestic deliveries) and self-supplied water use. Self-supplied domestic water use is typically withdrawn from a private source, such as a well, or captured as rainwater in a cistern.*

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<sup>68</sup> <https://www.ncdc.noaa.gov/news/drought-monitoring-economic-environmental-and-social-impacts>



# Hazard Identification and Risk Assessment

systems had a high vulnerability ranking. When a drought occurs, these areas would likely have a larger impact since most homes receive their water from wells, which may dry up during a drought. Low vulnerability was assigned to regions with more than 50% of their population drawing from public or private water systems. As a result of using the U.S. Census data, at the tract level, there are some discrepancies with the town boundaries. Boundary adjustments into “high vulnerability” areas are a result of the older census data, which is a data limitation issue and remains an issue in both the previous plan and this update. Future updates of this plan will use, if available, the most current census data for water systems.

Figure 4-143 shows each of the designated categories for each of the localities. Most towns and Lynchburg City are supplied by a public or private water system. Mitigation actions for the region reflect the regions concern for drought and water supply. Although there are areas in the CVPDC area that have a “low” drought vulnerability distinction, the entire planning region is susceptible to future drought conditions.

*Table 4-139 Population served by public supply and self-supplied water for 2015 in the CVPDC area*

Jurisdiction	Total population (in 2015)	Public Supply, total population served	Domestic, self-supplied population
Amherst County	31,914	18,785	13,129
Appomattox County	15,414	1,997	13,417
Bedford County	77,724	31,766	45,958
Campbell County	55,086	29,168	25,918
Lynchburg City	79,812	79,812	0

*(Towns included in the county numbers. Source: USGS) <sup>69</sup>*

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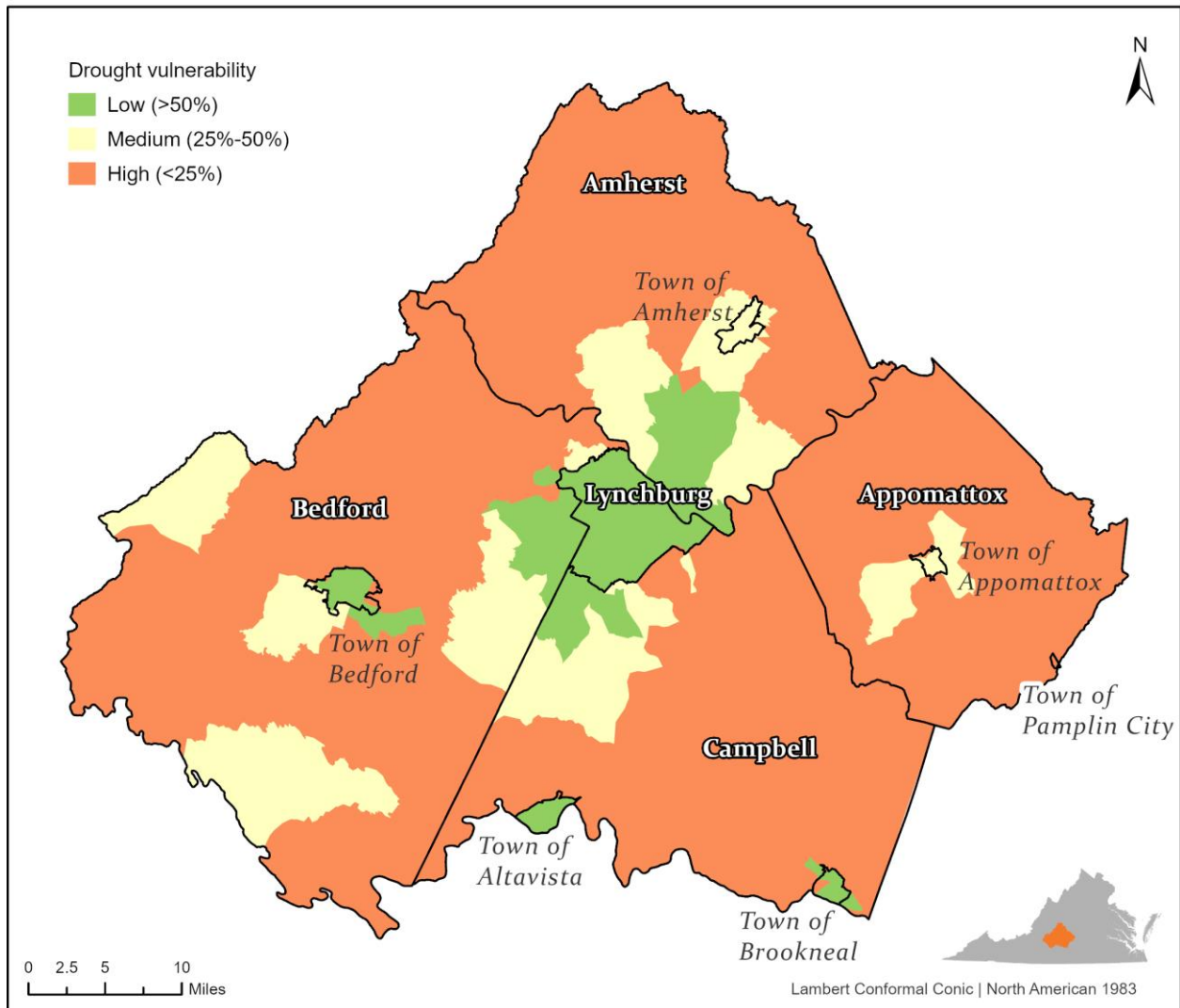
<sup>69</sup> <https://water.usgs.gov/watuse/data/>



# Hazard Identification and Risk Assessment

## Drought Vulnerability in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Low, medium, and high vulnerability was assigned to areas with more than 50%, 25%-50%, and less than 25% of their population drawing from public or private water systems respectively.

Data source: U.S. Census 1990, 2000  
Center for Geospatial Information Technology at Virginia Tech. 11/2019



Figure 4-143 Drought Vulnerability in CVPDC Area

### 4.12.4 Probability of Future Occurrences

Drought was of high concern in the previous plan. The data in this section also suggests a high degree of probability for future drought events in CVPDC localities.



# Hazard Identification and Risk Assessment

## 4.12.5 References

- Bradley, M.W., comp., 2017, *Guidelines for preparation of State water-use estimates for 2015*: U.S. Geological Survey Open-File Report 2017–1029, 54 p., <https://doi.org/10.3133/ofr20171029>.
- Dieter, C.A., Linsey, K.S., Caldwell, R.R., Harris, M.A., Ivahnenko, T.I., Lovelace, J.K., Maupin, M.A., and Barber, N.L., 2018, *Estimated use of water in the United States county-level data for 2015* (ver. 2.0, June 2018): U.S. Geological Survey data release, <https://doi.org/10.5066/F7TB15V5>.
- NOAA National Centers for Environmental Information. *Storm Events Database - Search Results*. [https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+Drought&beginDate\\_mm=01&beginDate\\_dd=01&beginDate\\_yyyy=1950&endDate\\_mm=12&endDate\\_dd=31&endDate\\_yyyy=2019&county=AMHERST%3A9&county=APPOMATTOX%3A11&county=BEDFORD%3A19&county=BEDFORD%2B%2528C%2529%3A515&county=CAMPBELL%3A31&county=LYNCHBURG%2B%2528C%2529%3A680&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefilter=51%2CVIRGINIA](https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+Drought&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=12&endDate_dd=31&endDate_yyyy=2019&county=AMHERST%3A9&county=APPOMATTOX%3A11&county=BEDFORD%3A19&county=BEDFORD%2B%2528C%2529%3A515&county=CAMPBELL%3A31&county=LYNCHBURG%2B%2528C%2529%3A680&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefilter=51%2CVIRGINIA)
- NOAA National Centers for Environmental Information. *Drought: Monitoring Economic, Environmental, and Social Impacts*. <https://www.ncdc.noaa.gov/news/drought-monitoring-economic-environmental-and-social-impacts>
- U.S. Geological Survey. *Estimated Use of Water in the United States County-Level Data for 2015*. June 2018. <https://water.usgs.gov/watuse/data/data2015.html>
- Virginia DEQ. *Virginia Drought Assessment and Response Plan*. 2003. [https://www.deq.virginia.gov/Portals/0/DEQ/Water/WaterResources/VirginiaDroughtStatus/DroughtAssessment\\_ResponsePlan\\_2003.pdf](https://www.deq.virginia.gov/Portals/0/DEQ/Water/WaterResources/VirginiaDroughtStatus/DroughtAssessment_ResponsePlan_2003.pdf)





# Hazard Identification and Risk Assessment

## 4.13 Wildfire

### 4.13.1 Hazard Profile

A wildfire is a raging, uncontrolled fire that spreads rapidly through vegetative fuels, exposing and possibly consuming structures. Wildfire is a unique hazard in that it can be significantly altered based on efforts to control its course during the event. The Virginia Department of Forestry (VDOF) indicates that there are three principal factors that can lead to the formation of wildfire hazards: topography, fuel, and weather. The environmental conditions that exist during these seasons exacerbate the hazard. When relative humidity is low and high winds are coupled with a dry forest floor (brush, grass, leaf litter), wildfires may easily ignite.

Years of drought can lead to environmental conditions that promote wildfires. Accidental or intentional setting of fires by humans is the largest contributor to wildfires. Residential areas or “woodland communities” that expand into wild land areas also increase the risk of wildfire threats. Spring and fall are the two seasons for wildfires.

Secondary effects from wildfires can pose a significant threat to the communities surrounding the hazard. During a wildfire, the removal of ground cover that serves to stabilize soil can potentially lead to hazards such as landslides, mudslides, and flooding. In addition, the leftover scorched and barren land may take years to recover and the resulting erosion can be problematic.

#### 4.13.1.1 Geographic Location/ Extent

Wildfires occur throughout wooded and open vegetation areas of Virginia and can occur any time of the year. In Virginia, the greatest number of fires occur in February, March, April, and May. This period is known as Spring Fire Season. Fall Fire Season is in October, November, and December.<sup>70</sup>

#### 4.13.1.2 Magnitude/ Severity

Keetch and Byram (1968) designed a drought index specifically for fire potential assessment. It is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers. It is a continuous index, relating to the flammability of organic material in the ground. The Keetch-Byram Drought Index (KBDI) is the most widely used system by fire managers in the southeastern United States. This mathematical system for relating current and recent weather conditions to potential or expected fire behavior results in a drought index number ranging from 0 to 800. This number accurately describes the amount of moisture that is missing; a rating of 0 defines a point of no moisture deficiency and 800 defines the maximum drought possible.<sup>71</sup> Table 4-140 indicates the potential fire behavior represented by these KBDI numbers.

Prolonged droughts (high KBDI) influence fire intensity since more fuel is available for combustion (*i.e.* fuels have a lower moisture content). In addition, dry organic material in the soil can lead to increased difficulty in fire suppression. High values of the KBDI are an indication that conditions are favorable for the occurrence and spread of wildfires, but drought is not by itself a prerequisite for wildfires. Other weather factors, such as wind, temperature, relative humidity, and atmospheric stability, play a major role in determining the actual fire

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<sup>70</sup> Causes of Forest Fires in Virginia. Virginia Department of Forestry. 2014. <http://dof.virginia.gov/fire/fire-causes.htm>

<sup>71</sup> KBDI/CSI: Introduction. Virginia Department of Forestry. <http://dof.virginia.gov/fire/kbdi.htm>



# Hazard Identification and Risk Assessment

danger. The daily KBDI for the state of Virginia can be found on the Virginia Department of Forestry web site.  
<sup>72</sup>

*Table 4-140 Keetch-Byram Drought Index (KBDI) and correlated potential fire behavior*

KBDI Number	Potential fire behavior
0 - 200	Soil moisture and large class fuel moistures are high and do not contribute much to fire intensity. Typical of spring dormant season following winter precipitation.
200 - 400	Typical of late spring, early growing season. Lower litter and duff layers are drying and beginning to contribute to fire intensity
400 - 600	Typical of late summer, early fall. Lower litter and duff layers actively contribute to fire intensity and will burn actively
600 - 800	Often associated with more severe drought with increased wildfire occurrence. Intense, deep burning fires with significant downwind spotting can be expected. Live fuels can also be expected to burn actively at these levels

#### **4.13.1.3 Previous Occurrences**

According to the statistics from the Insurance Information Institute, there were 1,266 reported wildfire incidents in Virginia which burned 15,224 acres in 2018. In the past two decades, 2002 was the fourth busiest year, showing the severity of the abnormal summertime wildfire season. Virginia Department of Forestry documents wildfire occurrences across the Commonwealth. There were approximately 949 recorded wildfires in the CVPDC area (there was no data regarding the City of Lynchburg) during 2002 to 2016. Table 4-141 reflects the statistics for the CVPDC area, and Figure 4-144 depicts the location of these fires. It is worth noting that the data received from VDOF is for private or state-owned lands only. No fires on federal (U.S. Forest Service, National Park Service) should be included.

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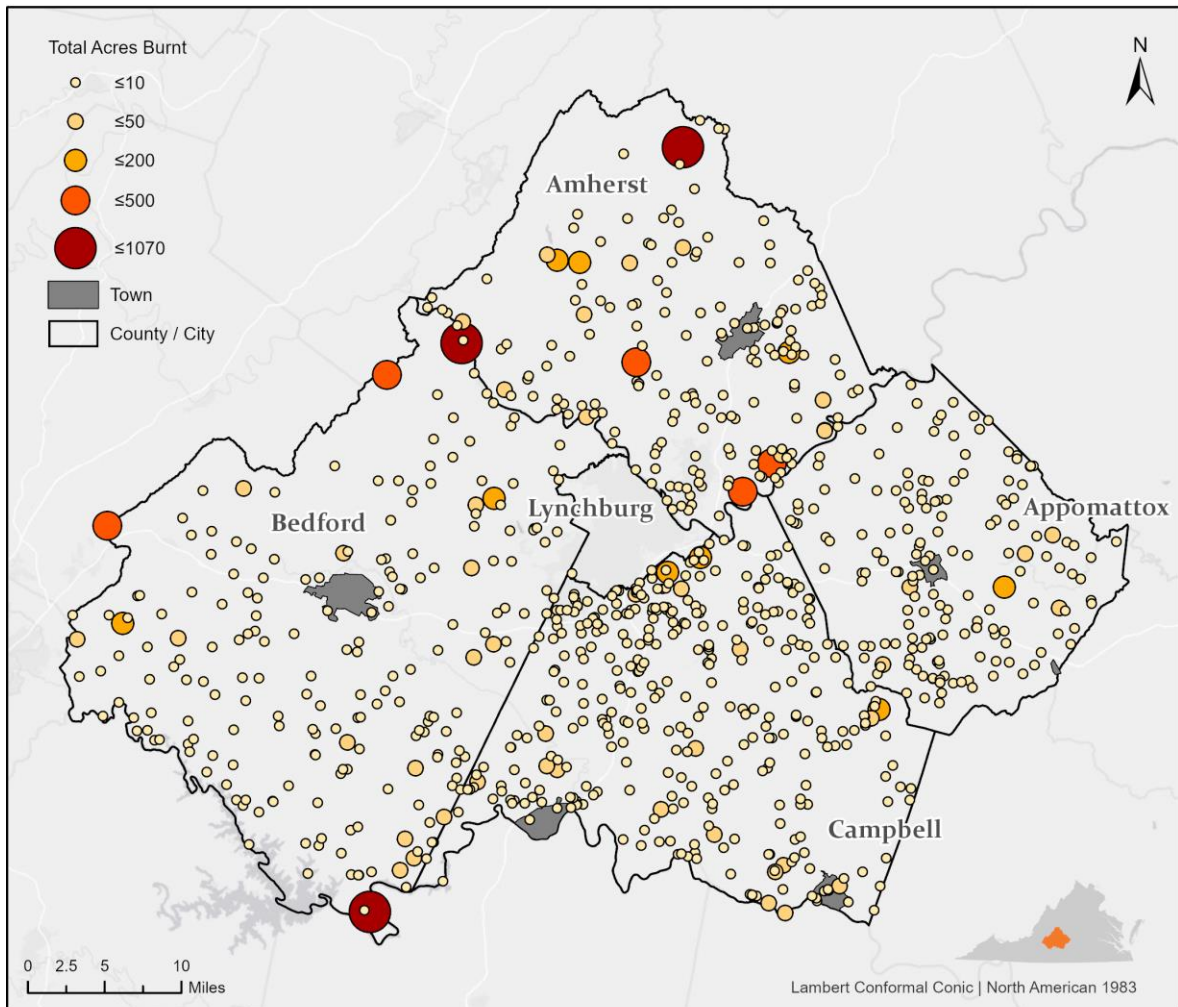
<sup>72</sup> Statewide Forest Fire Summation Report. <http://dof.virginia.gov/fire/sit-rep.htm>



# Hazard Identification and Risk Assessment

## Wildfire Incidence in Central Virginia PDC (2002 - 2016)

Central Virginia PDC Hazard Mitigation Plan Update 2020



Wildfire incidence data was compiled from VDOF statistics for 2002-2008, 2009, and 2010-2016. There were approximately 949 recorded wildfires in the CVPDC region during 2002 to 2016. There was no data regarding the Lynchburg City.

Data source: Virginia Department of Forestry  
Center for Geospatial Information Technology at Virginia Tech. 08/2019



(Source: Virginia Department of Forestry)

Figure 4-144 Wildfire incidence in CVPDC Area, 2002 - 2016.

Table 4-141 Wildfire Incidence and Burned Area in the CVPDC Area, 2002 - 2016

County	Number of Wildfires	Total Acres Burnt
Amherst County	177	2893.8
Appomattox County	173	487
Bedford County	225	3183.1
Campbell County	374	990.4
<b>Total</b>	<b>949</b>	<b>7554.3</b>

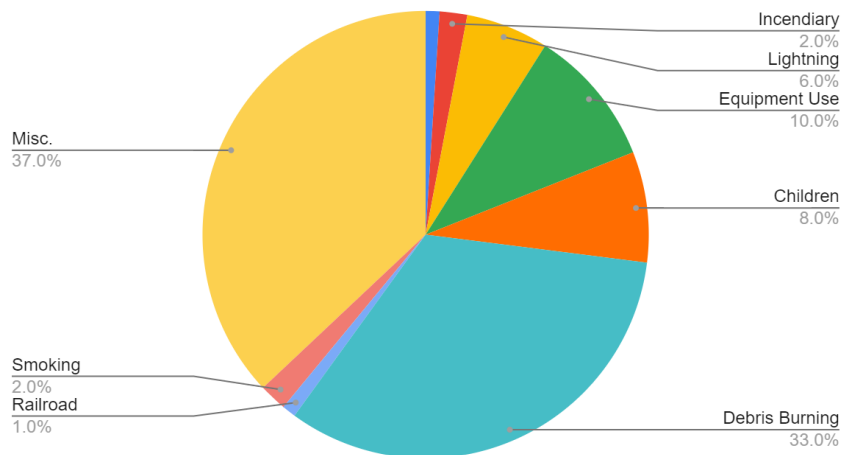
Towns included in the county numbers.



# Hazard Identification and Risk Assessment

The leading causes of wildfires in Virginia are the result of human actions, including open burning, arson, smokers, equipment use, railroads, lightning, campfires, and so on.<sup>73</sup> These fire incidents can be prevented by using common sense, following fire safety rules, and obeying fire laws. Figure 4-145 and Table 4-142 show a summary about the cause of wildfire occurred in the CVPDC area between 2010 and 2016.

**Causes of Reported Wildfire in Central Virginia PDC**



*Figure 4-145 Causes of Reported Wildfire Incidence in CVPDC Area, 2010-2016*

*Table 4-142 Number of Wildfires Incidence and Their Causes in the CVPDC Area, 2010-2016*

Causes \ County	Amherst County	Appomattox County	Bedford County	Campbell County
Number of fires	66	72	119	122
Camp Fire	0	1	0	0
Incendiary	0	1	0	1
Lightning	2	1	2	1
Equipment Use	3	0	0	7
Children	3	1	1	3
Debris Burning	4	9	1	19
Railroad	0	0	0	1
Smoking	0	0	0	2
Misc.	9	3	6	19
Not Reported	45	56	109	69

*Towns included in the county numbers.*

## 4.13.1.4 Relationship to Other Hazards

Figure 4-146 shows the interrelationship (causation, concurrence, etc.) between this hazard and other hazards discussed in this plan update.

<sup>73</sup> <http://www.dof.virginia.gov/fire/fire-causes.htm>





# Hazard Identification and Risk Assessment

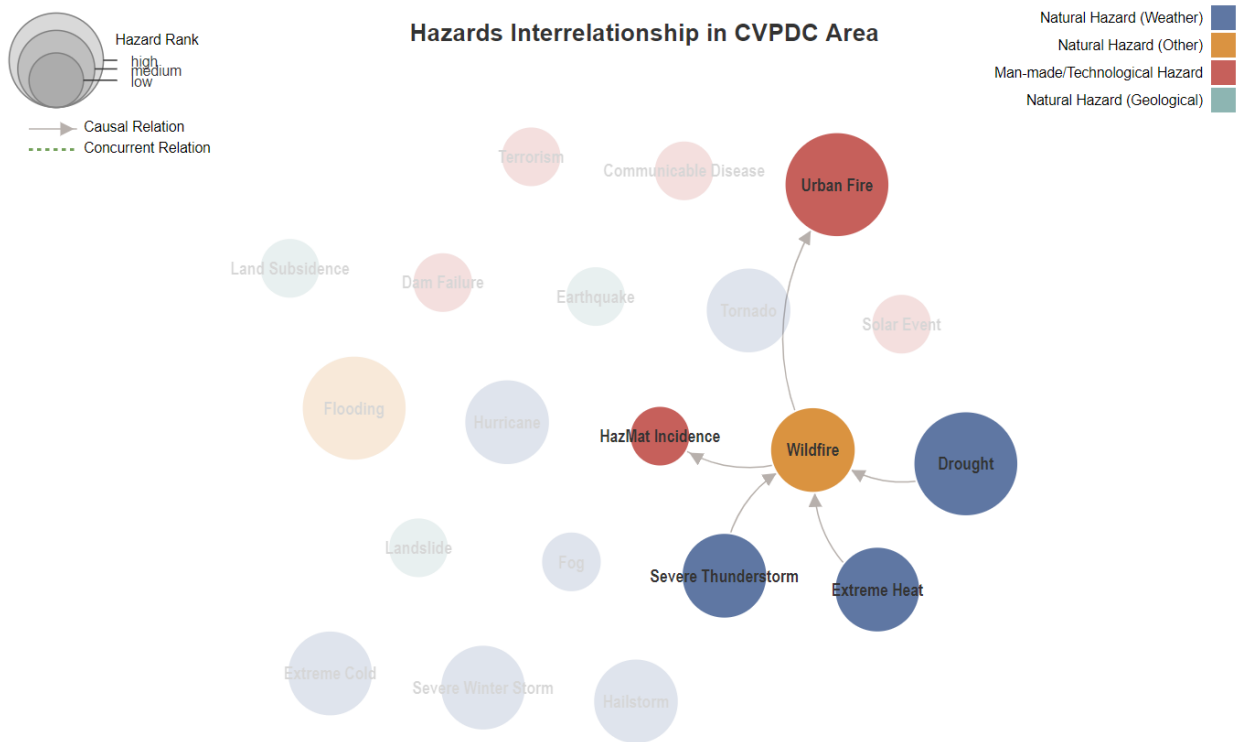


Figure 4-146 Hazards interrelationship

## 4.13.2 Impact and Vulnerability

A variety of factors like land cover, weather, etc. influence the vulnerability to wildfires. The impacts of wildfires are numerous and wide-ranging. They can have significant impacts on the economy, environment, heritage, and social fabric of the region. Economic costs of wildfires range from prevention to loss of income, livelihood, and property damage. Wildfires destroy the habitats and the intricate relationships of diverse flora and fauna, leading to loss of ecosystems and biodiversity. People who live and work in isolated areas or in the countryside are particularly vulnerable to wildfires. In addition, wildfires have the potential to affect the lives of communities well outside the immediate area of incident. Smoke can travel long distances, affecting the air quality and visibility of the surrounding regions.

## 4.13.3 Risk Assessment and Jurisdictional Analysis

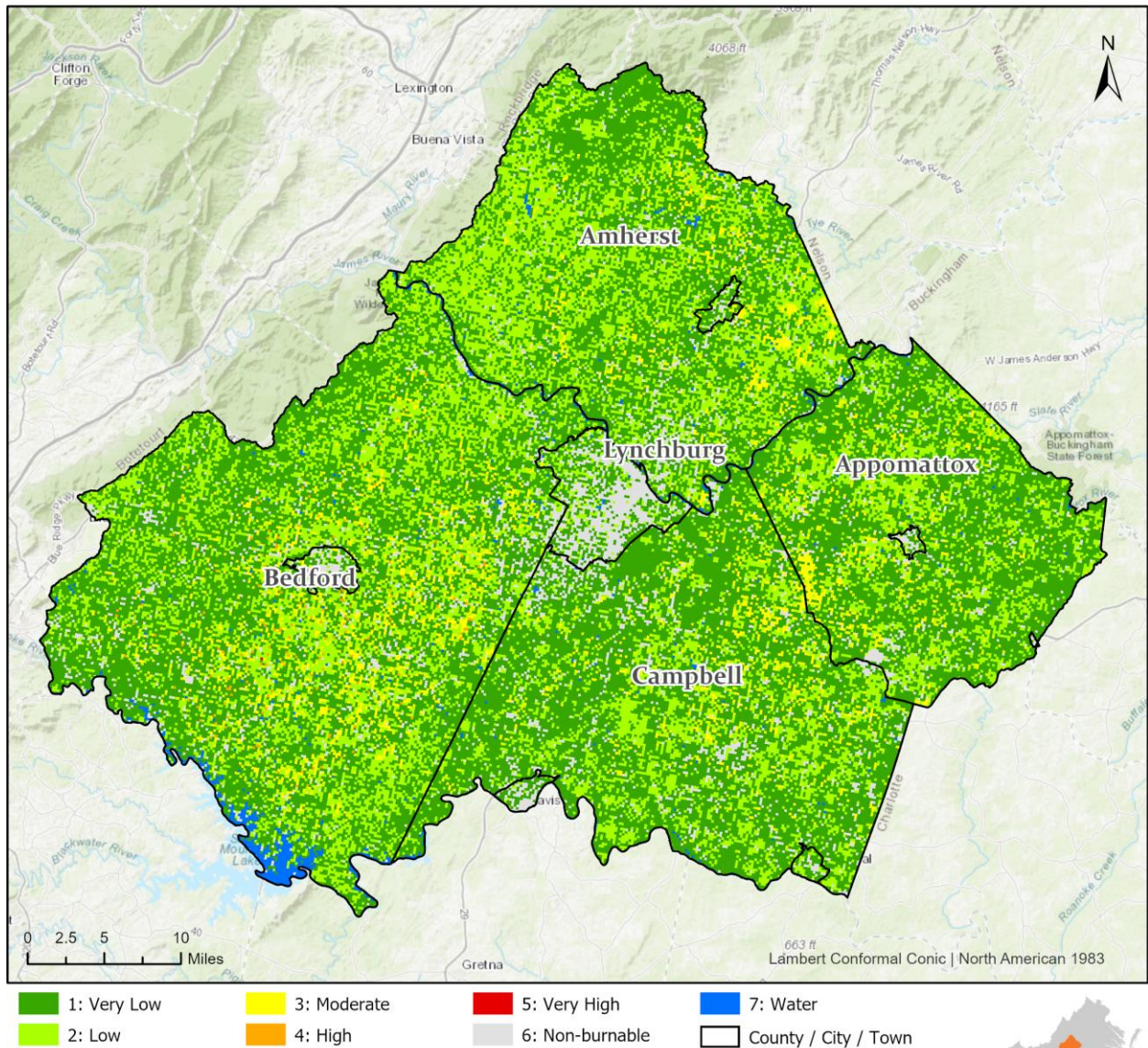
The USDA Forest Service Fire Modeling Institute produced the classified wildfire hazard potential (WHP) map to approximate relative wildfire risk for long-term strategic land management planning and fuels management. Areas mapped with higher WHP values represent fuels with a higher probability of experiencing torching, crowning, and other forms of extreme fire behavior under conducive weather conditions, based primarily on landscape conditions. Overall, the CVPDC region has relatively low to moderate potential for wildfire. Some sparse areas that have high to very high potential to highly valued assets and facilities are within Bedford County (Table 4-143 and Figure 4-147).



# Hazard Identification and Risk Assessment

## Wildfire Hazard Potential in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



This wildfire hazard potential (WHP) map shows relative wildfire risk for long-term strategic land management planning and fuels management. Area mapped with higher WHP values represents fuels with a higher probability of experiencing torching, crowning, and other forms of extreme fire behavior under conducive weather conditions.

Data source: USDA Forest Service, Fire Modeling Institute  
Center for Geospatial Information Technology at Virginia Tech. 08/2019



(Source: USDA Forest Service, 2018)

Figure 4-147 Wildfire Hazard Potential in CVPDC Area



# Hazard Identification and Risk Assessment

Table 4-143 Areas in Different Wildfire Risk Category in CVPDC Area

Locality	Wildfire Risk Area (per Wildfire Hazard Potential category)					
	Very Low	Low	Moderate	High to Very High	Non-burnable	Water
Amherst County	155,370	120,712	13,258	72	14,771	2,612
<i>Town of Amherst</i>	1,801	594	126	0	649	0
Appomattox County	131,376	58,906	13,114	0	10,394	991
<i>Town of Appomattox</i>	522	216	54	0	685	0
<i>Town of Pamplin</i>	72	0	0	0	108	18
Bedford County	265,021	154,722	32,659	2,882	29,381	12,087
<i>Town of Bedford</i>	2108	973	252	0	2,270	36
Campbell County	204,855	76,667	15,708	0	25,580	1,855
<i>Town of Altavista</i>	1,621	180	0	0	1,477	0
<i>Town of Brookneal</i>	1,333	558	0	0	414	18
Lynchburg City	11,583	4,918	126	0	14,465	540

(Unit: acre; Source: USDA Forest Service, 2018)

## 4.13.3.1 Wildland-Urban Interface

The wildland-urban interface (WUI) is the area where houses and wildland vegetation meet or intermingle. It is also the area where wildfires pose the greatest risk to people, due to the proximity of flammable vegetation. Wildfires frequently burn houses in the WUI and are most difficult to fight there. Furthermore, the WUI is where people often ignite wildfires and the vast majority of fires are human-caused. Federal wildfire management policy prioritizes fuel treatments and the promotion of fire-adapted communities in the WUI, while local jurisdictions use a variety of land use planning tools to limit the environmental impacts of housing growth in the WUI (Radeloff, *et al.* 2018).

Woodland Home Communities (WHC) are the clusters of homes located along forested areas at the WUI that are particularly susceptible to a nearby wildfire incident. The characteristics of WHC areas include: (1) Located close to wildland fuels (primarily forested areas); (2) contain greater than 10 addressable structures; and (3) have been geographically isolatable. WHCs pose two problems related to wildfires. First, there will be more wildfires-prone due to human ignitions. Second, wildfires that occur will pose a greater risk to lives and homes, they will be harder to fight, and letting natural fires burn becomes impossible.

Figure 4-148 shows the location of all 120 WHCs in the CVPDC area, according to the classification and assessment by VDOF. Eighty-one of them are under high wildfire risk and the rest are under moderate risk. Table 4-144 and Figure 4-149 present the location and number of homes of 81 WHCs that are at high wildfire risk. According to the statistics of VDOF, a total of over 2,500 homes, in 12 communities in Amherst County, 2 in Appomattox County, 38 in Bedford County, and 29 in Campbell County, are at risk.

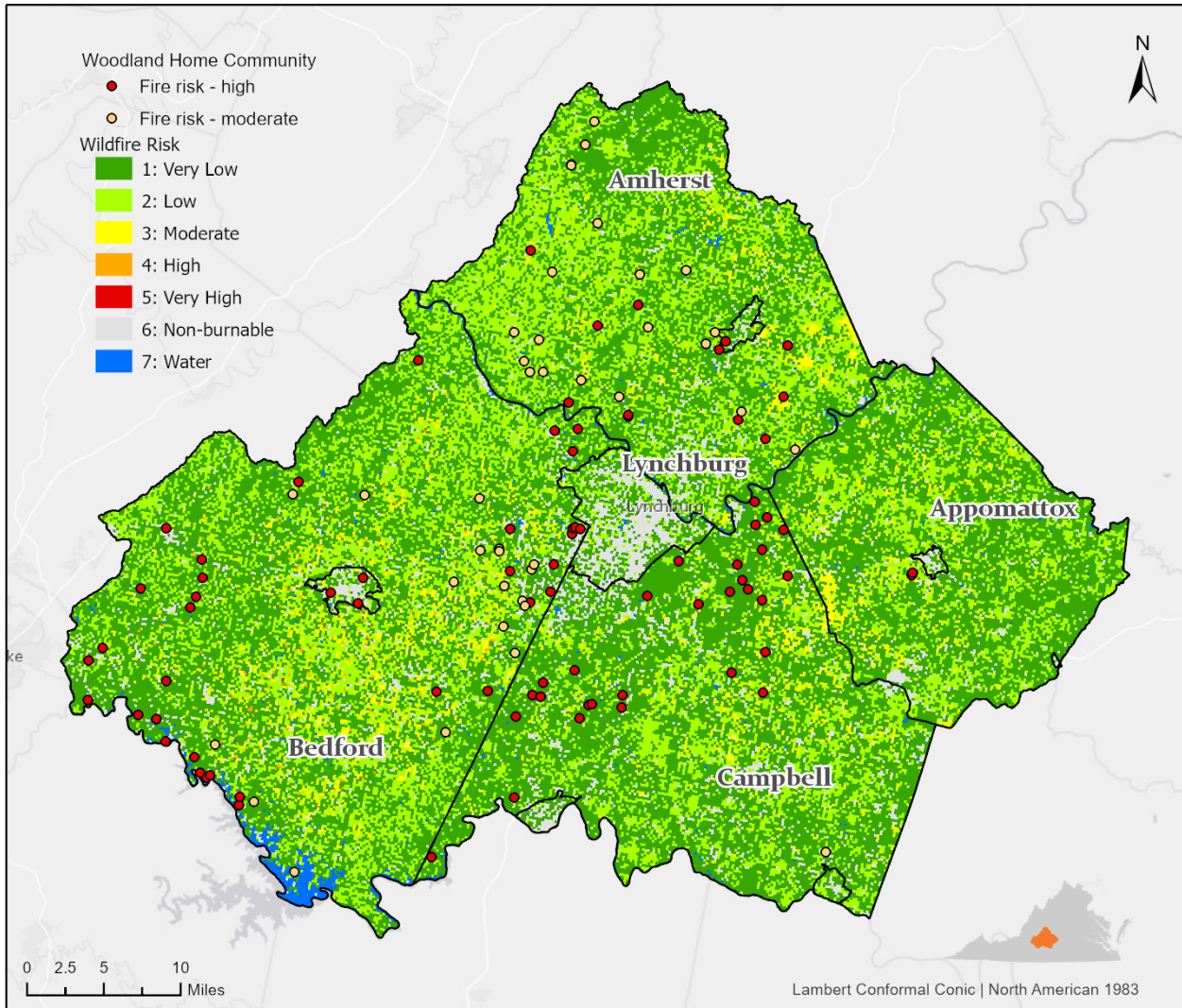




# Hazard Identification and Risk Assessment

## Woodland Home Communities in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



This wildfire hazard potential (WHP) map shows relative wildfire risk for long-term strategic land management planning and fuels management. Area mapped with higher WHP values represents fuels with a higher probability of experiencing torching, crowning, and other forms of extreme fire behavior under conducive weather conditions.

Data source: USDA Forest Service, Fire Modeling Institute  
Center for Geospatial Information Technology at Virginia Tech. 04/2020



Figure 4-148 Woodland Home Communities in CVPDC Area

Table 4-144 Woodland home community with high wildfire risk in CVPDC Area

Locality	Community	Community Type	Number of homes	Coordinates
Amherst	Robinson Gap Rd	Intermix	18	-79.301, 37.655
Amherst	Tinsley Rd	Intermix	13	-79.257, 37.512
Amherst	Forest Of Pedlar Dr	Intermix	17	-79.222, 37.584
Amherst	Johns Creek Rd	Intermix	32	-79.187, 37.498
Amherst	Ridgeview Rd	Intermix	33	-79.186, 37.500





# Hazard Identification and Risk Assessment

Locality	Community	Community Type	Number of homes	Coordinates
Amherst	Grants Hollow Rd	Intermix	12	-79.174, 37.603
Amherst	Woodland Rd	Intermix	17	-79.079, 37.561
Amherst	Sunset Dr	Intermix	17	-79.071, 37.569
Amherst	Stallion Rd	Intermix	26	-79.057, 37.494
Amherst	Hayshed Rd	Intermix	37	-79.024, 37.477
Amherst	Victoria Dr	Intermix	12	-79.003, 37.516
Amherst	Pierces Mill Rd	Intermix	11	-78.997, 37.564
Appomattox	Walton Drive	Interface	33	-78.852, 37.347
Appomattox	Charles Drive	Interface	21	-78.851, 37.349
Bedford	Dean Drive	Interface	21	-79.501, 37.346
Bedford	Hill Drive	Interface	16	-79.539, 37.332
Bedford	Fairview Drive	Interface	30	-79.507, 37.322
Bedford	Windhaven Tri	Intermix	22	-79.827, 37.230
Bedford	Glendale Drive	Interface	25	-79.825, 37.267
Bedford	Cascade Drive	Intermix	40	-79.809, 37.279
Bedford	Woodlake Drive	Intermix	20	-79.767, 37.216
Bedford	Woodcroft Road	Intermix	10	-79.764, 37.336
Bedford	Hemlock Shores Drive	Intermix	25	-79.745, 37.213
Bedford	Dewey Road	Intermix	16	-79.734, 37.393
Bedford	Morris Road	Intermix	20	-79.734, 37.191
Bedford	Hidden Forest Drive	Intermix	26	-79.733, 37.249
Bedford	Country Lane	Interface	16	-79.706, 37.317
Bedford	Westin Ridge Drive	Interface	14	-79.699, 37.328
Bedford	Tosh Lane	Interface	12	-79.701, 37.176
Bedford	Misty Ridge Lane	Intermix	14	-79.692, 37.363
Bedford	Sliding Lane	Intermix	10	-79.691, 37.346
Bedford	Shidow Drive	Intermix	15	-79.693, 37.162
Bedford	Lakeview Estate	Intermix	45	-79.685, 37.157
Bedford	Point Road	Intermix	15	-79.682, 37.159
Bedford	Forest Way Circle	Intermix	22	-79.648, 37.131
Bedford	Waterfront Drive	Intermix	45	-79.646, 37.139
Bedford	Peaks Road	Intermix	43	-79.578, 37.436
Bedford	Dahlia Court	Intermix	19	-79.435, 37.551
Bedford	Ivy Woods Drive	Intermix	22	-79.327, 37.392
Bedford	Lake Vista Drive	Intermix	42	-79.254, 37.387
Bedford	Forest Oaks Drive	Intermix	11	-79.253, 37.393
Bedford	Woodville Drive	Intermix	45	-79.250, 37.393
Bedford	Brookfield Road	Intermix	46	-79.244, 37.392
Bedford	Thompson Lane	Intermix	15	-79.327, 37.352
Bedford	Mill Spring Drive	Intermix	65	-79.304, 37.322
Bedford	Brookwood Drive	Intermix	10	-79.354, 37.239
Bedford	Prosperity Drive	Intermix	32	-79.414, 37.238
Bedford	Paul Revere/William Penn Rds	Intermix	150	-79.280, 37.332
Bedford	Eagle Eyrie Drive	Interface	32	-79.274, 37.485



# Hazard Identification and Risk Assessment

Locality	Community	Community Type	Number of homes	Coordinates
Bedford	Jefferson Woods Drive	Intermix	75	-79.275, 37.359
Bedford	Ivy Ridge Lane	Intermix	12	-79.252, 37.466
Bedford	Abert Road	Intermix	10	-79.246, 37.486
Campbell	Johnson Mt Rd	Intermix	16	-79.320, 37.214
Campbell	Cowan Rd	Intermix	20	-79.301, 37.235
Campbell	Church Ln	Intermix	88	-79.291, 37.233
Campbell	Plateau Dr	Intermix	36	-79.288, 37.247
Campbell	Doe Run Ln	Intermix	20	-79.251, 37.258
Campbell	Autumn Dr	Intermix	41	-79.245, 37.213
Campbell	Crescent Hill Dr	Intermix	16	-79.235, 37.226
Campbell	Hallwood Rd	Intermix	50	-79.231, 37.227
Campbell	Hawkins Rd	Intermix	111	-79.195, 37.223
Campbell	Elwood Ln	Intermix	18	-79.195, 37.235
Campbell	Shercell Ln	Intermix	63	-79.165, 37.329
Campbell	Camp Hydaway Rd	Intermix	120	-79.128, 37.361
Campbell	Beaver Creek Xing	Intermix	49	-79.104, 37.320
Campbell	Kingswood Ln	Intermix	14	-79.067, 37.332
Campbell	Stormcrest	Intermix	18	-79.066, 37.256
Campbell	Hiley Ter	Intermix	10	-79.058, 37.357
Campbell	Smoky Hollow Rd	Intermix	12	-79.053, 37.343
Campbell	Holiday Ln	Intermix	80	-79.045, 37.334
Campbell	Mt Athos Rd	Intermix	65	-79.038, 37.417
Campbell	Petigrew Dr	Intermix	27	-79.036, 37.395
Campbell	Mt Olivet Church Rd	Intermix	54	-79.029, 37.372
Campbell	Anslem Dr	Intermix	22	-79.029, 37.324
Campbell	Greenfields Rd	Intermix	25	-79.029, 37.237
Campbell	Birdcage Ln	Intermix	26	-79.023, 37.402
Campbell	Hardwood Ter	Intermix	19	-79.026, 37.275
Campbell	Archer Mill Rd	Intermix	22	-79.003, 37.390
Campbell	Sunset Dr	Intermix	21	-78.999, 37.347
Campbell	Old Pocket Rd	Intermix	30	-79.323, 37.138
Campbell	Mt Airy Rd	Intermix	78	-79.421, 37.082

#### 4.13.3.2 Critical Facility and Infrastructure

Critical facilities and infrastructures at wildfire risk were identified using the high and very high WHP category in the aforementioned USDA WHP map. Several facilities are located in or adjacent to high risk areas; most are south of the Town of Bedford (Table 4-145 and Figure 4-149). Other critical infrastructure exposed to high risk areas include a portion of hazardous liquid pipeline in Centerville / Thaxton, and Norfolk Southern railroad tracks near Meador pass in Bedford County.

*Table 4-145 Critical facility and infrastructure located at high wildfire hazard potential areas in CVPDC Area*

Locality	Facility Name	Facility Type	Location	Coordinates
Amherst	Temperance Elementary	Schools	1981 Lowesville Road	37.6931, -79.0817



# Hazard Identification and Risk Assessment

Locality	Facility Name	Facility Type	Location	Coordinates
Bedford	Hawk Ridge Airport	Airport		37.2887, -79.4469
Bedford	Bedford County Department of Fire and Rescue - Headquarters	Fire Stations	1305 Falling Creek Road	37.3092, -79.5023
Bedford	Bedford County Emergency Operations Center	Emergency Operations Center	1345 Falling Creek Road	37.3116, -79.5052
Bedford	Bedford County Sheriff's Office - Headquarters	Law Enforcement	1345 Falling Creek Road	37.3115, -79.5054
Bedford	Bedford County Nursing Home	Nursing Home	1229 County Farm Road	37.3116, -79.5016
Bedford	Pump Station #12	Sewer Pump Station		37.3189, -79.5029



# Hazard Identification and Risk Assessment

## Woodland Home Community and Critical Facility at High Wildfire Risk in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020

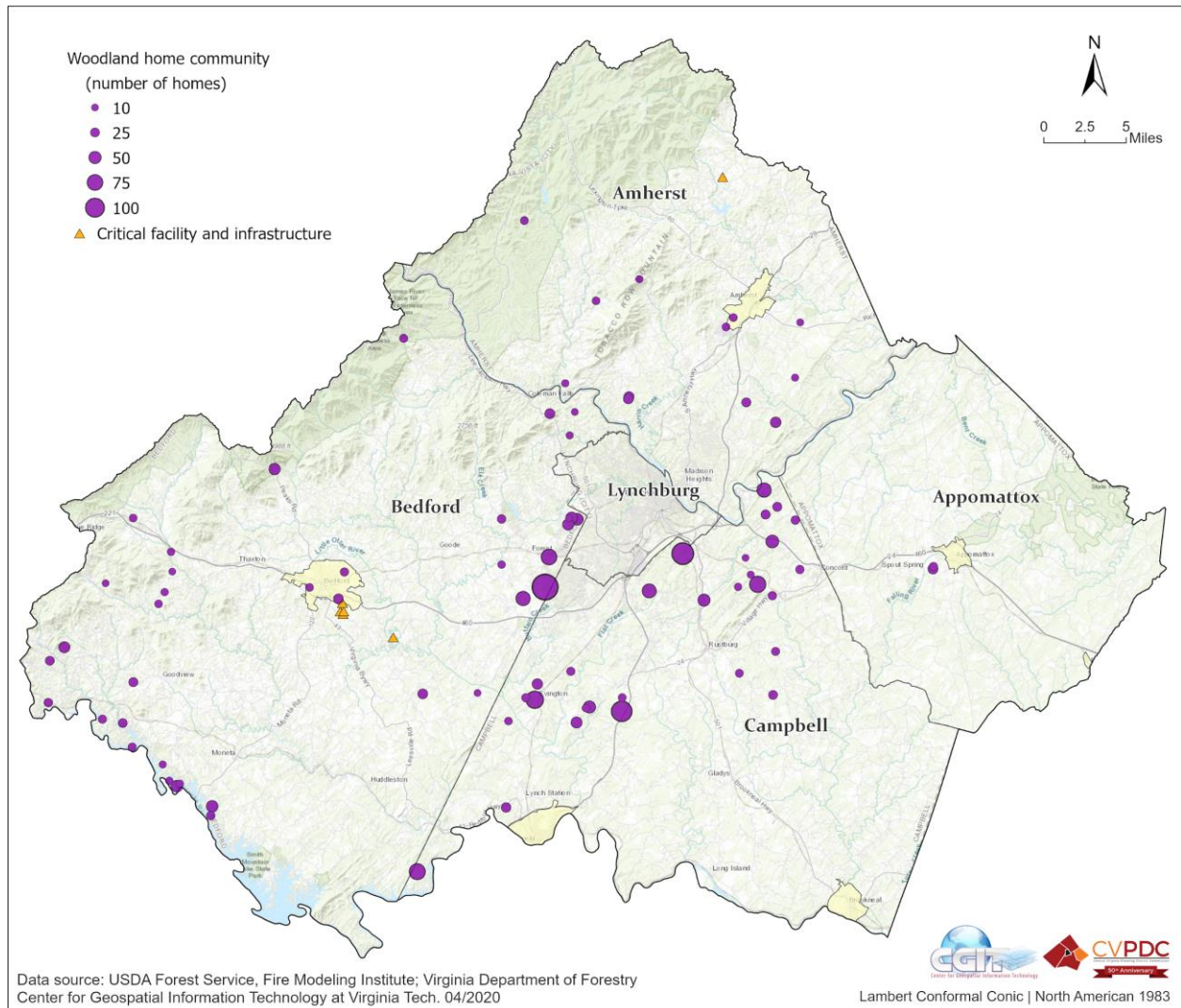


Figure 4-149 Woodland Home Community and Critical Facility at High Wildfire Risk in CVPDC Area

### 4.13.4 Probability of Future Occurrences

Future wildfire incidents are difficult to predict, as the factors influencing wildfire generation vary greatly with changing weather conditions, and human activities. Other natural hazards (such as tornadoes and hurricanes) can influence the structure and fuel distribution of forests, leading to a change in wildfire intensity and risk. The occurrence and frequency of wildfires also depends greatly upon the type of forests in Central Virginia, such as oak-hickory, loblolly-shortleaf pine, and mixed oak-pine. The likelihood of wildfires increases during drought cycles and abnormally dry conditions. In addition, increased development throughout the region leads to increased vulnerability.

There are some studies projecting an increase in the wildfire incidents in the United States. The U.S. Department of Agriculture (USDA), Pacific Northwest Research Station assessed future conditions of forest





# Hazard Identification and Risk Assessment

resources in the United States relative to climatic variability and change. There will be significant short-term effects on forest ecosystems caused by altered disturbance regimes. As a consequence, “wildfire will increase throughout the United States, causing at least a doubling of area burned by the mid-21st century”.<sup>74</sup> Currently, there are no quantitative estimates of future wildfire probability for specific regions of the state.

## 4.13.5 References

- Insurance Information Institute. Facts + Statistics: Wildfires. 2019. <https://www.iii.org/fact-statistic/facts-statistics-wildfires> (Accessed on June 16, 2019)
- Radeloff, Volker C., David P. Helmers, H. Anu Kramer, Miranda H. Mockrin, Patricia M. Alexandre, Avi Bar-Massada, Van Butsic, et al. “Rapid Growth of the US Wildland-Urban Interface Raises Wildfire Risk.” *Proceedings of the National Academy of Sciences* 115, no. 13 (March 27, 2018): 3314–19. <https://doi.org/10.1073/pnas.1718850115>.
- Vose, James M., David L. Peterson, and Toral Patel-Weynand. (e.d.). “Effects of Climatic Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the U.S. Forest Sector.” General Technical Report. Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, December 2012. [https://www.fs.fed.us/pnw/pubs/pnw\\_gtr870/pnw\\_gtr870.pdf](https://www.fs.fed.us/pnw/pubs/pnw_gtr870/pnw_gtr870.pdf).
- USGS. Federal Wildland Fire Occurrence Data. June 23, 2017. <https://wildfire.cr.usgs.gov/firehistory/data.html> (Accessed on June 12, 2019)
- USGS. LANDFIRE data Distribution Site. <https://landfire.cr.usgs.gov/viewer/viewer.html?extent=-85.944716695919,35.6472849020099,-80.8915930975021,39.3903993439807>
- Virginia Department of Forestry. Wildfire in Virginia. 2014. <http://dof.virginia.gov/fire/wildfire/index.htm> (Accessed on June 12, 2019)
- Virginia Department of Forestry. KBDI/CSI: Introduction. 2014. <http://dof.virginia.gov/fire/kbdi.htm> (Accessed on August 8, 2019)
- Virginia Department of Forestry. Virginia Woodland Homes Communities. <http://dof.virginia.gov/gis/download/whc-faq.htm#what.1>
- Virginia Department of Fire Programs. Fire and Data Statistics. <https://www.vafire.com/fire-and-data-statistics-2/> (Accessed on June 15, 2019)

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<sup>74</sup> USDA Tech. Rep. PNW-GTR-870



# Hazard Identification and Risk Assessment

## 4.14 Fog

### 4.14.1 Hazard Profile

The American Meteorological Society Glossary defines fog as water droplets suspended in the atmosphere in the vicinity of the earth's surface that affects visibility. This occurs when air is cooled to its dew point or the amount of moisture in the air increases. Fog obstructs visibility depending on how densely packed the water vapor is within the cloud. Fog is often accompanied by light rain or light snowfall.

#### 4.14.1.1 Magnitude/Severity

The extent of fog is difficult to measure. It could be measured in terms of thickness or visibility. There is no official classification for the severity of fog, however, when fog is thick enough to obstruct visibility and delays or stops travel, it is considered dense or heavy fog. There are three primary types of dense fog: radiation (or ground) fog, advection fog, and frontal/precipitation fog.<sup>75</sup> The density of fog can vary drastically within a singular fog cloud dependent on a number of variables, including soil moisture, ambient temperature, and altitude. Additionally, fog can accompany other precipitation events, such as rain or snow, and can vary in density throughout the duration of the primary precipitation event.

#### 4.14.1.2 Relationship to Other Hazards

Figure 4-150 shows the interrelationship (causation, concurrence, etc.) between this hazard and other hazards discussed in this plan update.

### 4.14.2 Impact and Vulnerability

Fog itself does not have a significant impact on buildings, infrastructure, health, and the economy. Fog becomes hazardous when it results in reduced surface visibility. Severe fog incidents can close roads, cause vehicle accidents, cause airport delays, and impair the effectiveness of emergency response.

#### 4.14.2.1 Critical Facility and Infrastructure

The primary risks from fog involve the dangers of traveling under conditions of limited visibility. Fog resulting in vehicular crashes may also result in damages to infrastructure such as roads, facility buildings, and utility structures.

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<sup>75</sup> [https://www.weather.gov/media/rnk/research/Dense\\_Fog\\_Study.pdf](https://www.weather.gov/media/rnk/research/Dense_Fog_Study.pdf)



# Hazard Identification and Risk Assessment

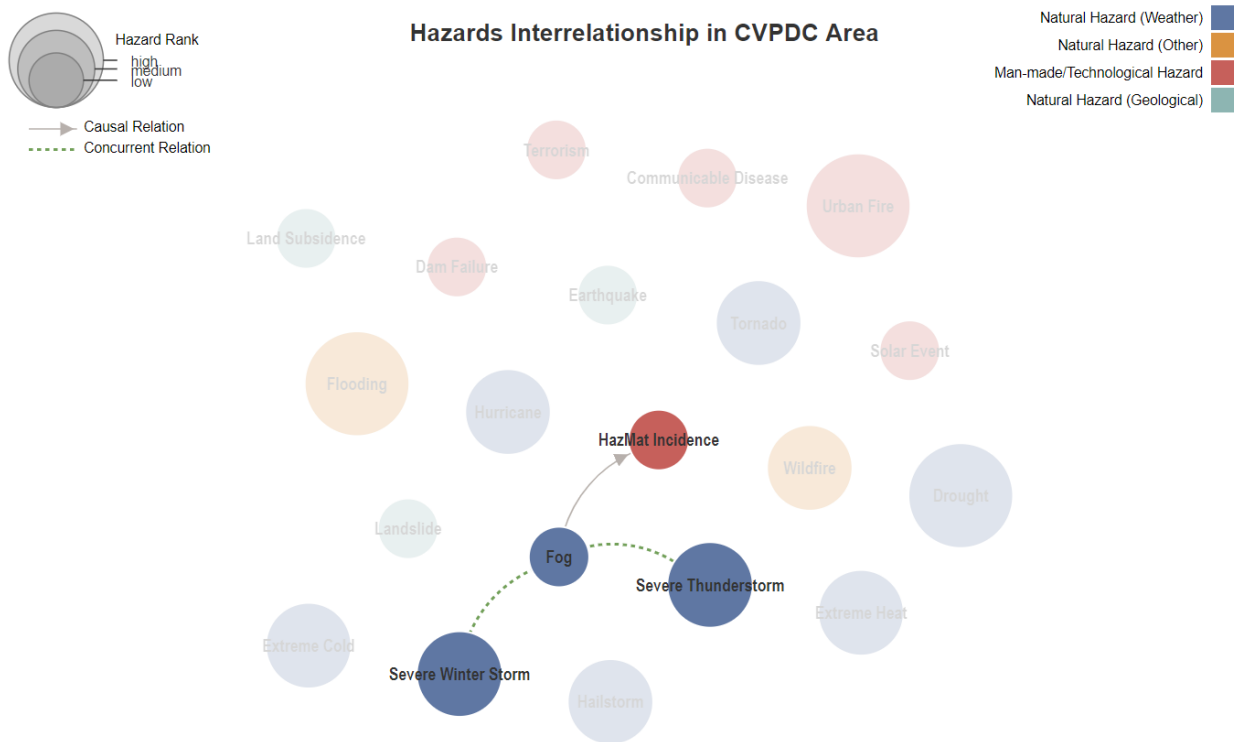


Figure 4-150 Hazards interrelationship

## 4.14.2.2 Public Health

Fog on its own does not directly impact public health. However, fog may reduce visibility and can create dangerous traveling conditions. Transportation accidents involving a chemical release may cause great harm to the environment by releasing toxins into the soil, groundwater, or air.

## 4.14.2.3 Economic Impact

Fog can impact air, marine, and land transportation, including travel on rail and roadways. Financial losses associated with transportation delays caused by fog have not been calculated in the United States, but they are known to be substantial. The total economic losses associated with the impact of the presence of fog on aviation and land transportation can be comparable to that of other severe weather like tornadoes, winter storms, and hurricanes. Aviation is directly impacted by fog as visibility is critical for landing and takeoffs. (Figure 4-151 provides the location of airports in the CVPDC area.) The Federal Aviation Administration issues weather-related delays for commercial aircraft. The National Weather Service issues advisories for freezing fog events.

## 4.14.3 Risk Assessment

Locations at higher elevations are at particular risk of heavy fog incidence. Fog can occur almost anywhere during any season and is classified based on how it forms, which is related to where it forms. Certain seasons are more likely to have foggy days or nights based on a number of factors, including topography.

## Hazard Identification and Risk Assessment

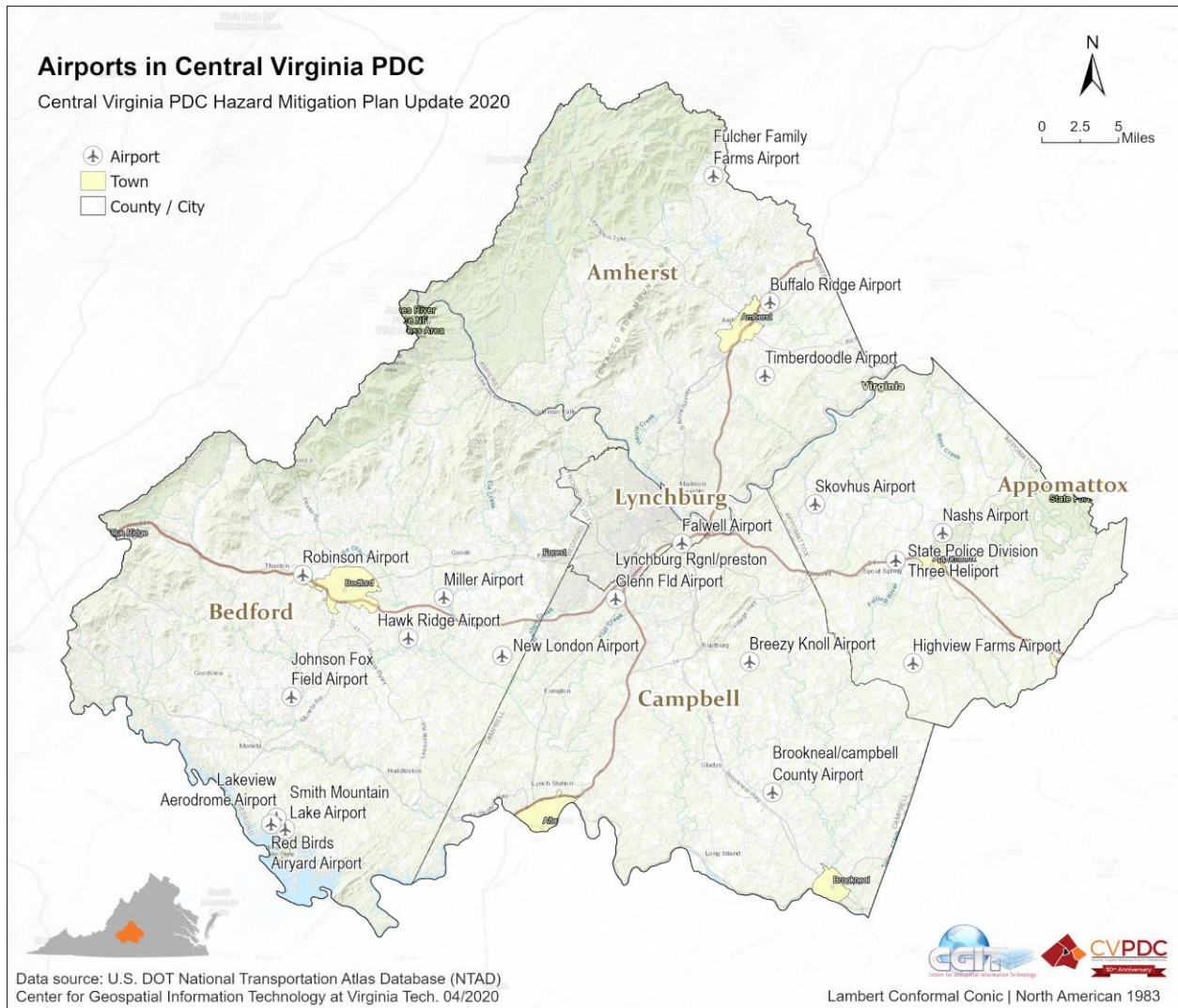


Figure 4-151 Airports in CVPDC Area

#### 4.14.4 Probability of Future Occurrences

Although historical dense fog observation data are currently unavailable for the CVPDC area, it is known that this area, especially the City of Lynchburg, Bedford County, and Amherst County, experience fog fairly frequently. As a regular occurrence for the CVPDC area, the probability assigned for future fog events is highly likely.

#### 4.14.5 References

- Cox, Robert E. *Applying Fog Forecasting Techniques Using AWIPS and the Internet*. Wichita, Kansas: National Weather Service, 2007. <http://nwafiles.nwas.org/ei/pdf/2007-FTT1.pdf>.
- LaDochy, Steve, and Michael R. Witiw. *Fog Hazard Mitigation*. In *Encyclopedia of Natural Hazards*, edited by Peter T. Bobrowsky, 338–42. Dordrecht: Springer Netherlands, 2013. [https://doi.org/10.1007/978-1-4020-4399-4\\_350](https://doi.org/10.1007/978-1-4020-4399-4_350).





# Hazard Identification and Risk Assessment

- Jackson, Jan, Ken Kostura, and William Perry. *Dense Fog Climatology for the Blue Ridge Foothills and Piedmont Areas of the Blacksburg, VA County Warning Area for the Period 1973 -2008*. NOAA Technical Memorandum. Blacksburg, VA: National Weather Service Office, February 2011.  
[https://www.weather.gov/media/rnk/research/Dense\\_Fog\\_Study.pdf](https://www.weather.gov/media/rnk/research/Dense_Fog_Study.pdf).



# Hazard Identification and Risk Assessment

## 4.15 Earthquake

### 4.15.1 Hazard Profile

An earthquake is the motion or trembling of the ground produced by sudden displacement of rock in the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of caverns and mines. Located near the center of the North American Tectonic plate, earthquakes in Virginia are known as "intraplate seismicity", and typically occur on faults at depths between 3 and 15 miles.

#### 4.15.1.1 Magnitude/Severity/Frequency

The majority of property damage and earthquake related deaths result from the failure and collapse of structures due to ground shaking. The level of damage depends upon the amplitude and duration of the shaking, which are directly related to distance from the fault and regional geology. Earthquakes can also cause landslides (the down-slope movement of soil and rock) and liquefaction (in which ground soil loses the ability to resist shear and acts much like quick sand).

Most earthquakes are caused by the release of stresses accumulated along active fault planes within the Earth's outer crust. No active major fault lines are located in or near the CVPDC area. The North American plate follows the continental border with the Pacific Ocean in the west, but follows the Mid-Atlantic Ridge in the east. Earthquakes occurring along the Mid-Atlantic Ridge usually pose little risk to humans, due to its location in the middle of the Atlantic Ocean. The greatest risk for earthquakes in the United States is along the Pacific Coast and Midwest.

Earthquakes are measured in terms of their magnitude and intensity. Magnitude is the amount of energy that is released by an earthquake and is often measured using the Richter Magnitude Scale (shortened to Richter scale). The scale is based on an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of seismic wave amplitude. Each unit increase in magnitude on the Richter Scale corresponds to a tenfold increase in wave amplitude, or a 32-fold increase in energy. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale (Table 4-146) based on direct and indirect measurements of seismic effects in the United States. The scale levels are typically described using roman numerals, with a I corresponding to imperceptible (instrumental) events, IV corresponding to moderate (felt by people awake), to XII for catastrophic (total destruction). Compared to the Mercalli scale which is based on observed effects of earthquakes, the Richter scale doesn't measure quake damage. Damage is dependent on a variety of factors located at or near the epicenter, including population/building density and local geological conditions.

#### **Peak ground acceleration**

*During an earthquake, when the ground is shaking, it experiences acceleration. The peak ground acceleration (PGA) is the largest increase in velocity recorded by a particular station during an earthquake.*

*<https://earthquake.usgs.gov/hazards/learn/technical.php#accel>*

The Richter scale does not provide accurate estimates for very large magnitude earthquakes. A newer, more uniformly applicable extension of the magnitude scale, known as Moment Magnitude (or Mw), was developed particularly for measuring very large earthquakes. Moment magnitude gives the most reliable estimate of



# Hazard Identification and Risk Assessment

earthquake size.<sup>76</sup> The moment magnitude scale is based on the total moment release of the earthquake. Moment magnitude is a product of the distance a fault moved and the force required to move it. It is derived from modeling recordings of the earthquake at multiple stations. Moment magnitude estimates are about the same as Richter magnitudes for small to large earthquakes but only the moment magnitude scale is capable of measuring M8 and greater events accurately.

## 4.15.1.2 Geographical Location and Extent

In 2014, the US Geological Survey updated national seismic hazard maps which include the latest science-based information on potential future earthquake ground motions. The hazard models incorporate more than 100 years of global earthquake observations at several hundred thousand sites across the United States. Probabilistic ground motion maps are typically used to assess the magnitude and frequency of seismic events. These maps measure the probability of exceeding a certain ground motion, expressed as percent peak ground acceleration (%PGA), over a specified period of years. Figure 4-152 is the long-term national earthquake hazard map by USGS. It depicts peak ground accelerations having a 2 percent probability of being exceeded in 50 years, for a firm rock site. According to the map, all the jurisdictions in the CVPDC area are located in low probability areas; therefore, the future threat is low.

The severity of earthquakes is site specific and is influenced by proximity to the earthquake epicenter and soil type, among other factors. The 100-year return period or one percent probability of happening in any given year for a significant earthquake is very low, with southwest Virginia having a slightly higher chance of experiencing such an event.

## 4.15.1.3 Previous Occurrences

In Virginia, a written record of earthquakes exists back to the 18th century. Table 4-147 and Figure 4-153 show the significant earthquakes that have been recorded. Most of Virginia's recorded earthquakes have been magnitude 4.5 or less, and the associated damage has been minor (cracks in foundation, tumbling chimneys, etc.). The largest magnitude earthquake in Virginia, a 5.8 magnitude (MMI VI) on the Richter scale, occurred on August 23, 2011. The epicenter of the earthquake was located in Louisa County, Virginia, approximately 80 miles northeast of Lynchburg. It was likely felt by more people than any other earthquake in U.S. history: approximately 1/3 of the U.S. population. According to VDEM, this

### **Mineral earthquake**

*August. 23, 2011. Louisa County, central Virginia. The epicenter of Virginia's largest earthquake was 13 km south-southwest of Mineral, Virginia, in the central Virginia seismic zone. The shock is known as the Mineral earthquake. The moment magnitude was Mw 5.7, mbLg magnitude 6.3. The earthquake was felt throughout much of the eastern United States and southeastern Canada, possibly by more people than any other earthquake in U.S. history. It was the largest and most damaging earthquake in the eastern United States since the 1886 Charleston, South Carolina earthquake. Damage in the epicentral area represents Modified Mercalli intensity VIII, with many instances of broken and collapsed masonry walls and chimneys, as well as shifting of structures on their foundations. Significant damage occurred to structures at distances in excess of 130 km to the northeast in the Washington DC area. The rupture process was a complex reverse fault event, initiating at a depth of 8 km. The mainshock was followed by a prolific aftershock sequence (August, 2014).*

<sup>76</sup> <https://www.usgs.gov/fags/moment-magnitude-richter-scale-what-are-different-magnitude-scales-and-why-are-there-so-many>



# Hazard Identification and Risk Assessment

earthquake caused between \$200 and \$300 million in damages, of which only about \$100 million were insured. Those damages included the North Anna Nuclear Generating Station in Louisa, a gas leak in Charlottesville, the Lake Jackson Dam in Manassas, and the Washington Monument.<sup>77</sup> In response to this event, The Federal Emergency Management Agency issued a major disaster declaration (DR-4042) to offer assistance to the residents and businesses that suffered damages in central Virginia.

Earthquakes occur underground along geologic faults. Although Virginia has many faults, nearly all of them are inactive. Most earthquakes in Virginia are not associated with a known fault, but concentrated in three distinct seismic zones (Figure 4-153): the Central Virginia seismic zone (CSVZ), the Giles County seismic zone (GCSZ), and the Eastern Tennessee seismic zone (ETSZ). The CVPDC area is situated on the periphery or within the CSVZ. Although there are documented damages from earthquakes in the CVPDC region, and estimated epicenters from the 1800s located in Lynchburg (Figure 4-153), there has never been a well recorded earthquake that has occurred in the CVPDC area.

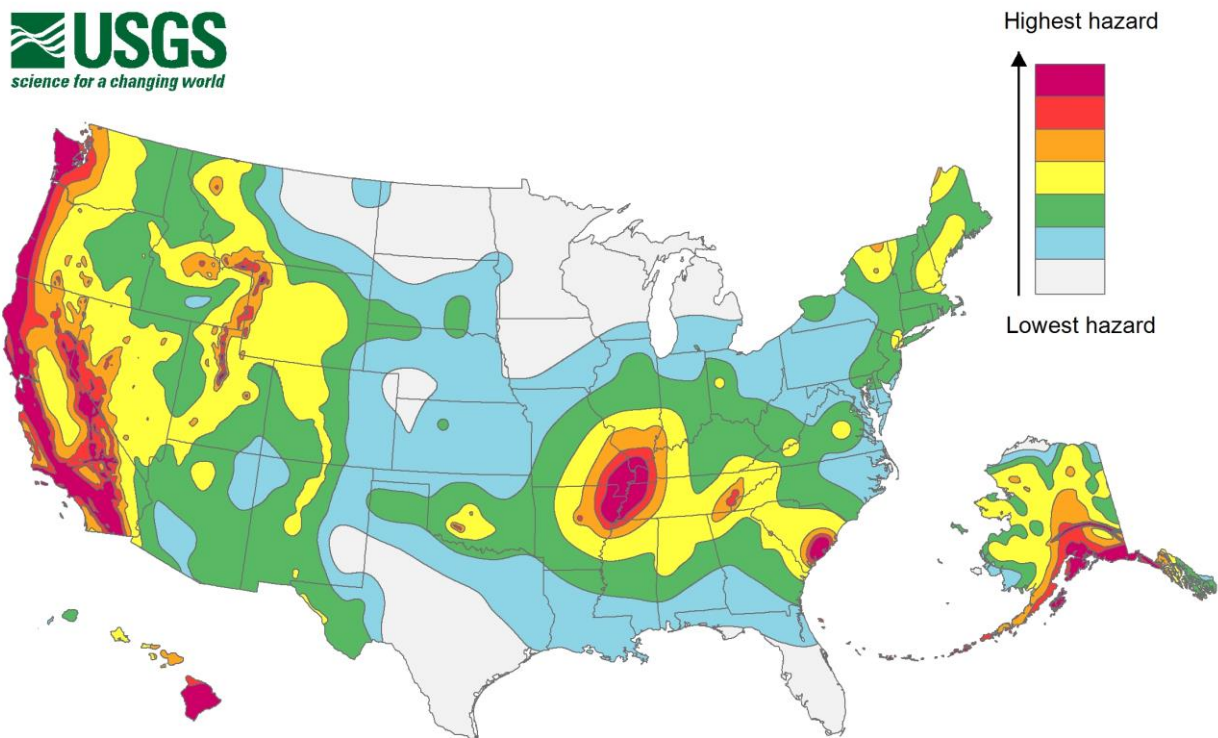


Figure 4-152 USGS 2018 Long-term National Seismic Hazard Map

<sup>77</sup> <https://www.vaemergency.gov/earthquakes/earthquakes-in-virginia/>





# Hazard Identification and Risk Assessment

Table 4-146 Modified Mercalli Intensity (MMI) Scale and corresponding Richter Scale

MMI Scale	Intensity	Description of Effects	Corresponding Richter Magnitude Scale
I	Instrumental	Felt by very few people; barely noticeable.	1.0-2.0
II	Feeble	Felt by a few people, especially on upper floors.	2.0-3.0
III	Slight	Noticeable indoors, especially on upper floors, but may not be recognized as an earthquake.	3.0-4.0
IV	Moderate	Noticeable indoors, especially on upper floors, but may not be recognized as an earthquake.	4.0
V	Slightly Strong	Felt by almost everyone, some people awakened. Small objects moved. trees and poles may shake.	4.0-5.0
VI	Strong	Felt by everyone. Difficult to stand. Some heavy furniture moved, some plaster falls. Chimneys may be slightly damaged.	5.0-6.0
VII	Very Strong	Slight to moderate damage in well-built ordinary structures. Considerable damage to poorly built structures. Some walls may fall.	6.0
VIII	Destructive	Little damage in specially built structures. Considerable damage to ordinary buildings, severe damage to poorly built structures. Some walls collapse.	6.0-7.0
IX	Ruinous	Considerable damage to specially built structures, buildings shifted off foundations. Ground cracked noticeably. Wholesale destruction. Landslides.	7.0
X	Disastrous	Most masonry and frame structures and their foundations destroyed. Ground badly cracked. Landslides. Wholesale destruction.	7.0-8.0
XI	Very Disastrous	Total damage. Few, if any, structures standing. Bridges destroyed. Wide cracks in ground. Waves seen on ground.	8.0
XII	Catastrophic	Total damage. Waves seen on ground. Objects thrown up into the air.	8.0 or greater

(Note: This Table indicates earthquakes are measured by the amount of damage they can cause (modified Mercalli scale) and by the amount of energy they release (Richter scale))

Table 4-147 Significant earthquakes in Virginia (magnitude greater than 4.5) (Source: VA DMME)<sup>78</sup>

Date	Local Time	Magnitude	Magnitude Type	Intensity	Localities
02/02/1774 (a)	2:00pm	4.5	Mb	VI	Petersburg
03/09/1828	10:00pm	5	Mb	V	Southwest VA
08/27/1833	6:15am	5	Mb_lg	VI	Richmond-Charlottesville
04/29/1852	12:45pm	4.9	Mb	VI	Grayson-Wythe
05/2/1853	9:20am	4.6	Mb	VI	VA/WVA border

<sup>78</sup> <https://www.dmme.virginia.gov/dgmr/majorearthquakes.shtml> and [http://www.magma.geos.vt.edu/vtso/va\\_quakes/VA-Eq.html](http://www.magma.geos.vt.edu/vtso/va_quakes/VA-Eq.html)



# Hazard Identification and Risk Assessment

Date	Local Time	Magnitude	Magnitude Type	Intensity	Localities
12/22/1875	11:45pm	4.5	Mb_lg	VII	Richmond
05/31/1897 (b)	1:58pm	5.5	Mw	VIII	Pearisburg
11/25/1898	3:10pm	4.6	Mb	V	Pulaski-Wytheville
02/13/1899	4:30am	4.7	Mb	V	Wytheville
4/9/1918	9:09pm	4.6	ML	VI	Luray
12/9/2003 (c)	3:59pm	4.5	Mb_lg	VI	Columbia
8/23/2011 (d)	12:51pm	5.8	Mw	VIII	Mineral
8/25/2011	12:07am	4.5	Mb_lg	VI	Mineral

(a) The first documented earthquake in Virginia. (b) The second largest earthquake in Virginia. (c) The largest earthquake recorded in Virginia since the widespread use of modern seismic equipment in the 1970's. (d) The largest Virginia earthquake recorded by seismometers.

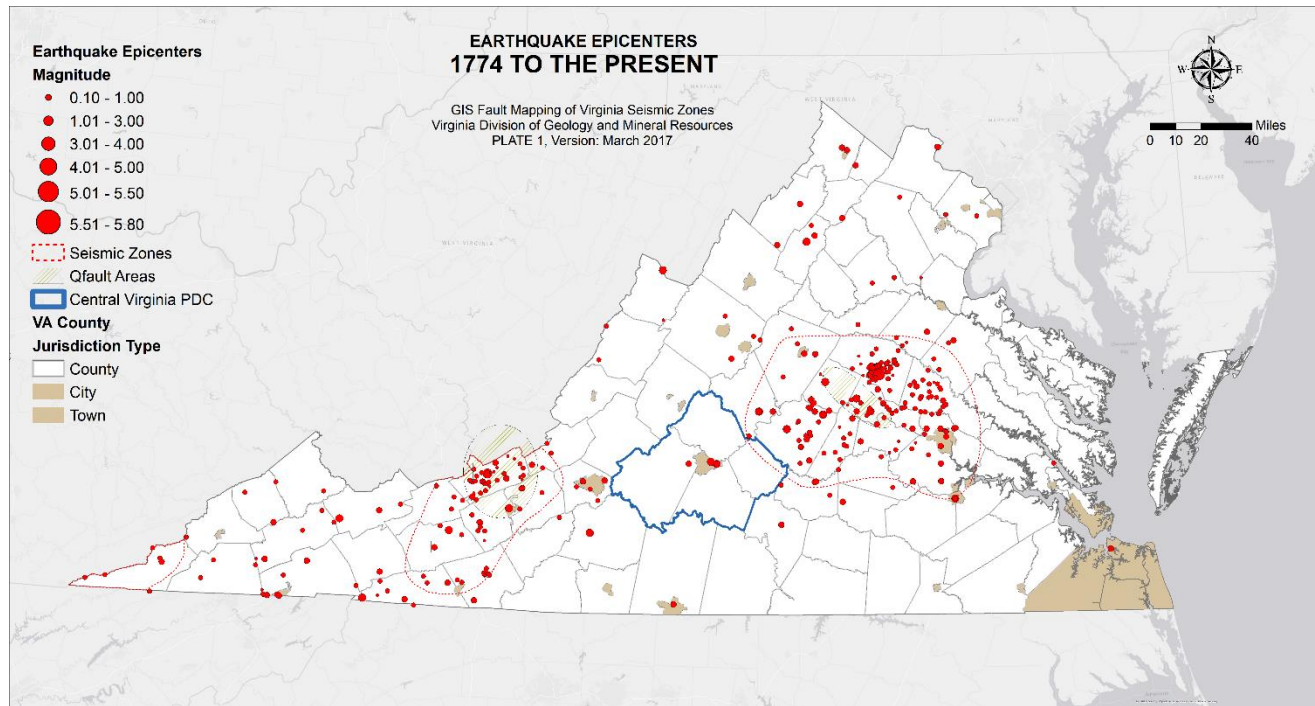


Figure 4-153 Earthquake epicenters in Virginia, 1774 - 2017

## 4.15.1.4 Relationship to Other Hazards

Figure 4-154 shows the interrelationship (causation, concurrence, etc.) between this hazard and other hazards discussed in this plan update.

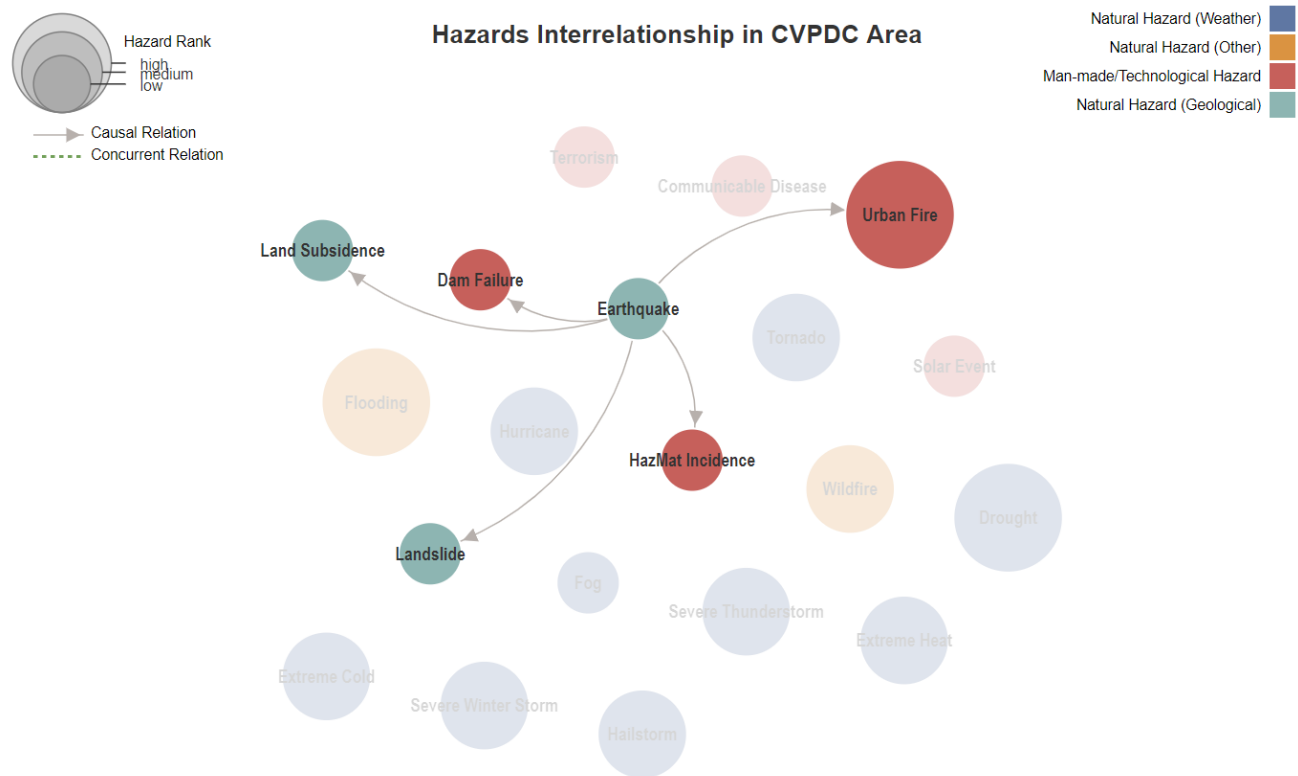


Figure 4-154 Hazards interrelationship

#### 4.15.2 Impact & Vulnerability

Earthquakes in Virginia are low probability, high-consequence events. If Central Virginia experienced an earthquake with a magnitude 6.0 or greater, a worst-case scenario would include the collapse of bridges and tall buildings, flash-flooding from breached reservoirs, widespread electrical fires, and exploding gas pipelines. Damage would be compounded as ruptured water lines would hinder fire abatement and disrupted transportation systems would delay the evacuation of seriously injured persons.

#### 4.15.3 Risk Assessment and Jurisdictional Analysis

In spite of extensive research and sophisticated equipment, earthquakes remain impossible to predict.

According to FEMA, earthquake risk is related to the following factors:

1. Ground motion;
2. Fault rupture under or near a building, often occurring in buildings located close to faults;
3. Reduction of the soil bearing capacity under or near a building;
4. Earthquake-induced landslide near a building; and
5. Earthquake-induced waves in bodies of water near a building.



# Hazard Identification and Risk Assessment

the dominant cause of damage. Landslides can be triggered by earthquake shaking. They can significantly damage structures, as well as transportation and utility lifelines, that are located on them or in their downslope paths. Liquefaction which occurs when loose, water-saturated sand is shaken by the earthquake and turns into a fluid-like substance, can cause it to lose the ability to support buildings and other structures. Areas along rivers where sandy sediments have been deposited along the course are susceptible to liquefaction.

#### **4.15.3.1 Risk to Critical Facilities**

The 2011 Mineral, Virginia earthquake led to a gas leak incident in Charlottesville. In the CVPDC area, there are both natural gas transmission pipelines and hazardous liquid transmission pipelines traversing the region that could be affected by a major earthquake (see Hazardous Material Incidents section of this plan). Earth movement associated with earthquakes can cause pipelines to shift and possibly rupture resulting in dangerous leaks. Older, more brittle pipelines would be more susceptible to damage as the result of abrupt earth movements. Given the low probability of this type of event, no additional assessment was deemed necessary in this plan update.

#### **4.15.3.2 Loss Estimates**

Earthquake loss estimation and planning scenarios quantify seismic risk based on seismic hazard and exposure and vulnerability of the built environment. The latest Hazus Earthquake Model (Hazus 4.2 SP3) was used to estimate damages and loss of buildings and essential facilities from earthquake events. Hazus is a regional loss estimation tool that uses population and building data aggregated at the census tract level. Building value and construction cost estimates are adjusted to reflect regional variations. The assessment with Hazus includes loss of buildings, critical facilities, and transportation and utility lines. This updated plan utilizes Hazus Level 2 analysis for the module. It uses modified default databases built into the methodology for information on building square footage and value, population characteristics, costs of building repair, and certain basic economic data.

The plan update team made some enhancement on the default dataset to optimize the analysis. First, the default building inventory data was adjusted to reflect the region's characteristics. The building inventory classification system in Hazus was developed to provide an ability to differentiate between buildings with substantially different damage and loss characteristics. The building type category is represented by low-rise (1-3 stories), mid-rise (4-7 stories, or typically 60-120 feet high), and high-rise (8+ stories, or typically 120+ feet high) in its building inventory data. By default, every building in the Hazus Earthquake model is considered a low-rise structure. However, there are some mid-rise and high-rise unreinforced masonry structures in downtown Lynchburg and Bedford County which are susceptible to damage from an earthquake (Table 4-148). The Lynchburg eTRAKiT Database was used to retrieve detailed parcel level information (*e.g.*, number of stories, occupancy, *etc.*) for Lynchburg City.<sup>79</sup> The relationships between building occupancy and building type were modified in the Hazus model to reflect the necessary changes. Secondly, soil maps, liquefaction potential, landslide potential, and water depth maps were also applied to the model rather than using the default information.

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<sup>79</sup> eTRAKiT Database, City of Lynchburg. <https://etrakit.lyncburgva.gov>





# Hazard Identification and Risk Assessment

Table 4-148 Mid-rise and high-rise buildings in CVPDC Area

Building	Floors	Height (ft)	Built Year	Address
Bank of the James Building	20	222	1972	828 Main Street
Allied Arts Building	17	185	1931	725 Church Street
Bank of America Building	11	118	1913	801 Main Street
Westminster Canterbury I	8	96	N/A	501 VES Road
Holiday Inn Select	8	96	1983	601 Main Street
Riverviews Artspace	8	96	1898	901 Jefferson Street
Lynchburg Utilities Division	7	84	1967	525 Taylor Street
920 Commerce Street	7	84	1906	920 Commerce Street
1101 Jefferson Street	7	84	1906	1101 Jefferson Street
The Virginian Building	7	84	1913	712-718 Church Street
Krise Building	7	75	1904	201-209 Ninth Street
Bedford County Courthouse	6	74	N/A	125-131 East Main Street
1309 Jefferson Street	6	72	N/A	1309 Jefferson Street
The Courtland Center	6	72	1909	620 Court Street
Jefferson House	6	72	1973	1818 Langhorne Square
Residence Hall 33	6	72	N/A	Flames Way, Liberty University
Westminster Canterbury II	6	72	N/A	501 VES Road
700 Main Street	6	72	1979	700 Main Street
Verizon Building	6	72	1945	700 Church Street
918 Commerce Street	6	72	1908	918 Commerce Street
Appalachian Building	6	72	1983	800 Main Street
528 Jackson Street	5	61	N/A	528 Jackson Street
Hilton Garden Inn Lynchburg	5	60	2008	4025 Wards Road
Lynchburg General Hospital	5	60	2007	1901 Tate Springs Road
Days Inn Airport	5	60	1981	3320 Candler's Mountain Road
YWCA Building	5	60	1912	626 Church Street
Lynchburg Social Services	5	60	1910	99 Ninth Street
926 Commerce Street	5	60	1904	926 Commerce Street
Craddock Terry Hotel	5	60	1906	1312 Commerce Street
1001 Church Street	5	60	1957	1001 Church Street

Earthquake loss analysis involves identifying the size and location of the earthquake and estimating its associated ground motions and ground deformations due to ground failure. The severity of an earthquake is site specific, and is influenced by proximity to the earthquake epicenter and soil type, among other factors. There are different ways to define an earthquake scenario for this analysis in Hazus, such as using historical events, probabilistic events, and arbitrary events. In this plan update, probabilistic, annualized, and user defined scenarios were considered to estimate the damage.

#### 4.15.3.3 Probabilistic Earthquake Loss

A probabilistic assessment was conducted for the CVPDC for the 500- and 2,500-year return periods using a Level 2 analysis in Hazus to analyze the earthquake hazard and provide a range of loss estimates. The probabilistic method uses information developed by the USGS from historic earthquakes and inferred faults,



# Hazard Identification and Risk Assessment

locations and magnitudes to calculate the probable ground shaking levels that may be experienced during a recurrence period by Census tract. The results are provided in Table 4-149 and Table 4-150, and Panels A and B of Figure 4-156.

*Table 4-149 Estimated Direct Economic Loss for Buildings in a 500-Year Event*

Locality	Capital Stock Losses (\$K)				Income Losses (\$K)				Total Loss (\$K)
	Cost Structural Damage	Cost Non-Structural Damage	Cost Contents Damage	Inventory Loss	Relocation Loss	Capital Related Loss	Wage Losses	Rental Income Loss	
Lynchburg	2,106	3,634	883	29	1,318	478	611	714	9,722
Amherst	661	1,064	204	8	413	63	93	159	2,665
Town of Bedford	231	401	111	5	156	53	82	78	1,117
Bedford	1,833	3,027	564	15	1,086	133	188	368	7,212
Appomattox	401	679	135	3	253	27	47	86	1,631
Campbell	1,355	2,230	485	26	861	177	230	319	5,683
<b>Total</b>	<b>6,587</b>	<b>11,035</b>	<b>2,331</b>	<b>85</b>	<b>4,087</b>	<b>930</b>	<b>1,251</b>	<b>1,723</b>	<b>28,030</b>

*Note: Scenario is based on a 500-year probabilistic event. Updated Default VA mapping scheme was used to ensure taller, unreinforced masonry structures were accounted for in the analysis. All values are in thousands of dollars. Town values are included in the totals for the corresponding county.*

*Table 4-150 Estimated Direct Economic Loss for Buildings in a 2500-Year Event*

Locality	Capital Stock Losses (\$K)				Income Losses (\$K)				Total Loss (\$K)
	Cost Structural Damage	Cost Non-Structural Damage	Cost Contents Damage	Inventory Loss	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Lynchburg	12,638	38,405	15,235	528	8,196	3,141	3,977	4,278	86,399
Amherst	4,125	11,541	4,201	154	2,663	426	611	1,004	24,725
Town of Bedford	1,379	4,255	1,910	86	970	342	519	461	9,923
Bedford	10,848	30,284	10,549	255	6,636	849	1,176	2,178	62,775
Appomattox	2,647	7,809	2,882	52	1,744	194	328	571	16,227
Campbell	7,984	22,478	8,670	438	5,265	1,145	1,470	1,883	49,332
<b>Total</b>	<b>39,621</b>	<b>114,771</b>	<b>43,447</b>	<b>1,513</b>	<b>25,474</b>	<b>6,097</b>	<b>8,082</b>	<b>10,375</b>	<b>249,380</b>

*Note: Scenario is based on a 2500-year probabilistic event. Updated Default VA mapping scheme was used to ensure taller, unreinforced masonry structures were accounted for in the analysis. All values are in thousands of dollars. Town values are included in the totals for the corresponding county.*

## 4.15.3.4 Annualized Earthquake Loss

The annualized earthquake loss (AEL) is the estimated long-term value of earthquake losses to the general building stock in any single year in a specified geographic area (e.g., state, county, metropolitan area). It addresses two key components of seismic risk: the probability of ground motion occurring in a given study area and the consequences of the ground motion in terms of physical damage and economic loss. According to the



# Hazard Identification and Risk Assessment

Hazus Estimated Annualized Earthquake Losses for the United States (FEMA 2017),<sup>80</sup> the AEL to the national building stock is \$6.1 billion per year, while the Virginia account for \$11.74 million per year. The three seismic zones aforementioned don't pose a significant earthquake threat.

The process for computing AEL with Hazus includes three steps. First, process the USGS earthquake hazard data for the 2011 Louisa County Earthquake into a Hazus-compatible format. Second, estimate losses at the census tract level for specific return periods using the updated building inventory. Third, compute the AEL using the earthquake model.

The following maps and tables (Table 4-151, Figure 4-155, and Figure 4-156, Panel C) illustrate the average annual loss for the regional earthquake hazard. Hazus estimated the total annualized economic loss to be approximately \$307 thousand dollars, which includes capital stock losses and income losses. Building-related losses are highlighted in the Figure 4-155 below.

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

While building-related losses are a reasonable indicator of relative regional earthquake risk, it is important to recognize that these estimates are not absolute determinants of the total risk from earthquakes. This is because factors such as the amount of debris generated and social losses including casualty estimates, displaced households, and shelter requirements need to be considered. Seismic risk also depends on other parameters not included herein such as damages to lifelines and other critical facilities and indirect economic loss.

*Table 4-151 Estimated Direct Economic Loss for Buildings in Annualized Scenario*

Locality	Capital Stock Losses (\$K)				Income Losses (\$K)				Total Loss (\$K)
	Cost Structural Damage	Cost Non-Structural Damage	Cost Contents Damage	Inventory Loss	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Lynchburg	19	44	14	1	12	5	6	6	107
Amherst	6	13	4	0	4	1	1	1	30
Town of Bedford	2	5	2	0	1	1	1	1	12
Bedford	16	35	10	0	10	1	2	3	77
Appomattox	4	9	3	0	2	0	0	1	19
Campbell	12	26	8	0	8	2	2	3	62
Total	59	131	40	1	38	38	12	16	307

*Note: Updated VA mapping scheme was used to ensure taller, unreinforced masonry structures were accounted for in the analysis. All values are in thousands of dollars. Town values are included in the totals for the corresponding county.*

<sup>80</sup> Hazus Estimated Annualized Earthquake Losses for the United States. FEMA. April 2017. [https://www.fema.gov/media-library-data/1497362829336-7831a863fd9c5490379b28409d541efe/FEMAP-366\\_2017.pdf](https://www.fema.gov/media-library-data/1497362829336-7831a863fd9c5490379b28409d541efe/FEMAP-366_2017.pdf)



# Hazard Identification and Risk Assessment

## 4.15.3.5 Annualized Social Impact

For the annualized loss results, Hazus estimated there would be no casualties due to earthquake damage.

## 4.15.3.6 User-defined Scenario Earthquake Loss (Hypothetical)

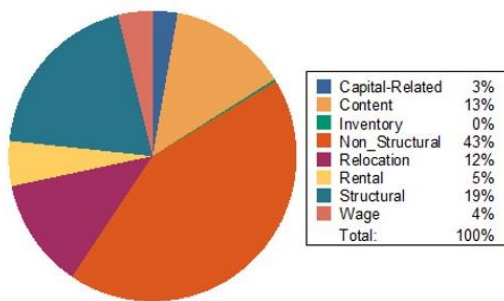
A user-defined scenario was created using a magnitude 5 earthquake located 6km underground (same depth as the 2011 Mineral Earthquake which had a magnitude of 5.8). The epicenter was placed in a seismic activity zone developed by the Virginia Department of Mines, Minerals and Energy. The Hazus analysis indicates the loss estimates for this particular scenario are much higher than many of the probabilistic scenarios (Table 4-152; Figure 4-156, Panel D).

Table 4-152 Estimated Direct Economic Loss for Buildings in User-defined Scenario

Locality	Capital Stock Losses (\$K)				Income Losses (\$K)				Total Loss (\$K)
	Cost Structural Damage	Cost Non-Structural Damage	Cost Contents Damage	Inventory Loss	Relocation Loss	Capital Related Loss	Wage Losses	Rental Income Loss	
Lynchburg	3,473	6,906	1,907	74	2,184	818	1,045	1,204	17,611
Amherst	2,092	4,863	1,465	50	1,335	203	303	530	10,840
Bedford City	66	80	10	0	43	14	22	22	2,487
Bedford	599	923	148	3	328	57	79	125	2,262
Appomattox	5,584	19,241	7,587	69	3,564	258	437	1,078	37,817
Campbell	1,632	2,949	710	29	1,050	198	257	367	7,192
Total	13,446	34,961	11,826	226	8,503	1,547	2,144	3,327	75,980

Note: The scenario is a user-defined earthquake with a 5.0 magnitude which was located in the eastern part of the CVPDC Area in Appomattox County. New mapping scheme for the Downtown Census Tract was used. All values are in thousands of dollars.

Earthquake Losses by Loss Type (\$ millions)



Earthquake Losses by Occupancy Type (\$ millions)

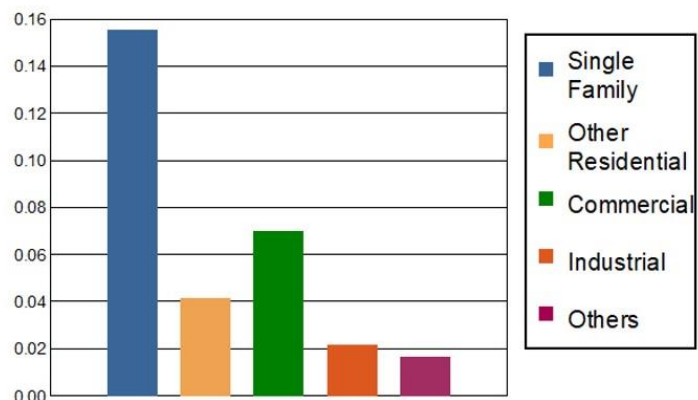


Figure 4-155 Total Building-related Earthquake Losses





# Hazard Identification and Risk Assessment

## 4.15.4 Probability of Future Occurrence

Though very rare, earthquakes have the potential to affect the CVPDC area. According to James R. Martin II, the former director of the Earthquake Engineering Center for the Southeastern United States, recent seismological studies suggest that the southern Appalachian highlands have the potential for even larger earthquakes than have occurred in the past. Although experts can estimate the likelihood of an earthquake occurring in a particular region, it is impossible to predict an earthquake, both in occurrence as well as in magnitude.

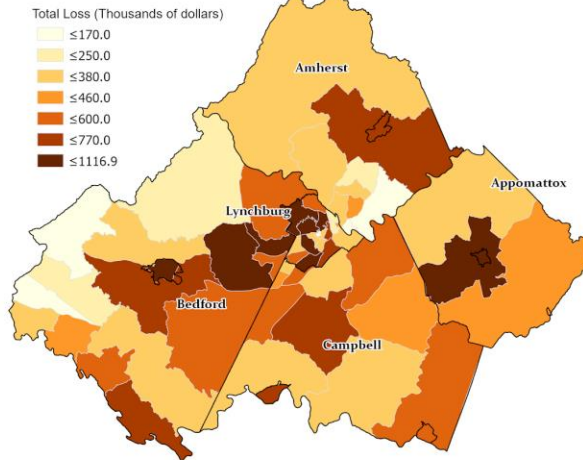


# Hazard Identification and Risk Assessment

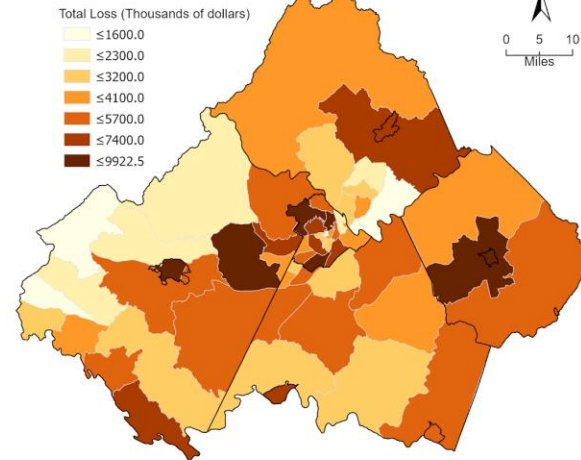
## Total Direct Economic Loss in Probabilistic, Annualized, User-defined Earthquake Scenarios

Central Virginia PDC Hazard Mitigation Plan Update 2020

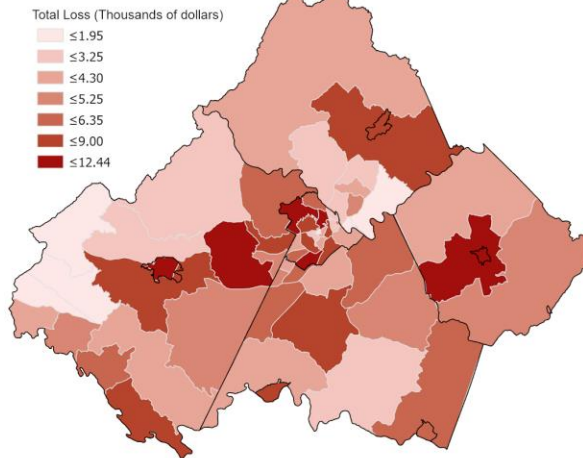
(A) 500-year Return Period Event



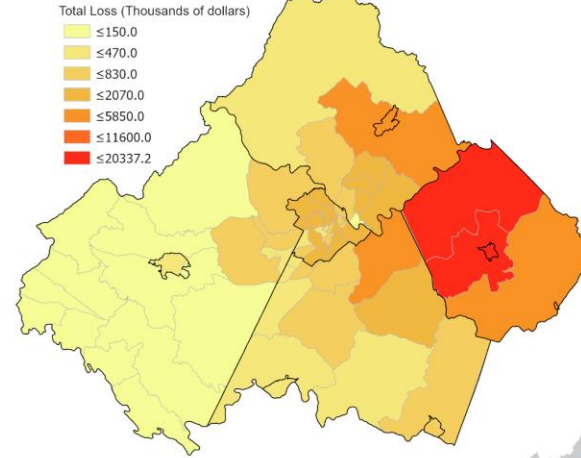
(B) 2500-year Return Period Event



(C) Annualized Loss Scenario



(D) User-defined Scenario



The user-defined scenario is hypothetical earthquake with a 5.0 magnitude located in the eastern part of the CVPDC Area in Appomattox County. The total direct economic loss includes: Structural Damage, Non-structural Damage, Building Damage, Contents Damage, Inventory Loss, Relocation Cost, Income Loss, Rental Income Loss, and Wage Loss.

Data source: USGS; HAZUS  
Center for Geospatial Information Technology at Virginia Tech. 07/2020

Lambert Conformal Conic | North American 1983



Figure 4-156 Total Direct Economic Loss in Probabilistic, Annualized, User-defined Earthquake Scenarios for CVPDC Area



# Hazard Identification and Risk Assessment

## 4.15.5 References

- Earthquake Preparedness Guide. Virginia Department of Emergency Management. <https://www.vaemergency.gov/wp-content/uploads/2016/09/Earthquake-Preparedness-In-House-Printing-and-Digital-Download.pdf>
- Petersen, et al., 2014. Documentation for the 2014 Update of the United States National Seismic Hazard Maps. USGS Open-File Report 2014–1091. Page 9. <https://doi.org/10.3133/ofr20141091>
- Earthquakes. Virginia Department of Mines, Minerals and Energy. <https://www.dmme.virginia.gov/dgmr/EARTHQUAKES.shtml> (Accessed on May 6, 2019).
- Virginia Earthquake (DR-4042). FEMA. 2011. <https://www.fema.gov/disaster/4042>
- Major Earthquakes in Virginia. Virginia DGMR. <https://www.dmme.virginia.gov/DGMR/majorearthquakes.shtml> (Accessed on May 6, 2019)
- Commonwealth of Virginia Hazard Mitigation Plan 2013. Virginia Department of Emergency Management. 2018. <https://www.vaemergency.gov/wp-content/uploads/2018/03/COV-SHMP-3-2018-Public.pdf>
- Chapman, M.C., 2013. On the Rupture Process of the 23 August 2011 Virginia Earthquake, *Bulletin of the Seismological Society of America*, 103, 613–628.
- Chapman, M.C., 2015. Magnitude, Recurrence Interval and Near-Source Ground Motion Modeling of the Mineral, Virginia Earthquake of August 23, 2011, in Horton, J.W., Jr., Chapman, M.C., and Green, R.A., eds., *The 2011 Mineral, Virginia, Earthquake, and Its Significance for Seismic Hazards in Eastern North America: Geological Society of America Special Paper 509*, doi:10.1130/2015.2509
- Horton, J. Wright, and Robert A. Williams. “The 2011 Virginia Earthquake: What Are Scientists Learning?” *Eos, Transactions American Geophysical Union* 93, no. 33 (August 14, 2012): 317–18. <https://doi.org/10.1029/2012EO330001>.
- Horton, J. Wright, M. C. Chapman, and Russell A. Green. “The 2011 Mineral, Virginia, Earthquake, and Its Significance for Seismic Hazards in Eastern North America—Overview and Synthesis.” In *The 2011 Mineral, Virginia, Earthquake, and Its Significance for Seismic Hazards in Eastern North America*, 1–25. Special Paper 509. Boulder, Colorado: The Geological Society of America, 2015. <https://pubs.geoscienceworld.org/books/chapter-pdf/979930/spe509-01.pdf>.



# Hazard Identification and Risk Assessment

## 4.16 Landslides

### 4.16.1 Hazard Profile

A landslide is defined as the movement of a mass of rock, debris, or earth down a slope. The term "landslide" encompasses five modes of slope movement: falls, topples, slides, spreads, and flows. These are further subdivided by the type of geologic material (bedrock, debris, or earth). Debris flows (commonly referred to as mudflows or mudslides) and rock falls are examples of common landslide types. In Virginia, heavy rainfall is the major cause of landslides, but they can also be triggered by rapid snow melt or oversteepening of slopes by stream incision. Certain man-made changes to the land, such as slope modification or drainage alteration, can greatly increase the likelihood of landslides.

#### 4.16.1.1 Geographical Location and Extent

Landslides are a major geologic hazard and occur most frequently in the mountainous terrain of Virginia because of the presence of steep slopes and highly fractured bedrock that exists over shallow soils. The lower-relief areas of the Piedmont region also have landslides, but they are often smaller and generated by human disturbance, such as making an over-steepened road cut. The most disastrous landslide events have been associated with heavy rainfall along the steep slopes of the Blue Ridge Mountains and the Appalachians.

#### 4.16.1.2 Magnitude or Severity

Landslides are frequently associated with periods of heavy rainfall. Such landslides tend to worsen the effects of flooding that often accompanies these weather events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly.

#### 4.16.1.3 Previous Occurrence

There are very few documented landslides events for the CVPDC area. Historically, major rainfall events have caused the greatest numbers of documented landslides in the Virginia mountains. Hurricane Camille in 1969 stalled over the Blue Ridge Mountains, dropping more than 30 inches of rain in less than eight hours. Flooding and numerous landslides and debris flows occurring in the north of the CVPDC area (Nelson, Amherst, and Rockbridge counties) led to the deaths of more than 150 people, 100 injuries, destruction of more than 100 bridges, and more than \$150 million in property damage. This event resulted in the most recorded deaths by a natural hazard in the Commonwealth.

There are two minor landslide events occurring recently recorded in the U.S. Landslide inventory by USGS. On September 19, 2010, a mudslide caused by a downpour knocked out the boiler in Central Virginia Training Center, Madison Heights, Amherst County. On May 18, 2018, heavy rain triggered a mudslide on US Route 460 near the Route 122 interchange and the exit for the National D-day Memorial. It caused traffic jams and at least one lane in Bedford County was shut down.<sup>81</sup>

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<sup>81</sup> <https://wset.com/news/local/mudslide-on-route-501-in-bedford>





# Hazard Identification and Risk Assessment

## 4.16.1.4 Relationship to Other Hazards

Floods and landslides are often associated with major tropical storms. In 2004, several organizations, including NOAA, NASA and USGS proposed a research project called the Hurricane–Flood–Landslide Continuum (HFLC), aiming to develop and integrate multidisciplinary tools for practical use in emergency response and disaster mitigation. Figure 4-157 shows the interrelationship (causation, concurrence, *etc.*) between this hazard and other hazards discussed in this plan update.

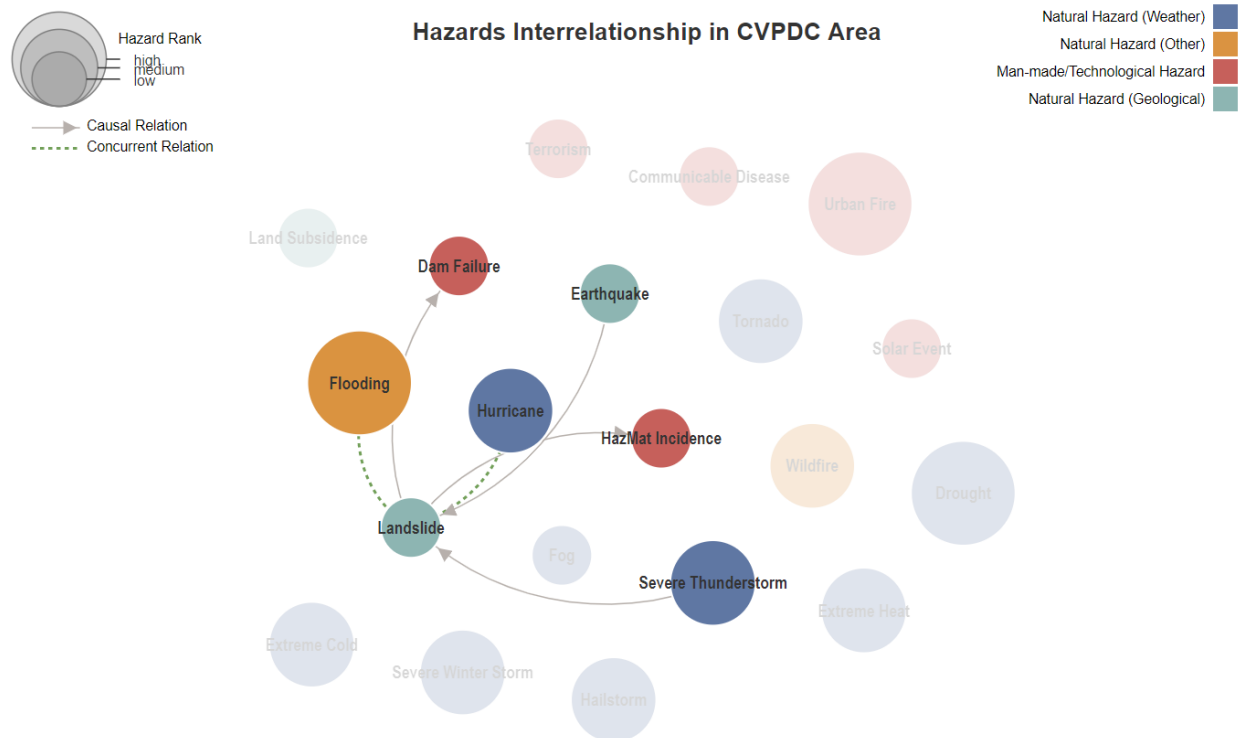


Figure 4-157 Hazards interrelationship

## 4.16.2 Impact and Vulnerability

Landslides can cause serious damage to highways, buildings, homes, and other structures that support a wide range of economies and activities. In Virginia, landslides can be expected to occur in conjunction with other natural hazards events, such as flooding or a major earthquake (magnitude 6 or larger, according to VA DMME). Several natural and human factors may contribute to or trigger landslides. How these factors interrelate is important in understanding the hazard. The three principal natural factors are topography, geology, and precipitation. The primary trigger for debris flows is heavy rainfall (generally greater than 125–250 mm in 24 hrs.) that results in excess pore-water pressures in relatively thin soil on steep slopes. Areas that are prone to mass movement include areas where landslides have occurred in the past; steep slopes with an angle greater than 25-30 degrees; and oversteepened cuts and fills, particularly due to home and road building.

Expansion of urban development activities contributes to greater risk of damage by landslides. The principal human activities are cut-and-fill construction for highways, construction of buildings and railroads, and mining operations. Research in North Carolina has revealed that about 56 percent of recent



# Hazard Identification and Risk Assessment

landslides occurred on slopes that had been altered in some way by development.<sup>82</sup> Every landslide, or slope movement is different and unpredictable. Some geological areas are more prone to landslides, such as the bases of steep slopes or hillsides, incised drainages, and mountain streams.<sup>83</sup> Flatter areas away from slope changes tend to be safer from landslides.

Landslide incidence is the percentage of the area involved in landsliding. Susceptibility is defined as the probable degree of the areal response of rocks and soil to natural or artificial cutting or loading of slopes, or to anomalously high precipitation (Wooten *et al*, 2016).

## 4.16.3 Risk Assessment and Jurisdictional Analysis

### 4.16.3.1 Landslide Susceptibility

The USGS divides landslide risk into six categories on the national landslide incidence and susceptibility map. These six categories were grouped into three broader categories to be used for the risk analysis and ranking: High (categories 1-3), Moderate (categories 4-5), and Low (category 6). Geographic extent is based off of these groupings (Table 4-153).

Table 4-153 USGS Landslide Risk Category

Risk Level	Description
Risk Level	Description
High Risk	1. High susceptibility to landsliding and moderate incidence. 2. High susceptibility to landsliding and low incidence. 3. High landslide incidence (more than 15% of the area is involved in land sliding).
Moderate Risk	4. Moderate susceptibility to landsliding and low incidence. 5. Moderate landslide incidence (1.5 – 15% of the area is involved in land sliding).
Low Risk	6. Low landslide incidence (less than 1.5% of the area is involved in land sliding).

### Mapping and Monitoring of Landslides Using LiDAR

*LiDAR, which stands for Light Detection and Ranging, is an active remote sensing method that uses light in the form of a pulsed laser to measure distances to Earth. LiDAR technology has been increasingly used as a way to detect and analyze the phenomenon of natural disasters such as landslides. Very-high resolution digital terrain models (DTM) obtained from airborne LiDAR data, and derivative products (such as contour maps, slope maps, shaded relief images, curvature, and measures of surface roughness) help geologists to map, monitor, and even predict landslides. With advances in computational capabilities and LiDAR acquisition projects in Virginia, the utility of LiDAR provides an efficient yet economic way in visual analysis of the topographic surface, and semi-automatic recognition of morphometric landslide features. The high-resolution LiDAR dataset, once available for the CVPDC, will be valuable to help with landslide preparedness and mitigation planning for the area.*

<sup>82</sup> <https://www.dmm.virginia.gov/dgmr/landslides.shtml>

<sup>83</sup> Frequency and Magnitude of Selected Historical Landslide Events in the Southern Appalachian Highlands of North Carolina and Virginia: [https://link.springer.com/chapter/10.1007%2F978-3-319-21527-3\\_9](https://link.springer.com/chapter/10.1007%2F978-3-319-21527-3_9)



# Hazard Identification and Risk Assessment

The best available landslide data is the USGS landslide overview map of the contiguous United States. This dataset shows areas in the US where large numbers of landslides have occurred and areas which are susceptible to landslides. According to the USGS generalized map of landslide incidence and susceptibility digitized from Godt (1997), the risk of landslides is much higher in western Virginia because of the Appalachian Mountains (Figure 4-158).<sup>84</sup> The CVPDC area falls into the area with an overall high potential for landslides.

The hazard ranking for landslides is based on events reported in the National Climatic Data Center (NCDC) Storm Events database and a generalized geographic extent rating developed from the USGS landslide susceptibility and incidence. It depicts the risk of landslides in general across the entire Virginia by locality. All the jurisdictions in the CVPDC area are located in a high risk zone.

The risk assessment mapping at local level was developed with the Hazus Earthquake model (at Level 1 analysis) using digital elevation models (DEM) and soil data for the area. Landslide susceptibility is characterized by the geologic group, slope angle, and critical acceleration. The acceleration required to initiate slope movement is a complex function of slope geology, steepness, groundwater conditions, type of landsliding, and history of previous slope performance. Please note the DEM used in the assessment is at resolutions of 1 arc-second (about 30 meters). High resolution DEM data (1-3 meter resolution) from LiDAR (Light Detection and Ranging) will be available once the Virginia LiDAR acquisition for Central Virginia is accomplished, and will be used for the next update for this plan.

Landslide susceptibility is measured on a scale of I to X, with X being the most susceptible. The site condition is identified using three geologic groups: strongly cemented (crystalline) rocks; weakly cemented rocks, including sandy soils; and argillaceous rocks (shales). Figure 4-159 indicates landslide prone areas in the CVPDC area. The northern and western areas of the CVPDC area (Amherst county and Bedford county) along the Blue Ridge Mountains are most susceptible to landslides. This landslide location dataset was developed by DMME as an ArcGIS geodatabase. Features are manually identified and entered into the database using a combination of historical storm records, currently available high-resolution terrain data, and several vintages of aerial photography. This dataset (still in draft) is neither an exhaustive inventory nor guarantees the presence or absence of a landslide location in the region. It identifies the presence of historical landslide occurrences in the region at a broad scale.

Transportation corridors through mountainous terrain are often susceptible to rock fall hazards. Highway landslides, rockfalls, and mudslides occur in Virginia and cause delays, damage, injury, and death to users of the routes. Virginia Department of Transportation (VDOT) is currently developing a slope cut inventory and rockfall hazard rating dataset by mid-2021.<sup>85</sup> This information, once available to localities, will allow agencies to develop rockfall hazard rating database to prioritize rock slopes for remediation based on a risk assessment and serve as an indication of risk when developing mitigation strategies in future plan updates.

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<sup>84</sup> Landslide incidence and susceptibility polygons were digitized from the original stable-base manuscripts at 1:3,750,000 from U.S. Geological Survey Professional Paper 1183. The data is unsuitable for local planning or actual site selection.

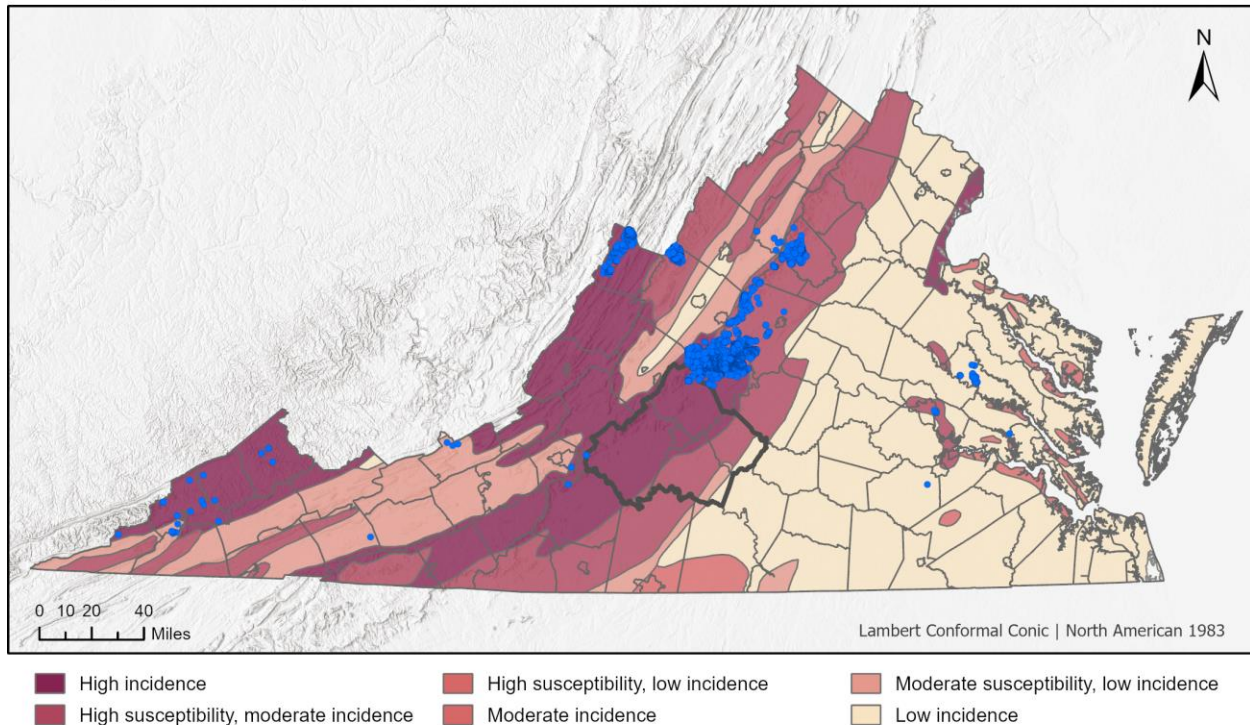
<sup>85</sup> <http://vtrc.virginiadot.org/ProjDetails.aspx?id=649>



# Hazard Identification and Risk Assessment

## Landslide Incidence and Susceptibility in Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020



This map developed by USGS displays where large numbers of landslides have occurred and areas which are susceptible to landsliding. The polygons were digitized from the stable-base manuscripts from USGS Professional Paper 1183. The landslide location dataset (points) was developed by DMME as an ArcGIS geodatabase. Features are manually identified and entered into the database using a combination of historical storm records, currently available high-resolution terrain data, and several vintages of aerial photography. This dataset (still in draft) is neither an exhaustive inventory nor guarantees the presence or absence of a landslide location in the region. It identifies the presence of historical landslide occurrences in the region at a broad scale.

Data source: USGS; Virginia DMME

Credit: Center for Geospatial Information Technology at Virginia Tech. 08/2019



*Figure 4-158 Landslide Incidence and Susceptibility in Virginia (Source: USGS)*

### 4.16.3.2 Critical Facility at Risk

The critical facilities at risk were estimated using the landslide susceptibility map. There are 32 facilities in Amherst County, 1 in Appomattox County, 28 in Bedford County, 11 in Campbell County, and 28 in the City of Lynchburg located in high and very high susceptibility areas of landslides (Table 4-154).

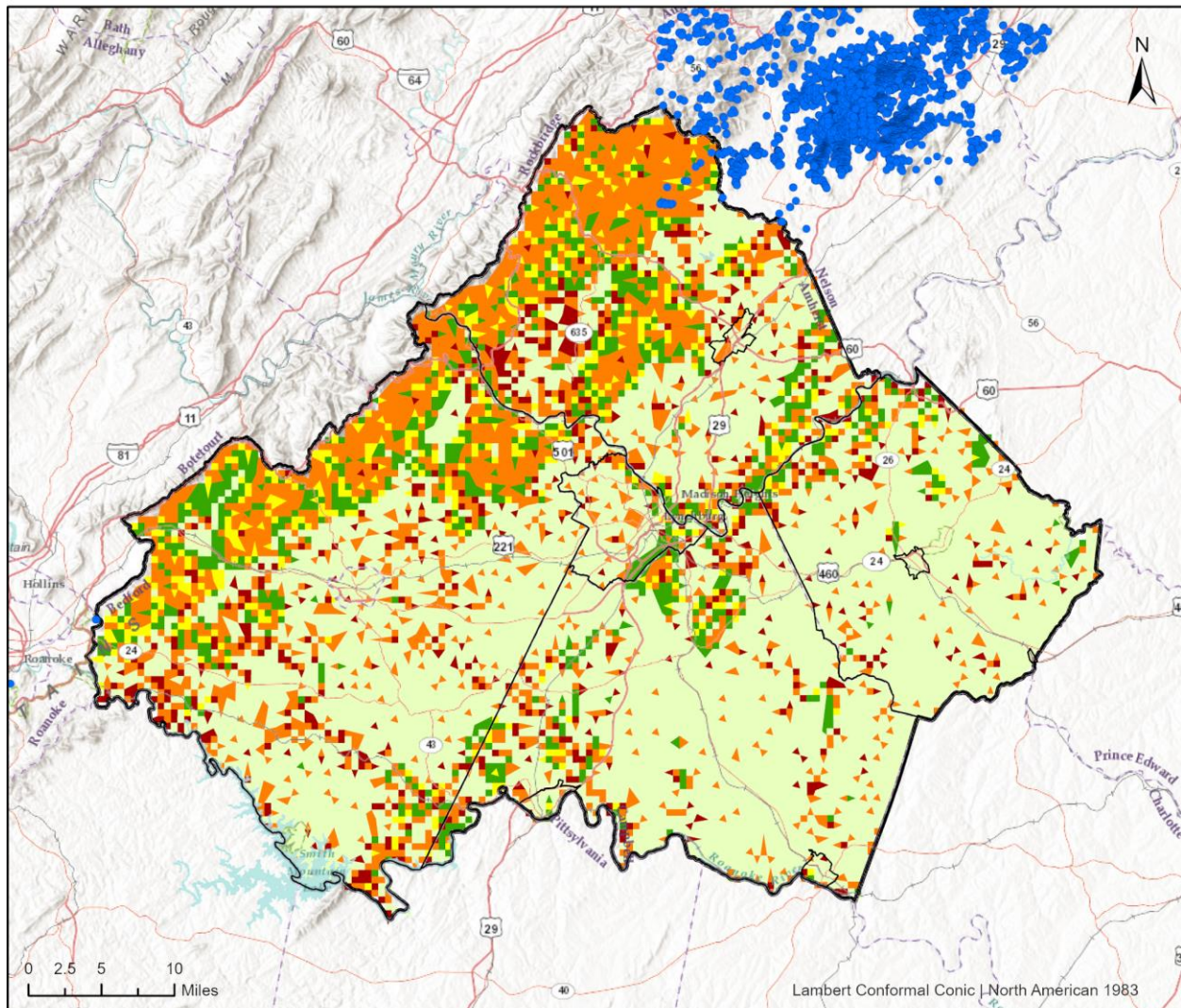




# Hazard Identification and Risk Assessment

## Landslide Susceptibility in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



### Legend

- |                       |                             |                              |
|-----------------------|-----------------------------|------------------------------|
| • Landslide locations | Landslide susceptibility    | Medium - Susceptibility VIII |
| County / Town         | Very Low - Susceptibility V | High - Susceptibility IX     |
|                       | Low - Susceptibility VII    | Very High - Susceptibility X |

The landslide susceptibility map was developed with HAZUS Earthquake model using slope and soil data. Susceptibility is characterized by the geologic group, slope angle and critical acceleration. The landslide location dataset was developed by DMME as an ArcGIS geodatabase. Features are manually identified and entered into the database using a combination of historical storm records, currently available high-resolution terrain data, and several vintages of aerial photography. This dataset (still in draft) is neither an exhaustive inventory nor guarantees the presence or absence of a landslide location in the region. It identifies the presence of historical landslide occurrences in the region at a broad scale.

Data source: Virginia DMME  
Center for Geospatial Information Technology at Virginia Tech. 08/2019



Figure 4-159 Landslides susceptibility estimates in CVPDC Area



# Hazard Identification and Risk Assessment

Table 4-154 Critical facilities in high and very high susceptibility areas of landslides

Locality	Facility Name	Facility Type	Location	Coordinates
Amherst	BUFFALO RIDGE AIRPORT	Airport		37.6053, - 79.0164
Amherst	WYYD - FS - CAPSTAR TX, LLC	Communication Facility		37.5609, - 79.1915
Amherst	WZZU - FM - CENTENNIAL LICENSING, LLC	Communication Facility		37.5632, - 79.1936
Amherst	WVBE-FM - FM - MEL WHEELER, INC	Communication Facility		37.4501, - 79.0748
Amherst	WJJX - FS - CAPSTAR TX, LLC	Communication Facility		37.5609, - 79.1915
Amherst	WNRS-FM - FM - STU-COMM, INC	Communication Facility		37.5641, - 79.1926
Amherst	Monacan Ancestral Museum	Attractions	2009 Kenmore Rd, Amherst, Va 24521	37.5729, - 79.1270
Amherst	Otter Creek Campground	Campground	60851 Blue Ridge Pkwy, Monroe, Va 24574	37.5760, - 79.3379
Amherst	Lynchburg/Blue Ridge Parkway KOA	Campground	6252 Elon Rd, Monroe, Va 24574	37.5744, - 79.3247
Amherst	Shady Mountain Campground	Campground	Panther Falls Rd, Vesuvius, Va 24483	37.7170, - 79.2893
Amherst	GREIF PACKAGING CONTAINERBOARD MILL	HazMat Facility	861 Fibre Plant Rd	37.5107, - 78.9101
Amherst	GREIF BROTHERS PACKAGING CORPORATION - RIVERVILLE MILL FIRE BRIGADE AND EMERGENCY MEDICAL SERVICES	Fire Stations	861 Fibre Plant Road	37.5120, - 78.9083
Amherst	MONELISON VOLUNTEER FIRE DEPARTMENT	Fire Stations	133 Amer Court	37.4698, - 79.1188
Amherst	CENTRAL VIRGINIA TRAINING CENTER POLICE DEPARTMENT	Law Enforcement	521 Colony Road	37.4156, - 79.1195
Amherst	JOHNSON SENIOR CENTER INC.	Nursing Home	108-112 Senior Street	37.5791, - 79.0572
Amherst	Snowden Hydro Power Plant	Energy Facility	7443 Elon Road	37.5736, - 79.3715
Amherst	AMHERST COUNTY ADULT DETENTION CENTER	Detention Facility	219 Riverview Rd	37.4088, - 79.0947
Amherst	AMELON ELEMENTARY	Schools	132 Amer Court	37.4700, - 79.1175
Amherst	AMHERST COUNTY HIGH	Schools	139 Lancer Lane	37.5700, - 79.0585
Amherst	PLEASANT VIEW	Schools	229 Dancing Creek Road	37.6028, -



# Hazard Identification and Risk Assessment

Locality	Facility Name	Facility Type	Location	Coordinates
	ELEMENTARY			79.2474
Amherst	CENTRAL VIRGINIA TRAINING CENTER	Schools	521 Colony Road	37.4155, - 79.1196
Amherst	OLD DOMINION JOB CORPS CENTER	Schools	1073 Father Judge Road	37.5536, - 79.1392
Amherst	Sewer Pump Station	Sewer Pump Station	Route 718 / Buffalo River	37.6091, - 79.0384
Amherst	Electrical Substation	Electrical Substation		37.6947, - 79.0120
Amherst	Electrical Substation	Electrical Substation		37.4062, - 79.0772
Amherst	Electrical Substation	Electrical Substation		37.4266, - 79.0846
Amherst	Electrical Substation	Electrical Substation		37.5103, - 79.2283
Amherst	Electrical Substation	Electrical Substation		37.5637, - 79.1928
Amherst	Electrical Substation	Electrical Substation		37.4622, - 79.1872
Amherst	AMELON IMMEDIATE CARE	Public Health	200 Amelon Square	37.4681, - 79.1166
Amherst	Water Tank	Water Storage Facility	Waugh'S Ferry Road	37.5637, - 79.0741
Amherst	Lanum Water Filtration Plant	Wastewater Treatment Plant	1355 Elon Rd	37.4846, - 79.1664
Appomattox	Electrical Substation	Electrical Substation		37.5070, - 78.7826
Bedford	MILLER AIRPORT	Airport		37.3271, - 79.4048
Bedford	HAWK RIDGE AIRPORT	Airport		37.2887, - 79.4469
Bedford	WBLT - AM - 3 DAUGHTERS MEDIA, INC.	Communication Facility		37.3475, - 79.5234
Bedford	WSLK - AM - SMILE BROADCASTING, LLC	Communication Facility		37.1647, - 79.6343
Bedford	WRXT - FM - POSITIVE ALTERNATIVE RADIO, INC	Communication Facility		37.3858, - 79.6686
Bedford	WSET-TV - DT - WSET INCORPORATED	Communication Facility		37.3151, - 79.6348
Bedford	MOORMAN MARINA	Campground	1510 Moorman Rd, Goodview	37.2232, - 79.7753
Bedford	TRI-COUNTY MARINA	Campground	1261 Sunrise Loop, Lynch Station	37.0595, - 79.4468
Bedford	ISLE OF PINES SUBDIVISION	Campground	Across From 3930 Isle Of	37.0998, -





# Hazard Identification and Risk Assessment

Locality	Facility Name	Facility Type	Location	Coordinates
	CAMPGROUND		Pines Drive	79.6246
Bedford	THE WOODS ADVENTURE & CONFERENCE RETREAT (LEASED)	Campground	1336 Simmons Mill Rd, Thaxton	37.3073, - 79.6844
Bedford	TUCK-A-WAY CAMPGROUND	Campground	1312 Sunrise Loop, Lynch Station	37.0605, - 79.4484
Bedford	SAFETY-KLEEN SYSTEMS	HazMat Facility	16090 Stewartsville Road	37.2727, - 79.8138
Bedford	BLUE RIDGE WOOD PRESERVING INCORPORATED	HazMat Facility	1220 Hendricks Store Road	37.1622, - 79.6325
Bedford	MONETA VOLUNTEER FIRE DEPARTMENT STATION 1	Fire Stations	12737 North Old Moneta Road	37.1868, - 79.6134
Bedford	Bedford Solar	Energy Facility	1477 Draper Rd.	37.3351, - 79.4810
Bedford	Smith Mountain Dam Hydro Plant	Energy Facility	Route 1, Penhook	37.0413, - 79.5356
Bedford	FOREST MIDDLE	Schools	100 Ashwood Drive	37.3693, - 79.3096
Bedford	Forest Middle School Pump Station	Sewer Pump Station		37.3707, - 79.3107
Bedford	Pump Station #2	Sewer Pump Station		37.3504, - 79.5224
Bedford	Lift Station	Sewer Pump Station		37.0985, - 79.5831
Bedford	Electrical Substation	Electrical Substation		37.5411, - 79.3978
Bedford	Mill Lane Ground Tank, 5,000,000 gallon	Water Storage Facility	Mill Lane	37.4490, - 79.2456
Bedford	Huntingwood Tank, 2,000,000 gallon	Water Storage Facility	Walnut Hollow Road	37.4454, - 79.2753
Bedford	Water Pump Station - 1 (Woods Landing Pump Station)	Water Booster Pump Station	Woods Landing On The James	37.4969, - 79.2465
Bedford	Water Pump Station - 3 (Deerwood Well House)	Water Booster Pump Station	Mountain View Shores Water System Improvements	37.0667, - 79.5411
Bedford	IVY CR Tank	Water Storage Facility	Ivy Cr Tank	37.4205, - 79.3045
Bedford	Cascade Forest LT 14 B-2 Water tank	Water Storage Facility	Cascade Forest Lt 14 B-2	37.2786, - 79.8101
Bedford	BP #665-05 TANK 100% COMP FOR 2006	Water Storage Facility	574 High Point Road	37.1271, - 79.6431
Campbell	WODI - AM - THE RAIN BROADCASTING, INC.	Communicatio n Facility		37.0384, - 78.9420





# Hazard Identification and Risk Assessment

Locality	Facility Name	Facility Type	Location	Coordinates
Campbell	Walnut Hill	Historic Site	129 Johnson Mountain Rd	37.2088, -79.3079
Campbell	Avoca Museum	Attractions	1514 Main St, Altavista, Va 24517	37.1300, -79.2697
Campbell	ABBOTT LABORATORIES - ROSS PRODUCTS DIVISION	HazMat Facility	1516 Main St, Altavista	37.1333, -79.2658
Campbell	RUSTBURG HIGH	Schools	1671 Village Highway	37.2766, -79.0849
Campbell	Lawyers Road Pump Station	Sewer Pump Station		37.3138, -79.1947
Campbell	Electrical Substation	Electrical Substation		37.4259, -79.0374
Campbell	Otter River Water Tank	Water Storage Facility	9625 Leesville Road	37.2109, -79.2992
Campbell	Rt 24 Finished Pump Station	Water Booster Pump Station	5 Blackwater Rd, Evington, Va 24550	37.2348, -79.2367
Campbell	BROOKNEAL TOWN - STAUNTON RIVER	Wastewater Treatment Plant	Radio Rd	37.0376, -78.9391
Campbell	Otter River Water Treatment Plant	Wastewater Treatment Plant	9605 Leesville Rd	37.2113, -79.2988
Lynchburg	WLLL - AM - HUBBARD'S ADVERTISING AGENCY, INC.	Communication Facility		37.4070, -79.2322
Lynchburg	Legacy Museum of African American History	Attractions	403 Monroe St	37.4142, -79.1543
Lynchburg	Maier Museum of Art	Attractions	1 Quinlan St	37.4393, -79.1699
Lynchburg	Old City Cemetery	Attractions	301 Monroe St	37.4149, -79.1565
Lynchburg	Historic Sandusky Foundation - Civil War Museum	Attractions	757 Sandusky Dr	37.3803, -79.1963
Lynchburg	CENTRAL VIRGINIA COMMUNITY COLLEGE	College		37.3589, -79.1844
Lynchburg	WESTROCK CONVERTING COMPANY	HazMat Facility	1801 Concord Turnpike	37.4032, -79.1277
Lynchburg	LYNCHBURG FIRE DEPARTMENT STATION 4 - BIRCH STREET	Fire Stations	410 Birch Street	37.4343, -79.1647
Lynchburg	Surgery Center of Lynchburg	Public Health	2401 Atherholt Road	37.4087, -79.1776
Lynchburg	CENTRAL VIRGINIA COMMUNITY COLLEGE POLICE	Law Enforcement	3506 Wards Road	37.3589, -79.1845



# Hazard Identification and Risk Assessment

Locality	Facility Name	Facility Type	Location	Coordinates
Lynchburg	CARRINGTON, THE	Nursing Home	2406 Atherholt Road	37.4083, -79.1758
Lynchburg	AVANTE AT LYNCHBURG	Nursing Home	2081 Langhorne Road	37.4130, -79.1824
Lynchburg	THE ELMS OF LYNCHBURG	Nursing Home	2249 Murrell Road	37.4077, -79.1725
Lynchburg	Reusens Dam Hydro Plant	Energy Facility	4300 Hydro Street	37.4630, -79.1867
Lynchburg	HOLY CROSS REGIONAL CATHOLIC SCHOOL	Schools	2125 Langhorne Rd	37.4125, -79.1778
Lynchburg	JAMES RIVER DAY SCHOOL	Schools	5039 Boonsboro Rd	37.4446, -79.2268
Lynchburg	NEW VISTAS SCHOOL	Schools	520 Eldon St	37.3987, -79.1724
Lynchburg	LAUREL REGIONAL SPECIAL EDUCATION CENTER	Schools	401 Monticello Avenue	37.4044, -79.1798
Lynchburg	HERITAGE ELEMENTARY	Schools	501 Leesville Road	37.3622, -79.2083
Lynchburg	HERITAGE HIGH	Schools	3020 Wards Ferry Road	37.3609, -79.2059
Lynchburg	SANDUSKY ELEMENTARY	Schools	5828 Apache Lane	37.3808, -79.2037
Lynchburg	WILLIAM M. BASS ELEMENTARY	Schools	1730 Seabury Avenue	37.3918, -79.1410
Lynchburg	CROSSROADS / SINGLE POINT OF ENTRY	Schools	405 Cabell Street	37.4227, -79.1467
Lynchburg	CENTRAL VIRGINIA GOVERNOR'S SCHOOL	Schools	3020 Wards Ferry Road	37.3609, -79.2059
Lynchburg	Electrical Substation	Electrical Substation		37.4062, -79.1339
Lynchburg	Electrical Substation	Electrical Substation		37.4345, -79.1653
Lynchburg	Electrical Substation	Electrical Substation		37.4620, -79.1889
Lynchburg	LYNCHBURG CITY SEWAGE TREATMENT	Wastewater Treatment Plant	2301 Concord Tpke	37.3968, -79.1141

## 4.16.4 Probability of Future of Occurrences

There is no simple, universal methodology for determining the probability and vulnerability to landslides and the available data provides only the broadest indications of areas that could expect a landslide (Virginia DGMR). The best predictors of future landslides are past landslides, because they tend to occur in the same places. Landslides, like other geologic hazards, are very complex and require someone with geologic expertise to conduct a geotechnical study. The impact and extent of the damage will greatly hinge



# Hazard Identification and Risk Assessment

on where the landslide occurs. The largest danger from landslides and debris flows occurs in areas of high relief or abrupt changes in topography, especially areas susceptible to slope failure initiated by sustained and/or heavy rain events.

## 4.16.5 References

- Rozelle, Jesse, Doug Bausch, and Hope A. Seligson. *Hazus Earthquake Model: FEMA Standard Operating Procedure for Hazus Earthquake Data Preparation and Scenario Analysis*, 2019. <https://www.fema.gov/media-library-data/1560288412257-a04f79331bc4d9dec3bf49420769e7bb/SOPfortheCreationofHazusEarthquakeScenarioPriorityMaps.pdf>.
- USGS. *What is a landslide and what causes one?* <https://www.usgs.gov/faqs/what-a-landslide-and-what-causes-one> (Accessed may 7, 2019)
- Virginia Department of Emergency Management. *Commonwealth of Virginia Hazard Mitigation Plan 2018*. 2018. p278. <https://www.vaemergency.gov/wp-content/uploads/2018/03/COV-SHMP-3-2018-Public.pdf>
- Virginia Department of Mines, Minerals, and Energy. *Landslides*. <https://www.dmme.virginia.gov/dgmr/landslides.shtml> (Accessed may 7, 2019)
- Wooten, Richard M., Anne C. Witt, Chelcy F. Miniati, Tristram C. Hales, and Jennifer L. Aldred. *Frequency and Magnitude of Selected Historical Landslide Events in the Southern Appalachian Highlands of North Carolina and Virginia: Relationships to Rainfall, Geological and Ecohydrological Controls, and Effects*. In *Natural Disturbances and Historic Range of Variation*, edited by Cathryn H. Greenberg and Beverly S. Collins, 32:203–62. Cham: Springer International Publishing, 2016. [https://doi.org/10.1007/978-3-319-21527-3\\_9](https://doi.org/10.1007/978-3-319-21527-3_9).



# Hazard Identification and Risk Assessment

## 4.17 Land Subsidence, Sinkhole, and Karst

### 4.17.1 Hazard Profile

Karst is the term used to refer to landscapes dominated by limestone and similar soluble carbonate rocks. Acidic groundwater and rainfall dissolves the surrounding carbonate rocks creating sinkholes. Sinkholes are classified as natural depressions of the land surface. Areas with large amounts of karst are characterized by the presence of sinkholes, sinking streams, springs, caves, and solution valleys (Weary and Doctor 2014). Human activities can expedite cavity formation in these susceptible materials and trigger their collapse, as well as the collapse of pre-existing subsurface cavities. Sinkholes are a frequent occurrence in areas underlain by calcareous carbonate formations, especially limestone and dolomite. Areas of abundant sinkholes are referred to as karst topography.

Land subsidence is the lowering of surface elevations due to changes made underground. It involves either the sudden collapse of the ground to form a depression or the slow subsidence or compaction of the sediments near the Earth's surface. It often occurs in regions with mildly acidic groundwater and the geology is dominated by limestone, dolostone, marble, or gypsum. Land subsidence is often due to natural processes: the dissolution of carbonate rocks (limestones) beneath the surface. In addition, human activity, such as fluid withdrawal (e.g. pumping of water, oil, or gas) from underground reservoirs, can cause land subsidence. Because the fluid withdrawal related subsidence usually destroys small areas, this plan update focuses on the carbonate substances related land subsidence which usually impacts massive areas.

#### **Karst Aquifers**

*An aquifer is a subsurface layer or zone of porous and permeable rock, or porous and permeable unconsolidated sediments (e.g., sand or gravel), that has groundwater in its openings. Water in karst regions typically moves from sinkholes--where it is diverted from surface to subsurface pathways--to subterranean passages, and back to surface water at the spring outlet. Aquifers in karst regions can hold tremendous quantities of water because of the very large size of the openings that are commonly present in the limestone (e.g. cave passageways that are completely flooded with water).*

#### **4.17.1.1 Geographic Location/Extent**

The distribution of mature surface karst landscapes are primarily dependent on the presence of soluble rocks at or near the land surface and mean annual precipitation above approximately 30 inches. In the United States, the formation of underground cavities can form and catastrophic sinkholes can occur. These rock types are evaporites (salt, gypsum, and anhydrite) and carbonates (limestone and dolomite). In the Eastern U.S., most karst features, such as sinkholes, occur in carbonate (limestone and dolomite) rocks. Figure 4-160 shows Karst distributions in Virginia where certain rock types are susceptible to dissolution in water.<sup>86</sup> It depicts areas containing rock types that, under a very broad definition, have developed or have the potential for developing karst features.

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<sup>86</sup> Weary and Doctor. 2014. <https://dx.doi.org/10.3133/ofr20141156>. The map data was compiled from the USGS karst map and database, and the USGS Groundwater Atlas of the United States.



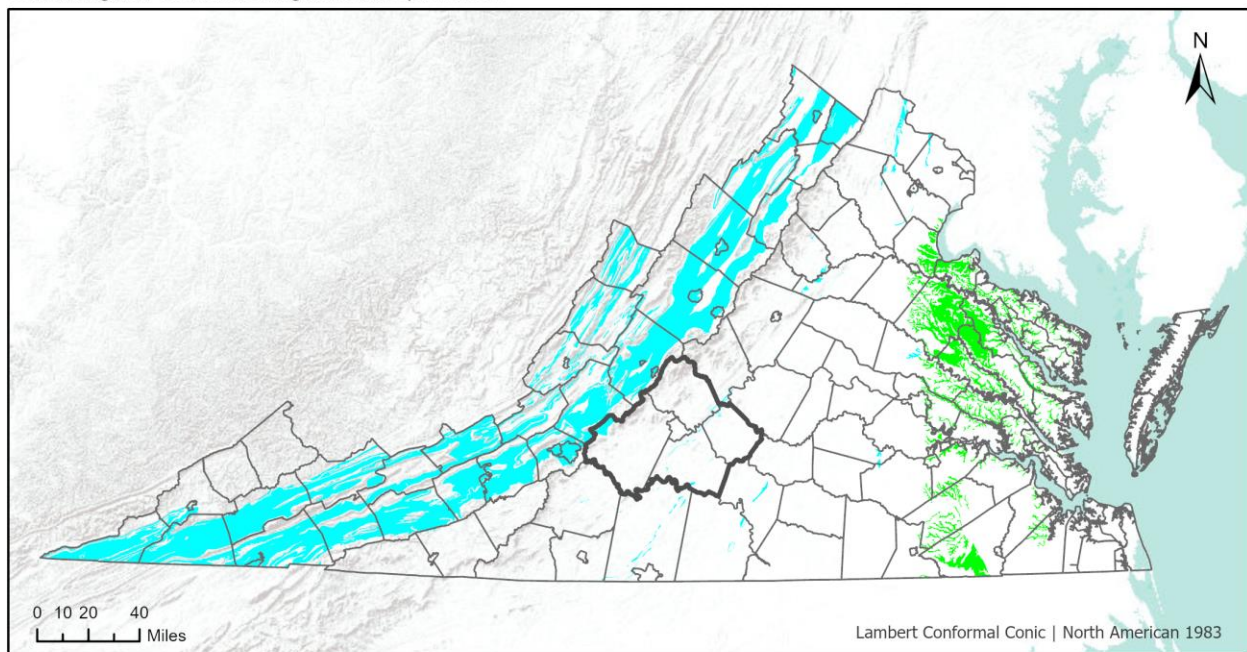


# Hazard Identification and Risk Assessment

In Virginia, the most dominant karst region is the Valley and Ridge Province in the western third of the state. Smaller karst areas also occur in the Piedmont, Cumberland Plateau, and Coastal Plain provinces. At least 29 counties contain significant karst terrain in western Virginia. Although the karst landscape is not prevalent in the Piedmont region where the CVPDC area is located, the western edge of the region is immediately adjacent to the edge of the Valley and Ridge Province. Soluble carbonate rock units susceptible to karst development include primarily limestone and dolomites, which are chiefly distributed throughout the Valley and Ridge Province. Smaller carbonate areas, consisting of limestone, dolomite, and marble, occur in the Piedmont region as well, primarily along the northern boundary of Appomattox County and Campbell County (Figure 4-161).

## Karst Distribution in Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020



Carbonate rocks at or near the land surface in a humid climate

Unconsolidated calcareous or carbonate rocks at or near the land surface in a humid climate

The Karst distribution areas portrayed on this map are based on the Digital Representation of the 1993 Geologic Map of Virginia produced by the Virginia Division of Geology and Mineral Resources at the scale of 1:500,000. Due to the aggregation of various lithologies within individual map units at this scale, some areas will have greater potential for karst development than others. Therefore, this map is neither meant to provide information for land use decisions at the county or municipal locality scale, nor to portray hazards associated with karst in the Commonwealth.

Data source: USGS; Virginia DMME

Credit: Center for Geospatial Information Technology at Virginia Tech. 08/2019



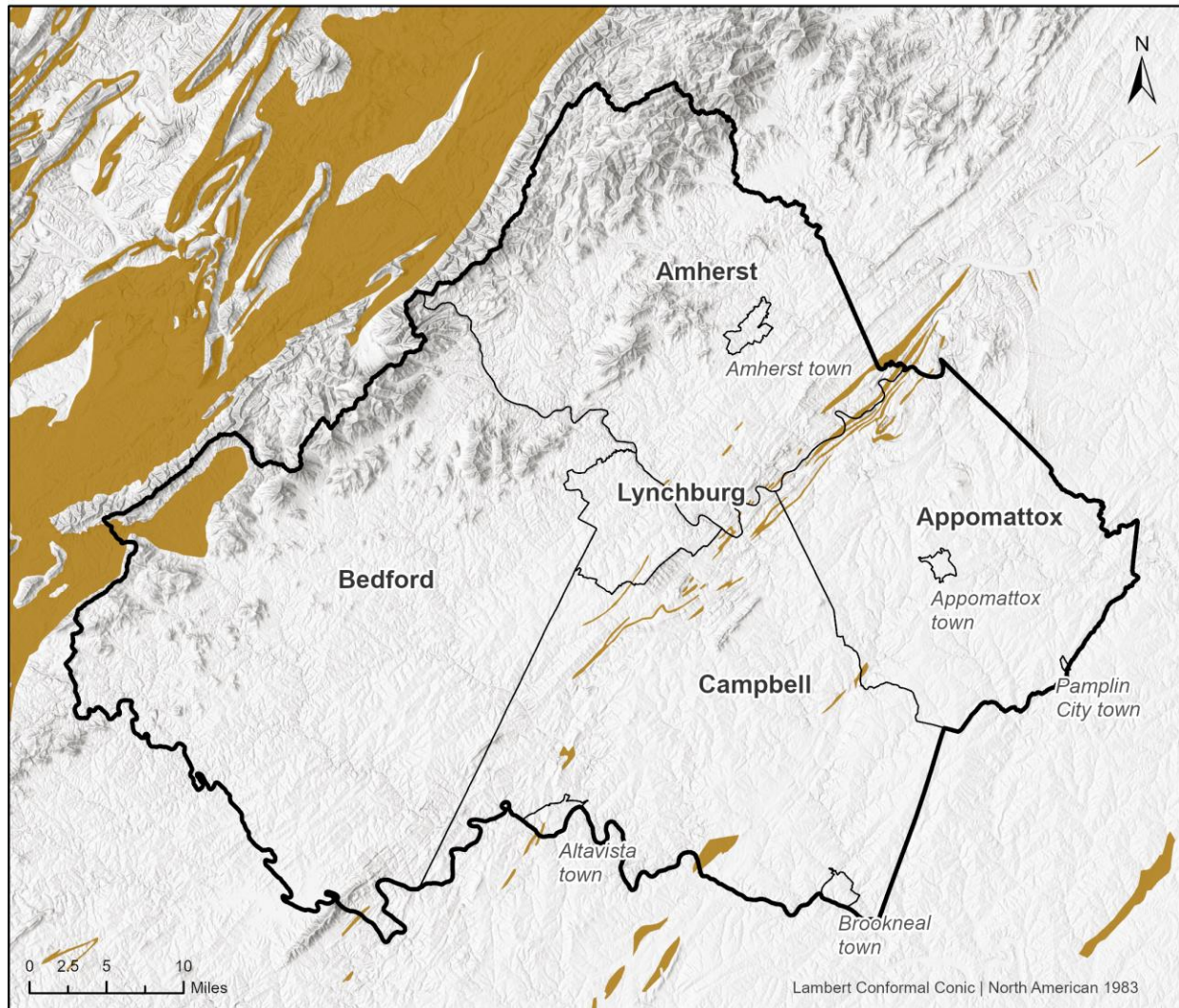
*Figure 4-160 Karst distribution in Virginia*



# Hazard Identification and Risk Assessment

## Distribution of Soluble Carbonate Rock Units in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



- County / Town
- soluble carbonate rock

Data source: USGS; Virginia DMME  
Center for Geospatial Information Technology at Virginia Tech. 08/2019



Figure 4-161 Distribution of Soluble carbonate rock units in CVPDC Area



# Hazard Identification and Risk Assessment

## 4.17.1.2 Previous Occurrence

According to the Virginia State Hazard Mitigation Plan, there have been no Federal Declared Disasters or National Centers for Environmental Information recorded events for karst related events, either in the CVPDC area or in the Commonwealth. Land subsidence and sinkholes are very site-specific. There is no comprehensive long-term record of past events in Virginia.

## 4.17.1.3 Relationship to Other Hazards

Figure 4-162 shows the interrelationship (causation, concurrence, etc.) between this hazard and other hazards discussed in this plan update.

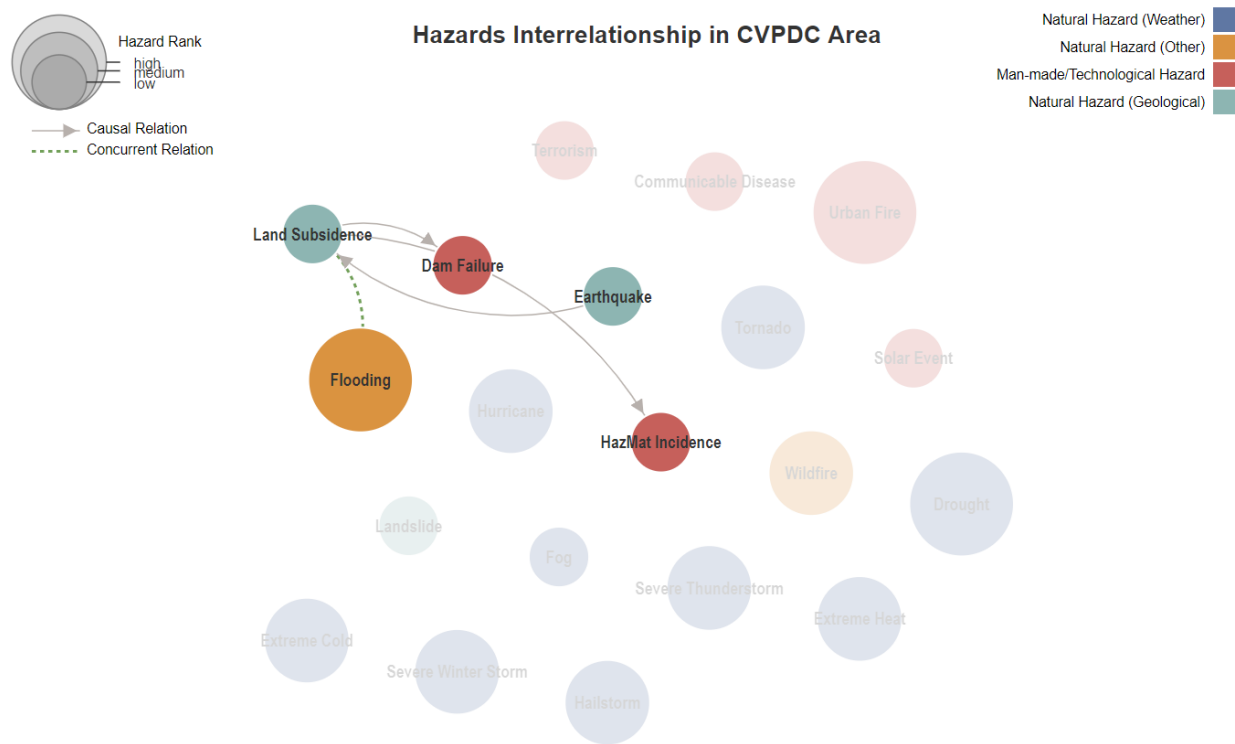


Figure 4-162 Hazards interrelationship

## 4.17.2 Impact and Vulnerability

In Virginia, the principal area affected by land subsidence or sinkholes is the Valley and Ridge Province, an extensive karst terrain underlain by limestone and dolomite, but the narrow marble belts in the Piedmont and some shelly beds in the Coastal Plain are also pocketed with sinkholes. Figure 4-163 presents potential risk areas for the Commonwealth of Virginia. These areas are broadly defined and mapped with a general understanding of karst hazard risks. According to Figure 4-160, a majority of the karst regions near the CVPDC area follow Interstate 81.

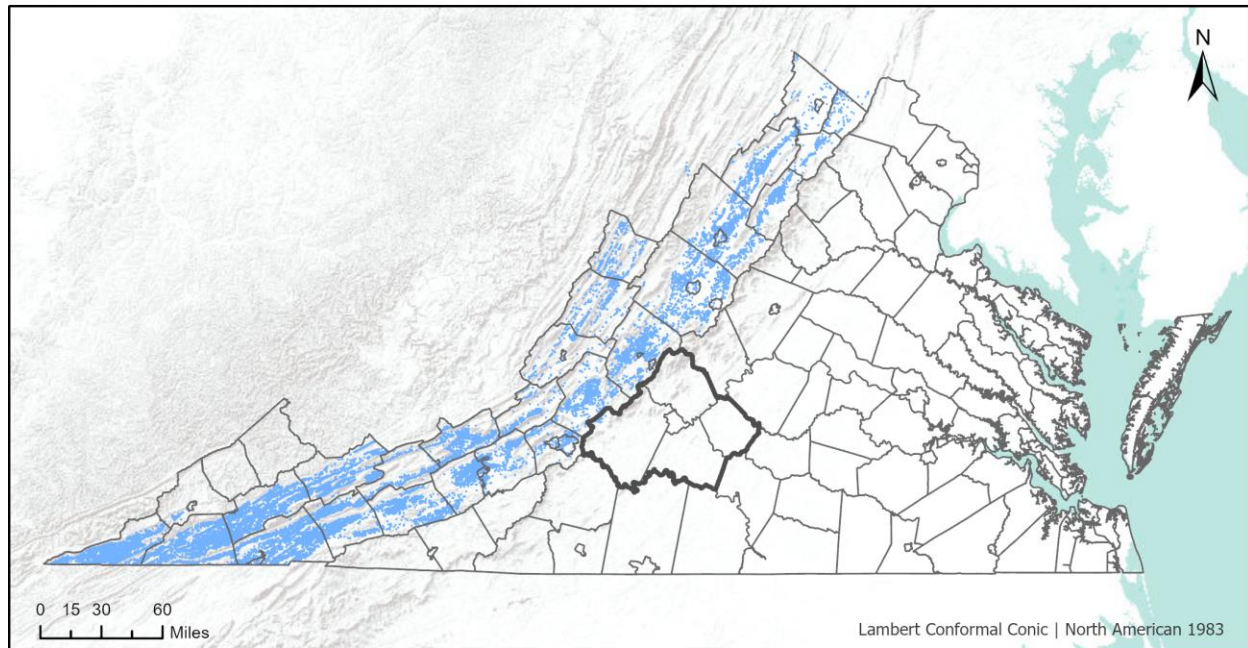




# Hazard Identification and Risk Assessment

## Identified Karst-related Sinkholes in Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020



□ county / city      ● identified sinkholes (by VA DGMR)

The data set was developed by the Virginia Division of Geology and Mineral Resources to depict areas of karst as defined by the presence of sinkholes. Sinkholes were identified from low-altitude stereoscopic aerial photo pairs and traced onto 1:24,000 paper topographic maps, from which they were table-digitized. Field checking has revealed that many more sinkholes are present than are depicted in this data set. Therefore, these data should serve as a general guide to areas of karst-related sinkhole development, and not as a true indication of the presence or absence of sinkholes at a particular location.

Data source: Virginia DMME

Credit: Center for Geospatial Information Technology at Virginia Tech. 08/2019



*Figure 4-163 Identified Karst-related Sinkholes in Virginia. (Source: Virginia DMME)*

### 4.17.2.1 Groundwater Supply

Sinkhole formation is a principal event associated with karst terrain. Although sinkholes are relatively uncommon events in the CVPDC area, they are still of particular concern because they serve as conduits between surface water and groundwater. This interaction can lead to rapid transport of surface pollutants introduced by various means such as urban runoff and use of sinkholes as trash dumps. The underground drainage system can also be blocked by erosion and sedimentation from construction sites and other human activities. In the United States, approximately 20 percent of the land surface is karst and roughly 43 percent of all groundwater withdrawals for public supply in the year 2000 came from karst aquifers.<sup>87</sup> Because so many people rely on groundwater (and wells) for drinking water, it is critical to protect the purity of groundwater, especially in environmentally sensitive karst terrain.

<sup>87</sup> Molly A. Maupin and Nancy L. Barber. Estimated withdrawals from principal aquifers in the United States, 2000. <https://pubs.er.usgs.gov/publication/cir1279>





# Hazard Identification and Risk Assessment

## 4.17.2.2 Flooding and Pollution

There are two additional problems besides collapse that can result from the existence or formation of sinkholes: flooding and pollution.

Sinkhole flooding can develop from a number of natural conditions; however, two man-made conditions are the most common causes in Virginia: *plugging* - backup of natural sinkhole drains by sediment - and *overwhelming runoff* - the overwhelming of natural sinkhole drains by increases in runoff due to artificial surfaces. Inadequate erosion control during construction can result in the plugging of natural sinkhole drains by sediment-laden runoff. The accompanying restriction of subsurface drainage causes an increase in ponding or flooding. Increased runoff from roads, parking lots, and structures is the most significant cause of sinkhole flooding. Much of the precipitation that would have percolated through a vegetated soil cover is introduced rapidly into surface and subsurface (input through sinkholes) drainage networks. Increases in runoff have been reported to range from 48 percent for areas of suburban housing to 153 percent or more for industrial or commercial areas. Such increases in runoff can exceed the drainage capacity of natural sinkhole drain and result in ponding or flooding. In severe cases, excessive runoff can overwhelm the capacity of the natural subsurface drainage systems of sinkholes, causing water to back-up and flood sinkholes up-system.<sup>88</sup>

Another major problem associated with sinkholes or karst topography is its impact on aquifers and potential for groundwater contamination. The greatest impact occurs when polluted surface waters enter karst aquifers. This problem is universal among all populated areas located in areas of karst. The groundwater problems associated with karst are accelerated with: (1) expanding urbanization, (2) misuse and improper disposal of environmentally hazardous chemicals, (3) shortage of suitable repositories for toxic waste (both household and industrial), and (4) ineffective public education on waste disposal and the sensitivity of the karstic groundwater system.<sup>89</sup>

The USGS recognizes four major impacts caused by land subsidence:

- Changes in elevation and slope of streams, canals, and drains
- Damage to bridges, roads, railroads, storm drains, sanitary sewers, canals, and levees
- Damage to private and public buildings
- Failure of well casings from forces generated by compaction of fine-grained materials in aquifer systems

Although land subsidence hazard in the CVPDC area is not ranked as high as it is in Virginia coastal regions, where low-lying topography are susceptible to sea-level rise, land subsidence does have the potential to negatively impact assets and residents in the area. Damage to infrastructure in the region, such as

### **Abandoned Coal Mines**

*Areas over underground mine workings are also susceptible to subsidence. According to the Abandoned Coal Mine Lands map by Virginia DMME, abandoned coal mines don't exist in the CVPDC area.*

<https://www.dmme.virginia.gov/web/maps/aml/>

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<sup>88</sup> Virginia DMME - Sinkholes: <https://www.dmme.virginia.gov/dgmr/pdf/sinkholes.pdf>

<sup>89</sup> Ernst H. Kastning. An expert report on geologic hazards in the karst regions of Virginia and West Virginia. 2016. <http://wp.vasierraclub.org/KastningReport.pdf>



# Hazard Identification and Risk Assessment

buildings, bridges, and pipelines, can be caused by relative groundwater rise or land settling. Storm and wastewater sewers in urban areas may be vulnerable because subsidence can alter the flow through the sewers, causing increased flooding and more frequent sewer discharge from overflows. Land subsidence can also increase flooding risk such as locations along James River. Land subsidence could alter the topographic gradient that drives the flow of the river and possibly contributing to the flooding.

In flat karst regions, landslide or rock failures could possibly occur along the walls of the valleys. In addition to the usual factors that influence slope movements, the presence of karst voids and conduits, and the deriving modality of water circulation may further influence rock failures.<sup>90</sup> Karst rocks like carbonate rocks and gypsum are especially failure-prone.<sup>91</sup> In addition to landslides and sinkholes, breakdown processes within caves are extremely common in karst, and may represent a geohazard even to the built-up environment, due to the possibility of void migration toward the surface.

## 4.17.3 Risk Assessment and Jurisdictional Analysis

Critical facilities and infrastructures at risk in karst terrain were identified using the map of known soluble carbonate rock units. Table 4-155 presents the names and locations of these facilities. Besides, several pipeline portions also transverse karst terrains: a portion of hazardous liquid pipeline line and a breakout tank in Montvale area in Bedford County and another portion near the boundary of Amherst County/Appomattox County; a portion of Transcontinental Gas pipeline near Long Island in Campbell County (Figure 4-164).

The risk and potential impacts of land subsidence depend on the type of subsidence that occurs (regional or localized, gradual or sudden) and the location in which the subsidence occurs. Potential damage and loss due to sinkholes or land subsidence is nearly impossible to assess because the nature of the damage is site- and event-specific.

## 4.17.4 Probability of Future of Occurrences

Given the report of small land subsidence/sinkhole in the CVPDC area is not uncommon in the news media, as well as the existence of karst landscape in the CVPDC area, it is certain that a future event will occur. However, the lack of long-term record of historical occurrences and comprehensive, readily available scientific studies make it difficult to predict probability of future occurrence, only that it is likely.

*Table 4-155 Critical Facility and Infrastructure in Karst Terrain in CVPDC Area*

Locality	Facility Name	Facility Type	Location	Coordinates
Amherst	Greif Packaging Containerboard Mill	HazMat Facility	861 Fibre Plant Rd	37.5107, -78.9101
Amherst	Greif Brothers Packaging Corporation - Riverville Mill Fire	Fire Stations	861 Fibre Plant Road	37.5120, -78.9083

<sup>90</sup> <http://cdn.intechweb.org/pdfs/27974.pdf>

<sup>91</sup> Rock Failures in karst: [https://www.researchgate.net/publication/233731628\\_Rock\\_failures\\_in\\_karst](https://www.researchgate.net/publication/233731628_Rock_failures_in_karst)



# Hazard Identification and Risk Assessment

Locality	Facility Name	Facility Type	Location	Coordinates
	Brigade And Emergency Medical Services			
Amherst	Gas Facility	Gas Facility		37.4951, -79.0568
Bedford	Woodhaven Nursing Home	Nursing Home	13055 West Lynchburg/Salem Turnpike	37.3981, -79.7539
Bedford	Transmontaigne - Montvale Piedmont Terminal	HazMat Facility	11685 W Lynchburg Salem Tpke	37.3881, -79.7316
Bedford	Montvale Wastewater Treatment	Wastewater Treatment Plant	185 Little Patriot Dr	37.3719, -79.7094
Bedford	Montvale Volunteer Fire Department	Fire Stations	1271 Volunteer Road	37.3850, -79.7305
Bedford	Montvale Pump Station	Sewer Pump Station		37.3788, -79.7098
Bedford	Montvale Elementary	Schools	1 Little Patriot Drive	37.3759, -79.7084
Bedford	Buckeye Terminals, Llc - Roanoke Terminal	HazMat Facility	1070 Oil Terminal Rd	37.3842, -79.7342
Campbell	Water Tank	Water Storage Facility	Bedford Avenue	37.1135, -79.2989
Campbell	Virginia State Police Division 3 Area 20 - Lynchburg	Law Enforcement	1065-G Airport Road	37.3306, -79.2030
Campbell	Rt 622 Pump Station	Water Booster Pump Station	1610 Waterlick Rd, Lynchburg, Va 24501	37.3147, -79.2263
Campbell	Lynchburg Regional Airport Aircraft Rescue Fire Fighting	Fire Stations	984 Airport Road	37.3289, -79.2016
Campbell	Lyn-Dan Heights Volunteer Fire Department	Fire Stations	578 Lawyers Road	37.3127, -79.1953
Campbell	Leesville Estates Pump Station	Sewer Pump Station		37.3027, -79.2425
Campbell	Lawyers Road Pump Station	Sewer Pump Station		37.3138, -79.1947
Campbell	Flat Creek Pump Station	Sewer Pump Station		37.3096, -79.1830
Campbell	Altavista High	Schools	904 Bedford Avenue	37.1095,



# Hazard Identification and Risk Assessment

Locality	Facility Name	Facility Type	Location	Coordinates
				-79.2953
Lynchburg	Sylvain Melloul International Hair Academy	College		37.3644, -79.1797
Lynchburg	Lynchburg City Emergency Communication Center	Emergency Operations Center	3621 Candler's Mountain Road	37.3638, -79.1720
Lynchburg	Liberty University Police Department	Law Enforcement	1971 University Boulevard	37.3581, -79.1757
Lynchburg	Electrical Substation	Electrical Substation		37.3617, -79.1798
Lynchburg	Davis Frost Inc	HazMat Facility	3420 Candler's Mountain Rd	37.3675, -79.1730
Lynchburg	C.R. Hudgins Plating, Inc.	HazMat Facility	3600 Candler's Mountain Rd	37.3639, -79.1721





# Hazard Identification and Risk Assessment

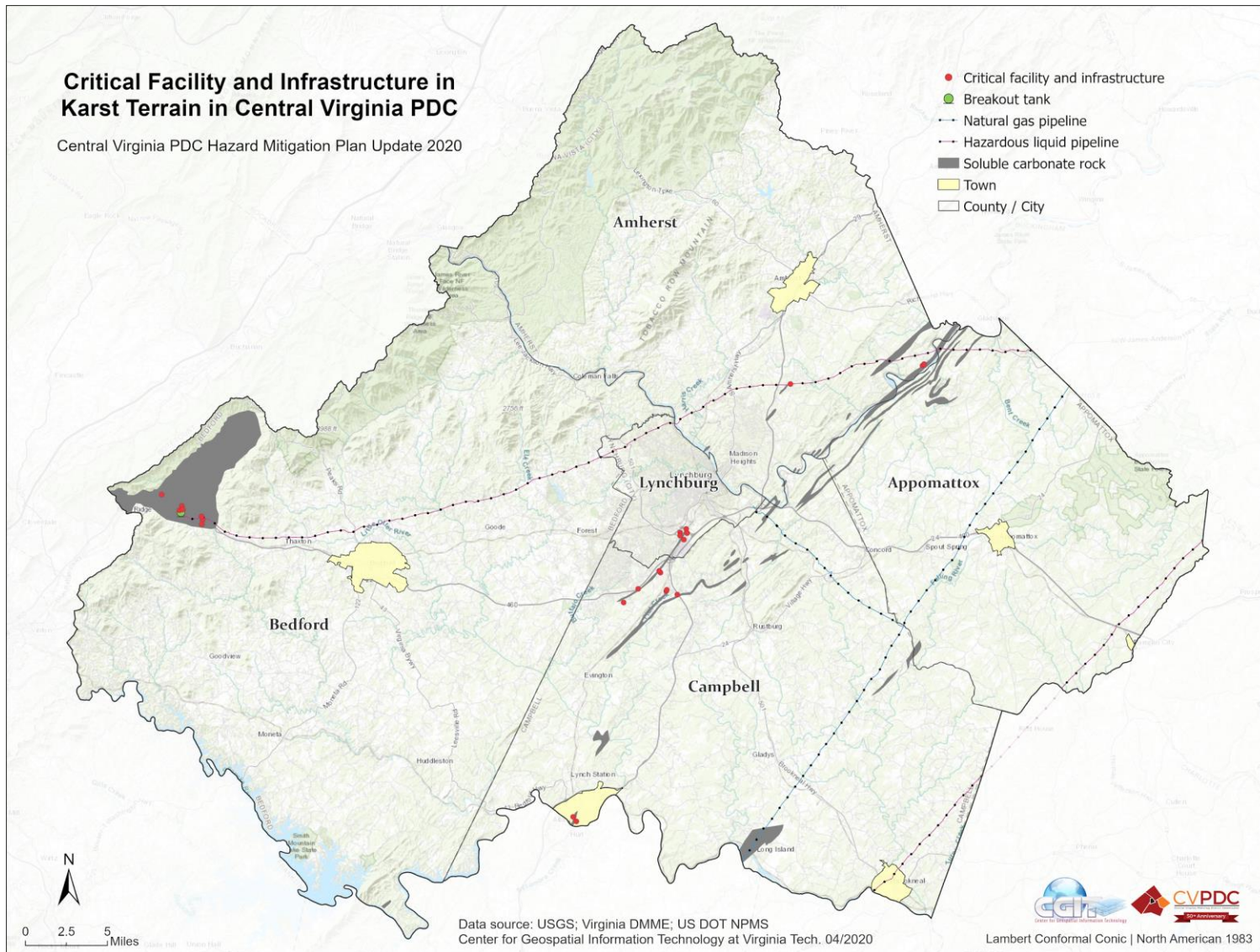


Figure 4-164 Critical Facility and Infrastructure in Karst Terrain in CVPDC Area



# Hazard Identification and Risk Assessment

## 4.17.5 Reference

- David A. Jr. Hubbard. *Sinkholes*. Charlottesville, VA: Virginia Department of Mines, Minerals and Energy Division of Geology and Mineral Resources, April 2014.  
<https://www.dmme.virginia.gov/dgmr/pdf/sinkholes.pdf>
- Ernst H. Kastning. An expert report on geologic hazards in the karst regions of Virginia and West Virginia. 2016. <http://wp.vasierraclub.org/KastningReport.pdf>
- Maupin, Molly A., and Nancy L. Barber. *Estimated Withdrawals from Principal Aquifers in the United States, 2000*. Circular 1279. Reston, Va. : Denver, CO: U.S. Dept. of the Interior, U.S. Geological Survey, 2005.
- Negri, Andrew J., et al. *The hurricane–flood–landslide continuum*. Bulletin of the American Meteorological Society. 2005. 86(9):1241-1247.
- Parise, Mario. “Rock Failures in Karst.” In *Landslides and Engineered Slopes. From the Past to the Future*, edited by Zuyu Chen, Jianmin Zhang, Zhongkui Li, Faquan Wu, and Ken Ho, 275–80. CRC Press, 2008. [https://www.researchgate.net/publication/233731628\\_Rock\\_failures\\_in\\_karst](https://www.researchgate.net/publication/233731628_Rock_failures_in_karst)
- United States Geological Survey. *Sinkholes*. <https://water.usgs.gov/edu/sinkholes.html> (Accessed May 13, 2019)
- Weary, David J., and Daniel H. Doctor. *Karst in the United States: A Digital Map Compilation and Database*. Open-File Report. Reston, Virginia: U.S. Geological Survey, 2014.  
<https://dx.doi.org/10.3133/ofr20141156>. ISSN 2331-1258 (online)



# Hazard Identification and Risk Assessment

## 4.18 Hazardous Material Incidents

### 4.18.1 Hazard Profile

A hazardous material (hazmat) is any solid, liquid, or gas that can harm people, other living organisms, property, or the environment. Chemical manufacturers, distributors and vendors are sources of hazardous materials, as are hazardous materials waste sites and many users, including service stations and hospitals. Spills or releases can occur during production, storage, transportation, use, or disposal. Most incidents occur at fixed facilities, such as an industrial plant, however, spills are also common along railroads, highways, pipelines, and waterways.

#### 4.18.1.1 HazMat classification

The U. S. Department of Transportation (USDOT) has specific rules for shipping hazardous materials. Hazardous materials are defined by the U. S. Department of Transportation in accordance with the Federal Hazardous Material Law regulations. A USDOT hazardous material classification (see Table 4-156) is applied if a material, in a particular amount and form, poses an unreasonable risk to health, safety or property.<sup>92</sup>

#### 4.18.1.2 Geographic Location/ Extent

##### 4.18.1.2.1 Toxic Release Inventory Facilities

Hazardous materials can be found in any community, as they are used in homes, hospitals, and factories, and are shipped daily via land, air, railways, and pipelines (FEMA, 2019). If released, these materials can damage the environment, critical infrastructure, property, and people. The U.S. Environmental Protection Agency's (EPA) Toxic Release Inventory (TRI) tracks the management of certain chemicals that may pose a threat to human health and the environment. Industrial facilities must report how much of each chemical is recycled, combusted for energy recovery, treated for destruction, and disposed of or released on- and off-site. Figure 4-165, Figure 4-166, and Table 4-157 show the available georeferenced TRI facilities that are located throughout the CVPDC area.

##### 4.18.1.2.2 Natural Gas and Hazardous Liquid Pipelines

There are two general types of energy pipelines – natural gas pipelines and hazardous liquid (or liquid petroleum) pipelines. Within the hazardous liquid pipeline network there are crude oil lines, refined product lines, highly volatile liquids lines, and carbon dioxide lines. Both types of energy pipelines traverse the CVPDC area (Figure 4-167). There are about 50 miles of natural gas pipeline operated by the Transcontinental Gas Pipe Line (Transco) Corporation, and about 85 miles of hazardous liquid pipeline operated by the Colonial Pipeline. Line 25 of Colonial Pipeline which was a subline delivering petroleum products to Bedford and Lynchburg terminals was disconnected from service in September 2018.<sup>93</sup>

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<sup>92</sup>

[https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/Hazardous\\_Materials\\_Markings\\_Labeling\\_and\\_Placarding\\_Guide.pdf](https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/Hazardous_Materials_Markings_Labeling_and_Placarding_Guide.pdf)

<sup>93</sup> Colonial Pipeline set to shut down section in Central Virginia. WSLs 10. May 31, 2018. <https://www.wsls.com/news/virginia/bedford/colonial-pipeline-set-to-shut-down-section-in-central-virginia>

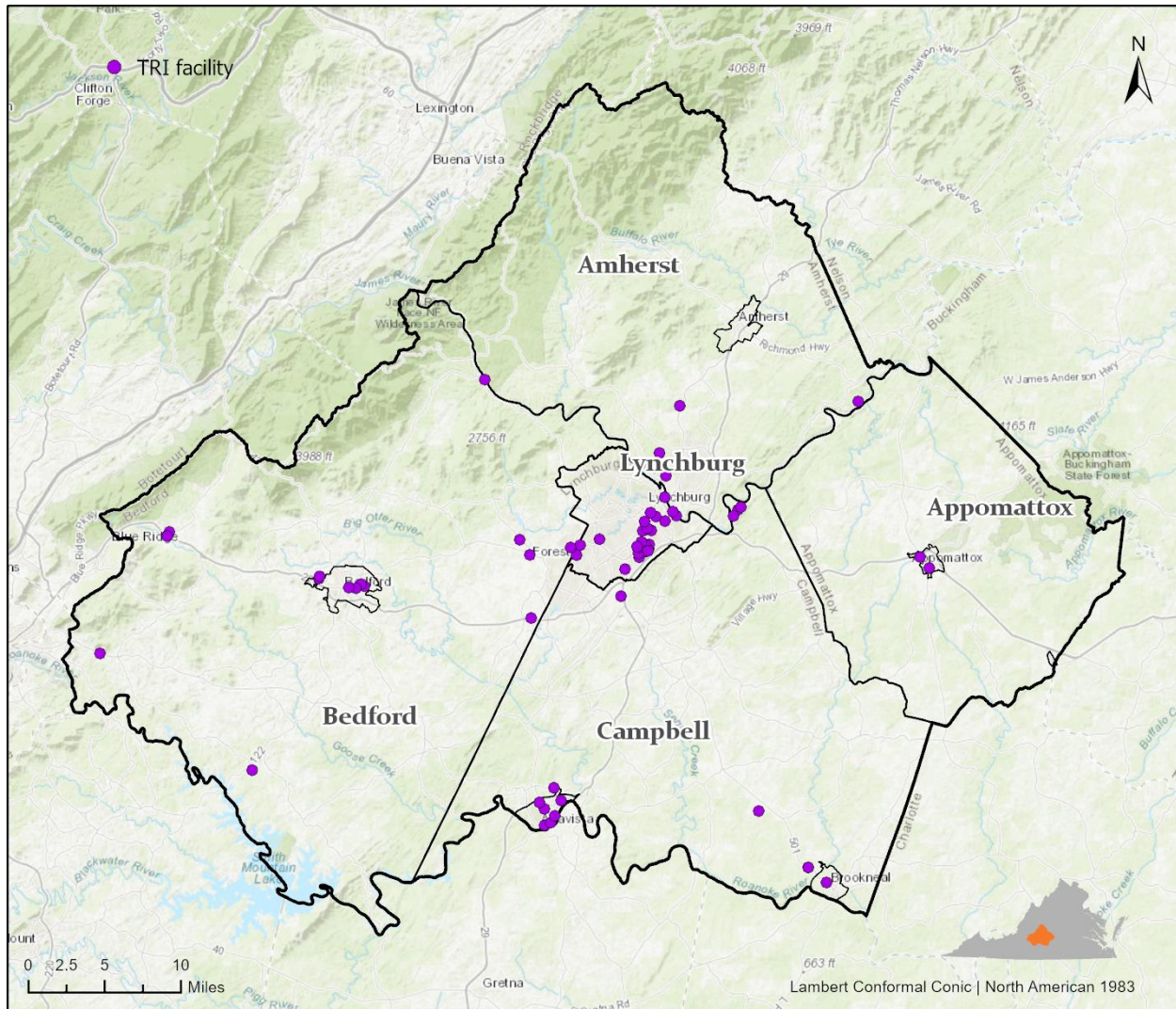




# Hazard Identification and Risk Assessment

## EPA Toxic Release Inventory (TRI) Facilities in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: EPA Emergency Response Toxic Release Inventory, as of 02/2020  
Center for Geospatial Information Technology at Virginia Tech. 05/2020



Figure 4-165 Location of EPA Toxic Release Inventory (TRI) Facilities in CVPDC

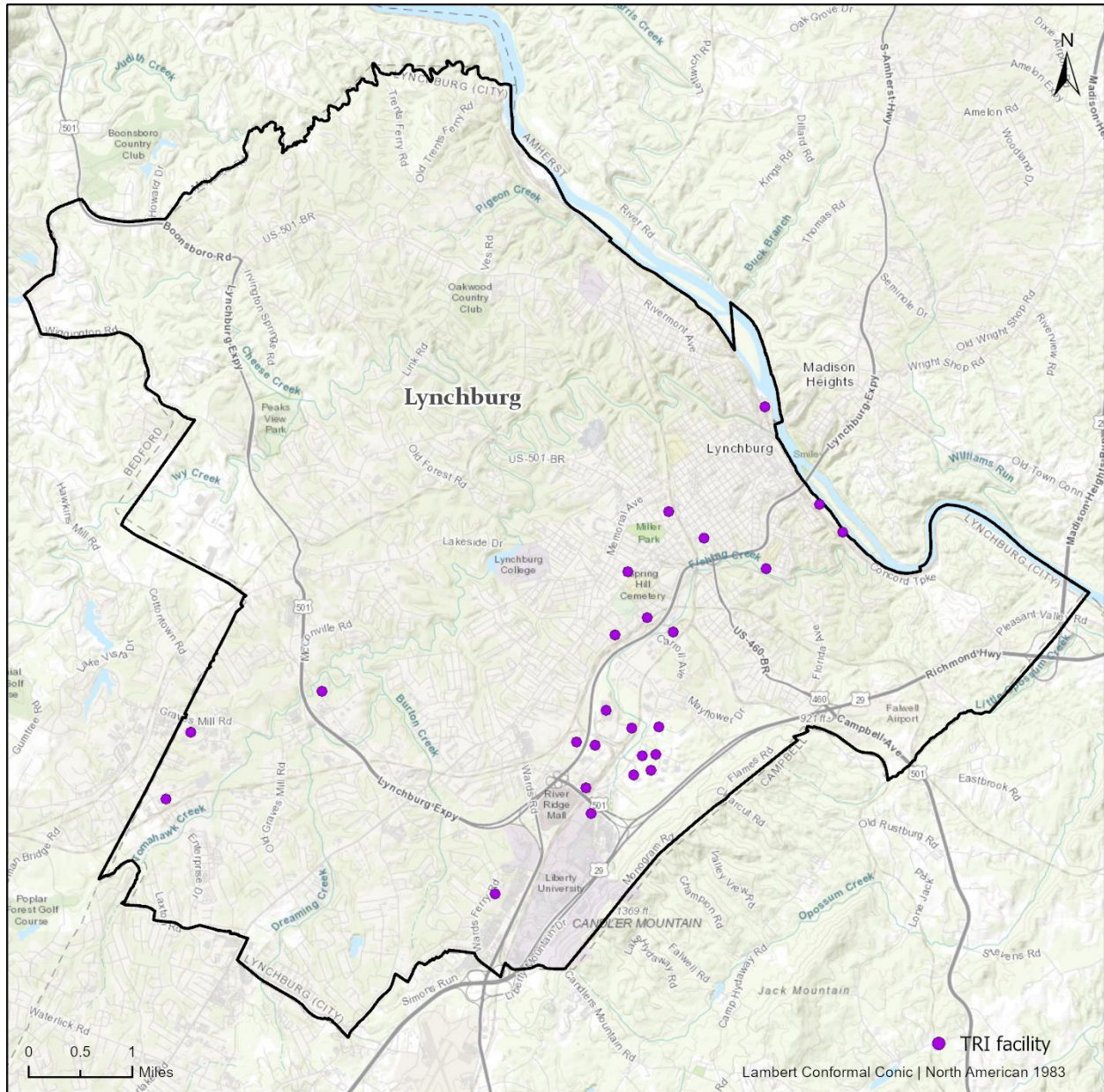




# Hazard Identification and Risk Assessment

## EPA Toxic Release Inventory (TRI) Facilities in City of Lynchburg

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: EPA Emergency Response Toxic Release Inventory, as of 02/2020  
Center for Geospatial Information Technology at Virginia Tech. 05/2020



Figure 4-166 Location of EPA Toxic Release Inventory (TRI) Facilities in City of Lynchburg



# Hazard Identification and Risk Assessment

Table 4-156 Hazardous materials classification by the U. S. Department of Transportation

DOT Hazard Class	Division or Definition
Class 1: Explosives	Division 1.1: Mass Explosive Hazard
	Division 1.2: Projection Hazard
	Division 1.3: Fire and/or Minor Blast/Minor Projection Hazard
	Division 1.4: Minor Explosion Hazard
	Division 1.5: Very Insensitive With Mass Explosion Hazard
	Division 1.6: Extremely Insensitive; No Mass Explosion Hazard
Class 2: Gases	Division 2.1: Flammable Gases
	Division 2.2: Nonflammable Gases
	Division 2.3: Toxic Gases
	Division 2.4: Corrosive gases
Class 3: Flammable Liquid and Combustible Liquid	Division 3.1: Flashpoint below -18°C(0°F)
	Division 3.2: Flashpoint below -18°C and above, but less than 23°C(73°F)
	Division 3.3: Flashpoint 23°C and up to 61°C(141°F)
Class 4: Flammable Solid, Spontaneously Combustible, and Dangerous When Wet	Division 4.1: Flammable Solids
	Division 4.2: Spontaneously Combustible
	Division 4.3: Dangerous When Wet
Class 5: Oxidizer and Organic Peroxide	Division 5.1: Oxidizing Substances
	Division 5.2: Organic Peroxides
Class 6: Poison (Toxic) and Poison Inhalation Hazard	Division 6.1: Toxic Substances
	Division 6.2: Infectious Substances
Class 7: Radioactive	Any material, or combination of materials, that spontaneously gives off ionizing radiation. It has a specific activity greater than 0.002 microcuries per gram.
Class 8: Corrosive	A material, liquid or solid, that causes visible destruction or irreversible alteration to human skin or a liquid that has a severe corrosion rate on steel or aluminum.
Class 9: Miscellaneous Hazardous Materials	A material that presents a hazard during transport, but which is not included in another hazardous freight classification.

Table 4-157 EPA Toxic Release Inventory (TRI) Facilities in CVPDC Area

County/City	Town	Facility Name	Location	Coordinates
Amherst		Greif Packaging Containerboard Mill	861 Fibre Plant Rd	37.5107, -78.9101
Amherst		Lynchburg Steel & Specialty Co Inc	275 Francis Avenue	37.5075, -79.1230
Amherst		Old Virginia Brick Co	1324 Mitchell Bell Rd	37.4628, -79.1475
Amherst		Thomas Road Landfill (Amsted Ind-Griffin Pipe Products Co)	Thomas Road & Route 685	37.4411, -79.1398
Appomattox	Town of	Thomasville Furniture Ind Inc-	Founder'S Lane	37.3627,



# Hazard Identification and Risk Assessment

County/City	Town	Facility Name	Location	Coordinates
	Appomattox	Virginia Operations (Closed)		-78.8375
Appomattox	Town of Appomattox	Tiger Fuel Company	130 Commerce St, Appomattox, Va 24522	37.3522, -78.8268
Bedford		Barr Laboratories Inc	2150 Perrowville Rd	37.3809, -79.3143
Bedford		Blue Ridge Wood Preserving Incorporated	1220 Hendricks Store Road	37.1622, -79.6325
Bedford		Buckeye Terminals, Llc - Roanoke Terminal	1070 Oil Terminal Rd	37.3842, -79.7342
Bedford		Commscope Technologies Llc	140 Vista Centre Dr	37.3734, -79.2536
Bedford		Custom Truck One Source	12660 E Lynchburg Salem Tpke	37.3065, -79.3008
Bedford		Georgia Pacific Corp - Big Island Mill	9363 Lee Jackson Highway	37.5328, -79.3556
Bedford		Nydree Flooring Llc (Closed)	1191 Venture Dr.	37.3664, -79.3023
Bedford		Safety-Kleen Systems	16090 Stewartsville Road	37.2727, -79.8138
Bedford		Transmontaigne - Montvale Piedmont Terminal	11685 W Lynchburg Salem Tpke	37.3881, -79.7316
Bedford		Wheelabrator Landfill (Winoa Usa, Inc.)	3 Abrasive Ave	37.3462, -79.5526
Bedford	Town of Bedford	Gran Tee Investments	906 Adams St.	37.3350, -79.5093
Bedford	Town of Bedford	Rubatex Corp Plant 2	Railroad Avenue At Grove Street	37.3356, -79.5178
Bedford	Town of Bedford	Sam Moore Furniture Llc	1556 Dawn Dr	37.3388, -79.5035
Bedford	Town of Bedford	Trident Seafoods Bedford Plant	940 Orange St	37.3369, -79.4993
Bedford	Town of Bedford	Winoa Usa (W Abrasives)	1 Abrasive Ave	37.3441, -79.5536
Campbell		Banker Steel Co Llc	351 Rangoon Rd	37.3269, -79.1939
Campbell		Brookneal Chip Mill	24 Price Ave	37.0687, -78.9728
Campbell		Bwx Technologies Inc - R&D (Closed)	1570 Mount Athos Road Route 726	37.4086, -79.0541
Campbell		Framatome Inc.	1724 Mount Athos Road	37.4111, -79.0506
Campbell		Georgia-Pacific Brookneal Osb	11795 Brookneal Highway	37.1225, -79.0313
Campbell		Lynchburg Casting Industries	1132 Mt Athos Rd	37.4027,



# Hazard Identification and Risk Assessment

County/City	Town	Facility Name	Location	Coordinates
				-79.0595
Campbell		Timken Co Altavista Bearing Plant	2097 Dearing Ford Rd.	37.1453, -79.2742
Campbell	Town of Altavista	A.O. Smith Electrical Products Company (Closed)	201 Ogden Road	37.1314, -79.2916
Campbell	Town of Altavista	Abbott Laboratories - Ross Products Division	1516 Main St, Altavista	37.1333, -79.2658
Campbell	Town of Altavista	Bgf Industries	401 Amherst Avenue, Altavista	37.1122, -79.2782
Campbell	Town of Altavista	Dominion - Altavista Power Station	104 Wood Lane	37.1187, -79.2734
Campbell	Town of Altavista	Lane Home Furnishings	701 5Th St, Altavista	37.1097, -79.2855
Campbell	Town of Altavista	Schrader-Bridgeport International	205 Frazier Rd	37.1253, -79.2856
Campbell	Town of Brookneal	Dan River Inc - Brookneal Plant 2 (Closed)	813 Lynchburg Avenue	37.0543, -78.9513
Lynchburg		Allen-Morrison Signage Company	319 Rutherford Street	37.3889, -79.1678
Lynchburg		Banker Steel Co Llc - 30997	1619 Wythe Rd	37.3913, -79.1621
Lynchburg		C.R. Hudgins Plating, Inc.	3600 Candler's Mountain Rd	37.3639, -79.1721
Lynchburg		Cb Fleet Co	4615 Murray Place	37.3735, -79.1713
Lynchburg		Davis Frost Inc	3420 Candler's Mountain Rd	37.3675, -79.1730
Lynchburg		Delta Star Inc.	3550 Mayflower Drive	37.3693, -79.1646
Lynchburg		Flowserve Corporation	5114 Woodall Road	37.3739, -79.1746
Lynchburg		Gnb Inc	2800 Carroll Ave.	37.3893, -79.1575
Lynchburg		U.S. Pipe	10 Adams Street	37.4208, -79.1413
Lynchburg		Hanson Industries Inc	3300 John Capron Rd.	37.3721, -79.1607
Lynchburg		Lynchburg Foundry Co Lower Basin Plant	Garnet Street And Concord Turnpike	37.4071, -79.1318
Lynchburg		Norcraft Companies	One Millrace Drive	37.3755, -79.2423
Lynchburg		Old Dominion Wood Products	800 Craddock Street	37.4061, -79.1583
Lynchburg		Parker Hannifin Corporation - Powertrain Division	3700 Mayflower Dr	37.3719, -79.1631





# Hazard Identification and Risk Assessment

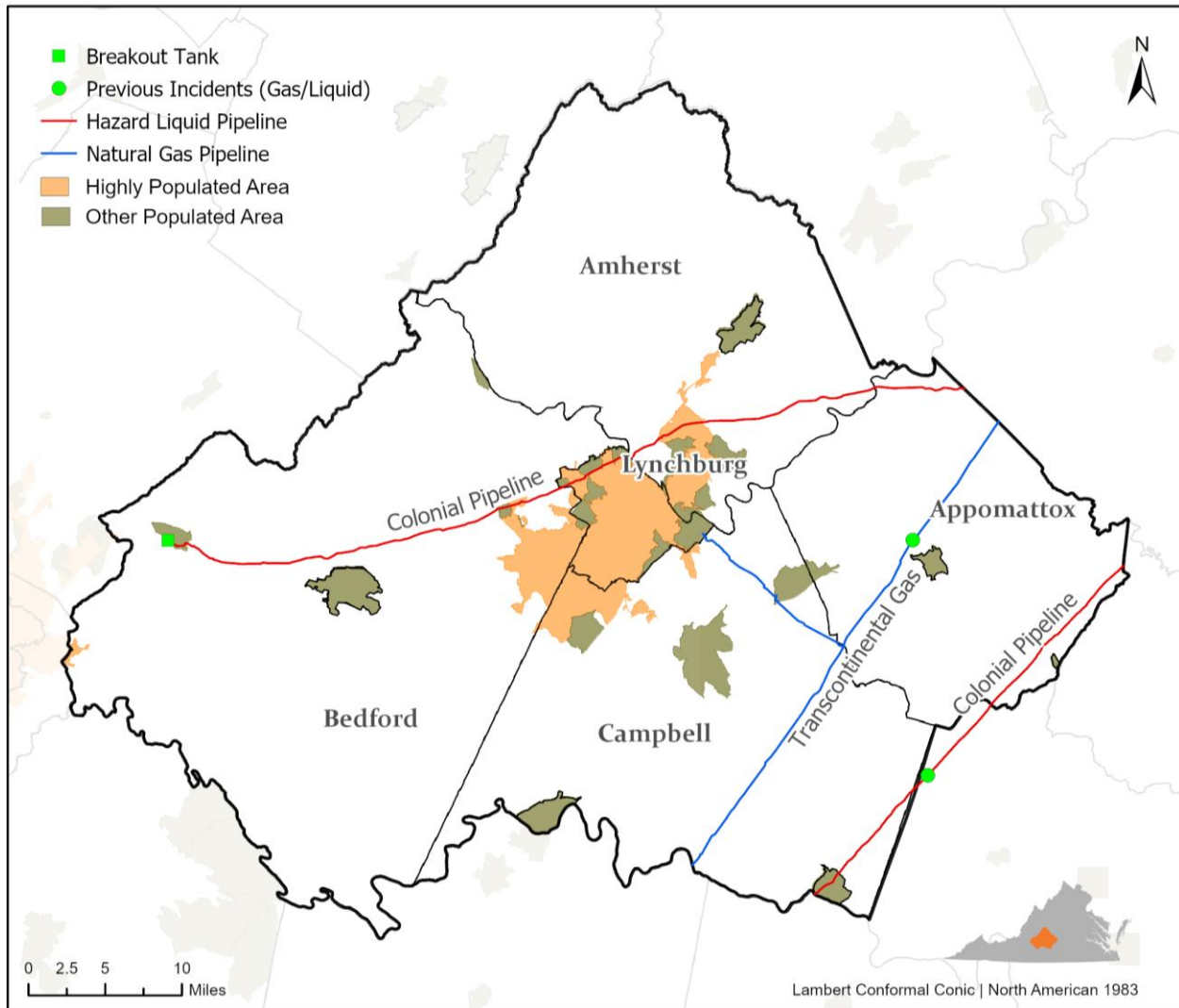
County/City	Town	Facility Name	Location	Coordinates
Lynchburg		Pepsi Bottling Group	121 Bradley Dr	37.3760, -79.1601
Lynchburg		Porters Group Llc	3726 Cohen Pl	37.3699, -79.1615
Lynchburg		Rr Donnelley Printing Company	4201 Murray Place	37.3783, -79.1694
Lynchburg		Simplimatic Eng Co	1320 Wards Ferry Road	37.3527, -79.1890
Lynchburg		Slocum Adhesives Corporation	1409 Buchanan Street	37.4024, -79.1521
Lynchburg		Smith Mountain Industries Inc	1000 Dillard Drive	37.3661, -79.2467
Lynchburg		Tri Tech Laboratories Inc	1000 Robins Rd	37.3981, -79.1412
Lynchburg		Waytec Electronics Corp	1104 Mcconville Rd.	37.3811, -79.2192
Lynchburg		Westover Dairy	2801 Fort Ave	37.3977, -79.1655
Lynchburg		Westrock Converting Company	1801 Concord Turnpike	37.4032, -79.1277
Lynchburg		World Color Procurement Llc (Closed)	4225 Murray Pl	37.3758, -79.1649



# Hazard Identification and Risk Assessment

## Gas transmission and Hazardous Liquid Pipelines in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: PHMSA, US DOT, as of 11/15/2018  
Center for Geospatial Information Technology at Virginia Tech. 12/2019



(Source: PHMSA, US DOT, as of 11/15/2018)

Figure 4-167 Gas transmission and hazardous liquid pipelines in CVPDC Area

### 4.18.1.3 Magnitude/Severity

Unless exempted, facilities that use, manufacture, or store hazardous materials in the United States fall under the regulatory requirements of the Emergency Planning and Community Right to Know Act (EPCRA) of 1986. Under EPCRA regulations, hazardous materials that pose the greatest risk for causing catastrophic emergencies are identified as Extremely Hazardous Substances (EHSs). Releases of EHSs can occur during transport to and from fixed site facilities. Transportation-related releases are generally more troublesome because they may occur anywhere, including close to human populations, critical facilities, or sensitive environmental areas. Transportation-related EHS releases are also more difficult to mitigate due to the variability of locations and distance from response resources.



# Hazard Identification and Risk Assessment

With any hazardous material release, the severity of an incident depends on several extenuating circumstances, including weather conditions, terrain, and compliance (or lack thereof) with codes, type of material released, and response time for emergency personnel. As a general guideline, there are three levels of hazardous materials incidents, ranging from easily contained by local responders to those that require vast amounts of resources (NFPA, 2008).

- Level 1: An incident involving hazardous materials that can be contained, extinguished, and/or abated using resources immediately available to the public sector responders. Level 1 incidents present little risk to the environment and/or public health with containment and cleanup.
- Level 2: An incident that is beyond the capabilities of the first responders on the scene and could be beyond the public sector responders having jurisdiction. Level 2 incidents might require the services of a state or regional response team or other state or federal assistance. This level can pose immediate and long-term risks to environmental and public health.
- Level 3: An incident that is beyond the capabilities of a single state or regional response team and requires additional assistance. Level 3 incidents can require resources from state and federal agencies and private industry. These incidents generally pose extreme, immediate, and/or long-term risks to the environment and public health.

## 4.18.1.4 Previous Occurrences

### Pipeline Incidents

There are 4 documented pipeline incidents in or near CVPDC area, which included two gas transmission incidents and two hazardous liquid transmission incidents (Table 4-158). On November 14, 2008, a gas pipeline explosion and fire occurred in Appomattox that destroyed two homes and injured five people. This incident also brought 1 million dollars PHMSA fine to Williams Transco for safety regulation violations.

94

Table 4-158 Gas transmission and hazardous liquid pipelines incidents in CVPDC Area

Incident	Locality	Date	Released type	Cause	Cost / loss
Gas Transmission	Campbell	1/21/1993	Natural Gas	Construction/Material Defect	73,000
Hazardous Liquid tank leaking	Bedford	11/12/2001	Kerosene	Tank Corrosion	54,000
Gas explosion	Appomattox	9/14/2008	Natural Gas	Pipe Corrosion	N/A
Hazardous Liquid leaking	Charlotte, Va (Near Campbell)	3/31/2010	Refined / Petroleum Product	Natural Force Damage	N/A

### Ground Transportation Incidents

According to the Hazmat transportation incidents report released by the U.S. DOT, Hazmat incidents occurred every year in the CVPDC in the past decade (2009 - 2019), primarily in the City of Lynchburg. The

<sup>94</sup> <http://spectrabusters.org/2014/05/18/williams-transco-explosion-in-appomattox-virginia-2008-11-14/>



# Hazard Identification and Risk Assessment

failures are caused for a variety of reasons including, a derailment, vehicular crash, rollover accident, forklift accident, improper preparation for transportation, and human error. Although no fatalities were reported, those documented incidents brought over 2 million damages (Table 4-159). The most significant incident occurred in 2014, as 16 cars of a 105-car train derailed in downtown Lynchburg and spilled crude oil into the James River. Officials noted that the situation could have been a lot worse had more than one tank car have ruptured and had most of the oil not quickly burned off.<sup>95</sup> The incident would also be worse if it had taken place on a warm, sunny day. There were no people on the trail and sitting on the Depot grille deck.

Table 4-159 Hazmat incidents in CVPDC Area, 2009 -2019

Locality	Date	Mode Of Transportation	Hazardous Class *	Commodity Long Name	Total Damages (\$)
Lynchburg	1/24/2019	Air	3	Resin Solution	0
Lynchburg	7/10/2018	Highway	3	Isopropanol or Isopropyl Alcohol	0
Lynchburg	6/22/2018	Highway	5	Hydrogen Peroxide and Peroxyacetic Acid Mixtures	0
Lynchburg	4/23/2018	Highway	8	Potassium Hydroxide	0
Lynchburg	4/3/2018	Highway	6	Chloroform	\$2,000
Lynchburg	9/11/2017	Highway	3	Paint	\$4,500
Lynchburg	8/23/2016	Highway	3	Paint Related Material	\$3,000
Lynchburg	6/23/2016	Highway	3	Petroleum Products, N.O.S.	\$4,000
Lynchburg	1/28/2016	Highway	8	Potassium Hydroxide	\$2,000
Lynchburg	12/4/2015	Highway	3	Paint	0
Lynchburg	6/30/2015	Highway	8	Corrosive Liquid	0
Lynchburg	6/24/2015	Highway	3	Adhesives	0
Lynchburg	3/15/2015	Rail	9	Sulfur, Molten	\$2,500
Lynchburg	4/30/2014	Rail	3	Petroleum Crude Oil	\$2,280,000
Lynchburg	7/18/2013	Highway	3	Paint Related Material	0
Lynchburg	2/8/2013	Highway	3	Diesel Fuel	\$8,500
Lynchburg	5/23/2012	Highway	3	Paint	0
Lynchburg	3/23/2012	Rail	8	Sodium Hydroxide	0
Lynchburg	7/19/2011	Highway	3	Adhesive	0
Lynchburg	4/12/2011	Highway	3	Gasoline	\$17,000
Lynchburg	6/18/2009	Highway	2	Aerosols	0
Amherst	1/2/2010	Highway	2	Petroleum Gases	\$100,000

(Source: U.S. DOT.<sup>96</sup> See Table 4-156 for USDOT hazardous Class)

<sup>95</sup> [https://www.newsadvance.com/news/local/csx-fined-over-lynchburg-train-derailment-oil-spill/article\\_eb126518-d708-11e4-b163-17911f8b40aa.html](https://www.newsadvance.com/news/local/csx-fined-over-lynchburg-train-derailment-oil-spill/article_eb126518-d708-11e4-b163-17911f8b40aa.html)

<sup>96</sup>

[https://portal.phmsa.dot.gov/analytics/saw.dll?Portalpages&PortalPath=%2Fshared%2FPublic%20Website%20Pages%2F\\_portal%2FHazmat%20Incident%20Report%20Search](https://portal.phmsa.dot.gov/analytics/saw.dll?Portalpages&PortalPath=%2Fshared%2FPublic%20Website%20Pages%2F_portal%2FHazmat%20Incident%20Report%20Search)





# Hazard Identification and Risk Assessment

## 4.18.1.5 Relationship to Other Hazards

In addition to accidental human-caused hazardous material events, natural hazards may cause the release of hazardous materials and complicate response activities. The impact of earthquakes on fixed facilities or pipelines may be particularly serious due to the impairment or failure of the physical integrity of containment facilities. The threat of any hazardous material event may be magnified due to restricted access, reduced fire suppression and spill containment, and even complete cutoff of response personnel and equipment. In addition, the risk of terrorism involving hazardous materials is considered a major threat due to the location of hazardous material facilities and transport routes throughout communities and the frequently limited antiterrorism security at these facilities. Figure 4-168 shows the interrelationship (causation, concurrence, etc.) between this hazard and other hazards discussed in this plan update.

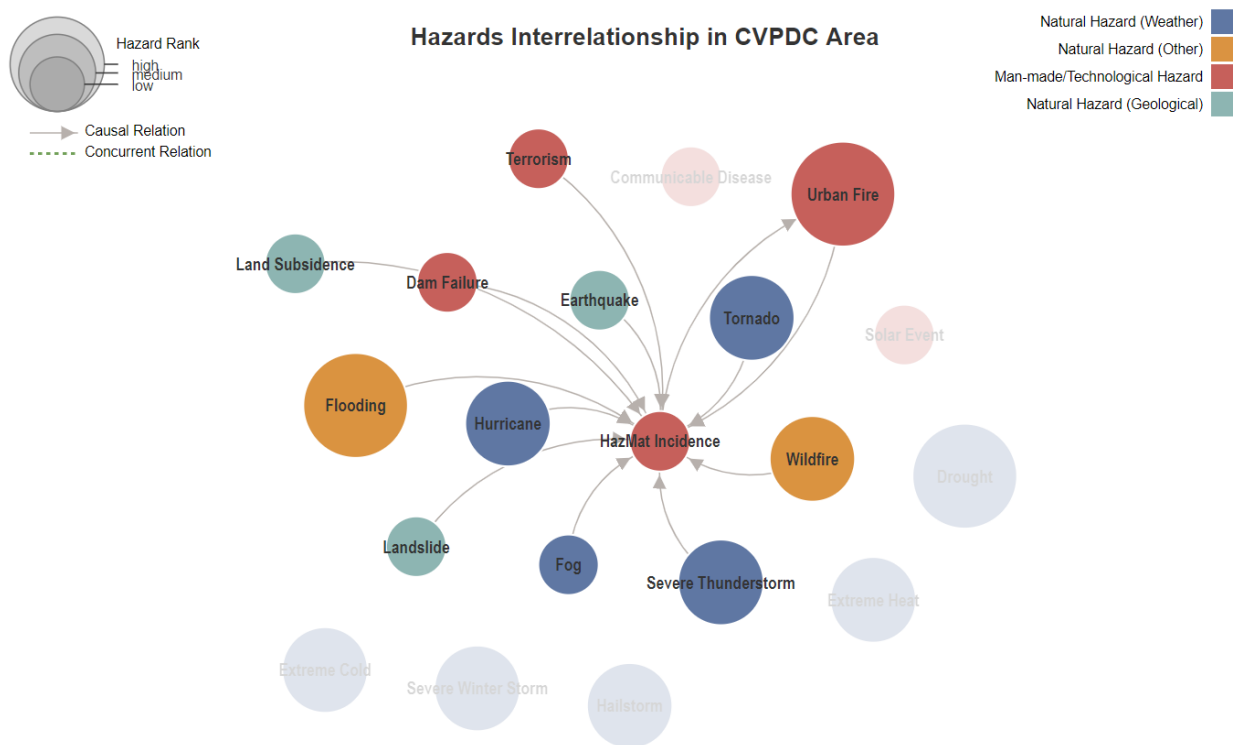


Figure 4-168 Hazards interrelationship

## 4.18.2 Impact & Vulnerability

Most hazardous material releases do not usually have a direct effect on critical facilities and infrastructure. Some critical infrastructure uses hazardous materials to operate such as chlorine for water treatment and PCB's for electric transformers. Similarly, the contamination of the water supply may be treated like a hazardous material release. Propane, oil, and natural gas, necessary fuels for heating, can also be hazardous if released during their delivery due to their explosive potential. Transportation may be limited if a key roadway or railway is blocked by an incident.

A hazardous material release can bring possible losses to structure due to inaccessibility, contamination, and structural and contents losses if an explosion is present; and possible economic losses caused by business closures and associated business disruption losses.



# Hazard Identification and Risk Assessment

A hazardous material release can also include significant environmental impacts, which are listed below.

- Hydrologic effects
  - Surface and groundwater contamination
  - Other effects on water quality such as changes in water temperature
  - Damage to streams, lakes, ponds, estuaries, and wetland ecosystems
- Air and soil quality effects
  - Pollutants, smoke, and dust
  - Loss of Quality in Landscape and Soil Quality
- Damage to plant communities
  - Loss of biodiversity
  - Damage to vegetation
- Damage to animal species
  - Animal fatalities
  - Degradation of wildlife and aquatic habitat
  - Pollution of drinking water for wildlife
  - Loss of biodiversity
  - Disease

## 4.18.3 Risk Assessment and Jurisdictional Analysis

### 4.18.3.1 Mobile HazMat Analysis

The areas along major hazmat transportation networks (including primary highways, railroads and energy pipelines) are considered to be risk-prone with respect to hazmat material ground transportation. In this risk analysis, two size buffers, 0.5 and 1 miles, were created for transportation networks and were assumed in respect to the different levels of impact area – immediate (primary) and secondary. The buffer sizes were adopted from the U.S. DOT 1996 HazMat Routing Guide (Table 4-160). Figure 4-169 and Figure 4-170 show the corridors and buffers of mobile hazardous materials overlaid with population density and critical facilities. Table 4-161 shows potential affected population in these impact areas of mobile hazard analysis. Table 4-162 lists total numbers of critical facilities within potential immediate impact area (0.5-mile transportation buffer) of hazmat release for each jurisdiction.

*Table 4-160 Potential Impact area (buffer size) by HazMat Material Class*

HazMat Class	Impact Area / Buffer size (mile)
Explosives	1.0
Flammable Gas	0.5
Poison Gas	5.0
Flammable/Combustible Liquid	0.5
Flammable Solid; Spontaneously Combustible; Dangerous when Wet	0.5
Oxidizer/Organic Peroxide	0.5
Poisonous, not gas	5.0
Corrosive Material	0.5

(Source: USDOT 1996)



# Hazard Identification and Risk Assessment

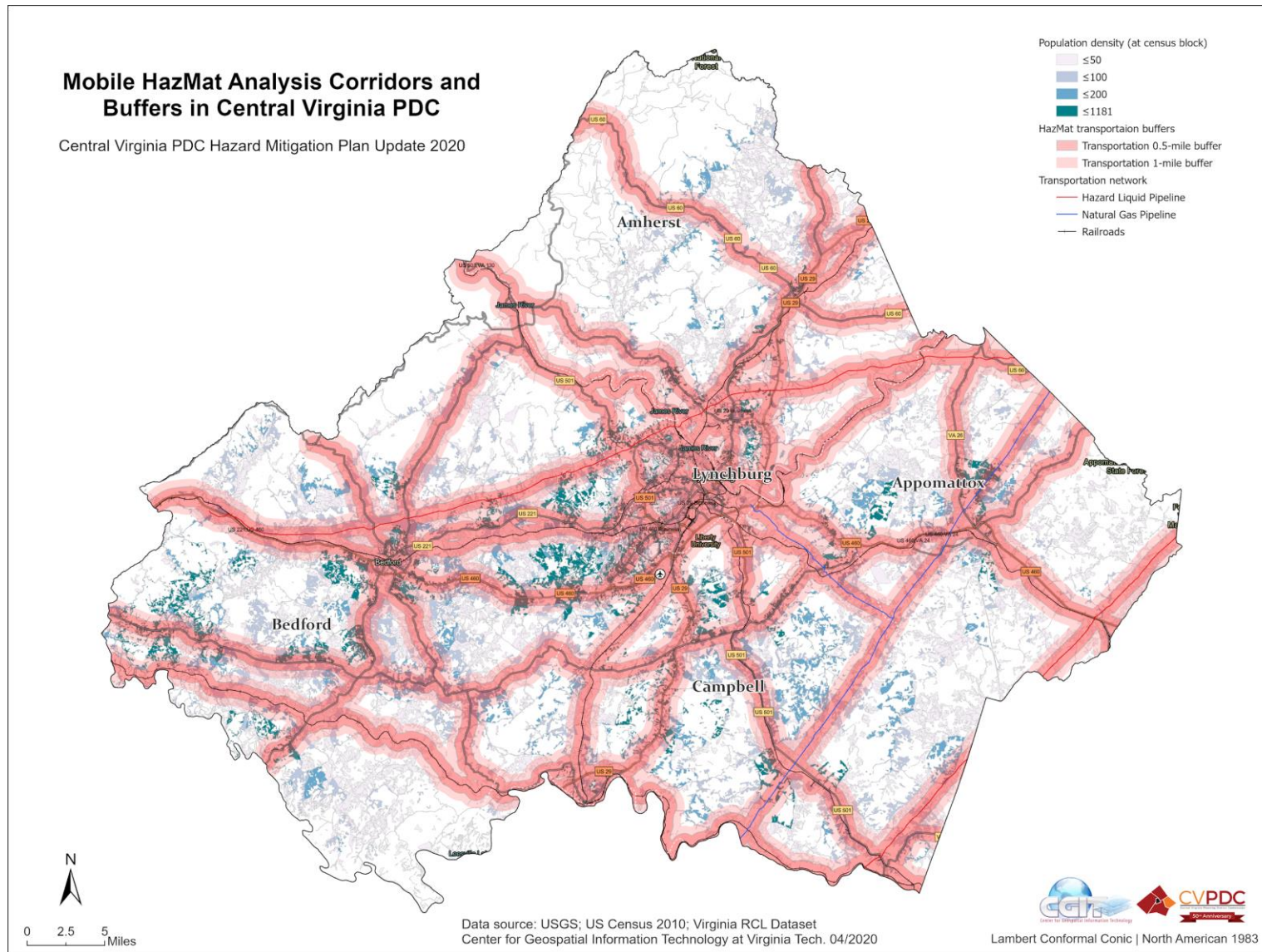


Figure 4-169 Mobile HazMat analysis corridors and buffers in CVPDC Area (overlay with population density)





# Hazard Identification and Risk Assessment

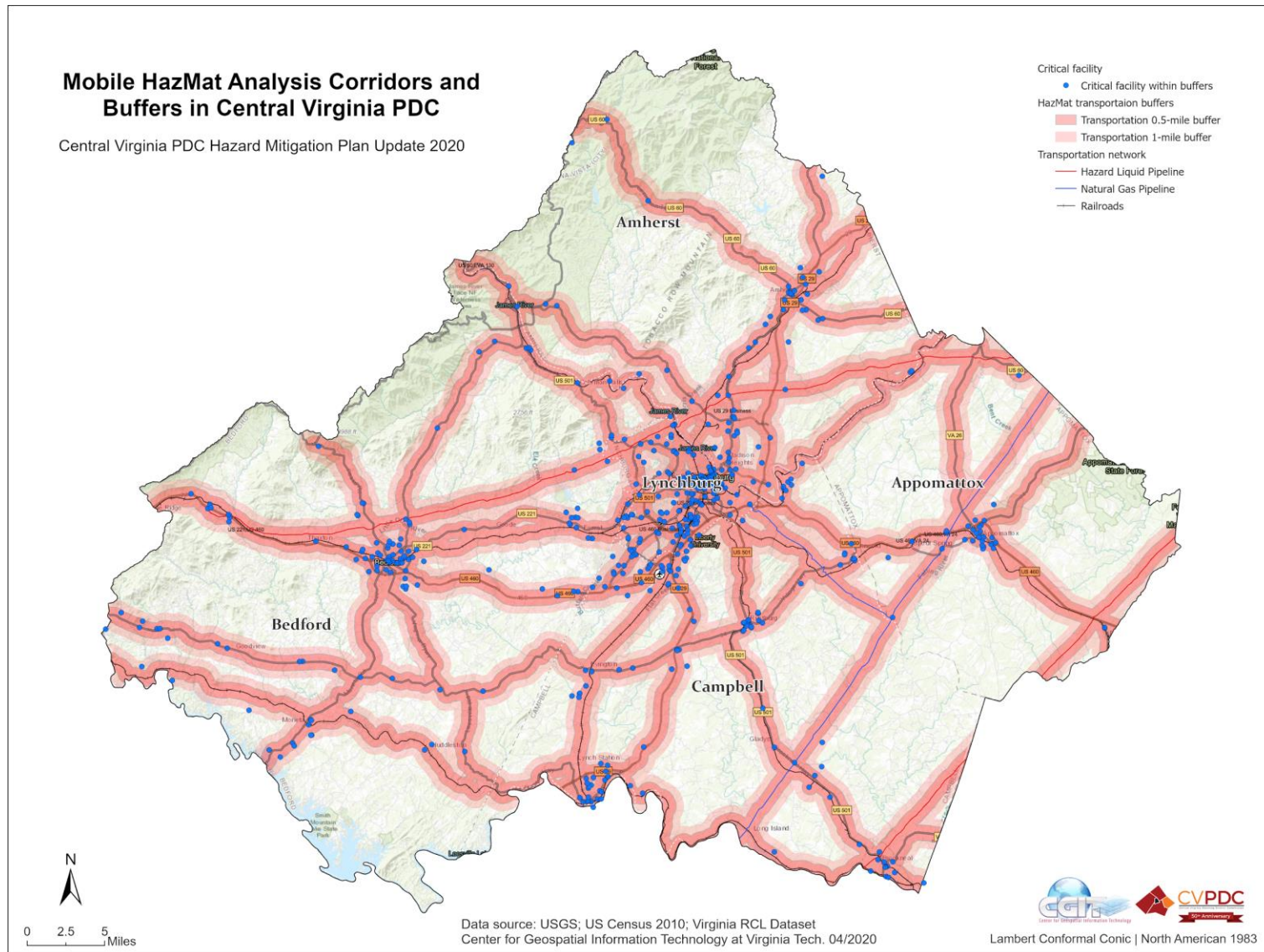


Figure 4-170 Mobile HazMat analysis corridors and buffers in CVPDC Area (overlay with critical facility)





# Hazard Identification and Risk Assessment

*Table 4-161 Potential affected population in impact area of mobile hazmat analysis*

Jurisdiction	Population in immediate impact area (0.5-mile buffer)	Population in secondary impact area (1-mile buffer)
Amherst County	26,311	29,193
Appomattox County	9,730	11,642
Bedford County	49,934	59,765
Campbell County	42,514	50,209
Lynchburg City	71,905	75,528
<b>Total</b>	<b>200,394</b>	<b>226,337</b>

*Table 4-162 Number of critical facilities within potential immediate impact area (0.5-mile transportation buffer) of hazmat release in mobile hazmat analysis*

Critical Facility	Amherst County	Appomattox County	Bedford County	Campbell County	Lynchburg City
Airport	1	1	2	1	1
Attractions	1	1	1	1	7
Campground	3	0	6	0	0
College	1	1	1	0	9
Communication Facility	9	2	2	13	1
Electrical Substation	8	2	8	8	14
Emergency Operations Center	1	1	0	1	1
Energy Facility	2	0	3	1	1
Fire Stations	4	2	12	12	9
Gas Facility	1	1	0	2	1
HazMat Facility	3	2	14	15	25
Law Enforcement	3	2	2	5	5
Public Health	1	0	2	0	4
Schools	12	4	24	19	26
Service Authority	1	0	0	1	0
Sewer Pump Station	1	4	18	16	0
Nursing Home	2	1	5	3	9
Detention Facility	2	1	1	1	2
Wastewater Treatment Plant	3	1	3	7	1
Water Storage Facility	6	3	5	17	7
Water Booster Pump Station	0	1	2	2	0
Historic Site	0	0	0	12	0
Large Population Venue	0	0	0	1	3
Cooling Center	0	0	0	0	2
Transportation Hub	0	0	0	0	1
<b>Total Count</b>	<b>65</b>	<b>30</b>	<b>111</b>	<b>138</b>	<b>129</b>



# Hazard Identification and Risk Assessment

## **4.18.3.2 Fixed HazMat Analysis**

In fixed hazmat site analysis, the georeferenced EPA TRI toxic sites were analyzed and the circle buffers are drawn around each hazardous material site. The same buffer sizes, 0.5 and 1 miles are used to represent immediate and secondary impact areas. Figure 4-171 displays the fixed hazmat analysis locations and buffers in CVPDC, overlaid with population density at census block level. Table 4-163 shows potential affected population in these impact areas.

Figure 4-172 displays the impact area of fixed hazmat facilities in the City of Lynchburg. A network of six turnpikes, the James River, and three railroads have made the City of Lynchburg an important transportation hub for the CVPDC area. Over two dozen HazMat facilities (accounting for 42% of total HazMat facilities in CVPDC) are situated here (Table 4-164). Such unique characteristics makes the city at particular high risk of HazMat release incidents.



# Hazard Identification and Risk Assessment

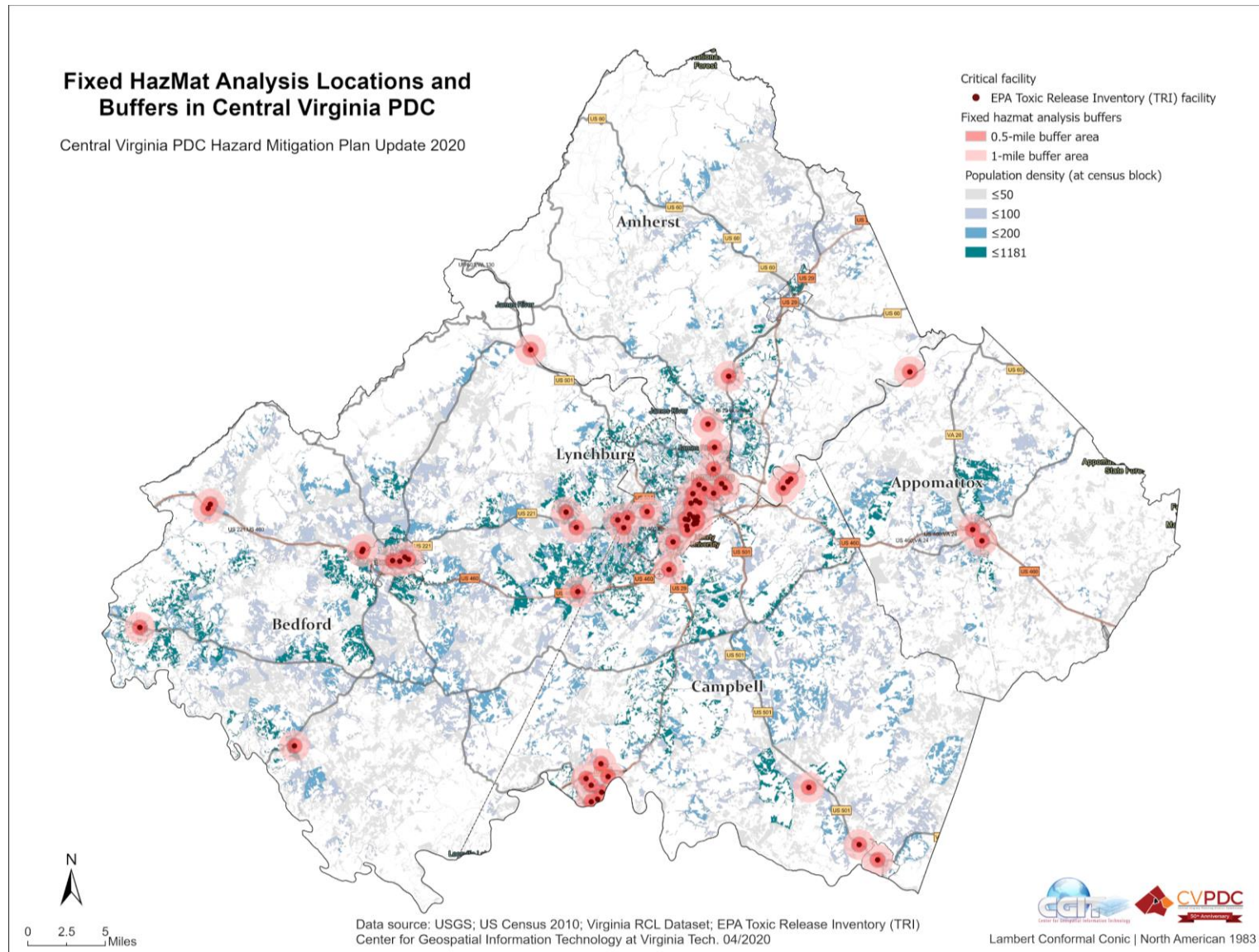


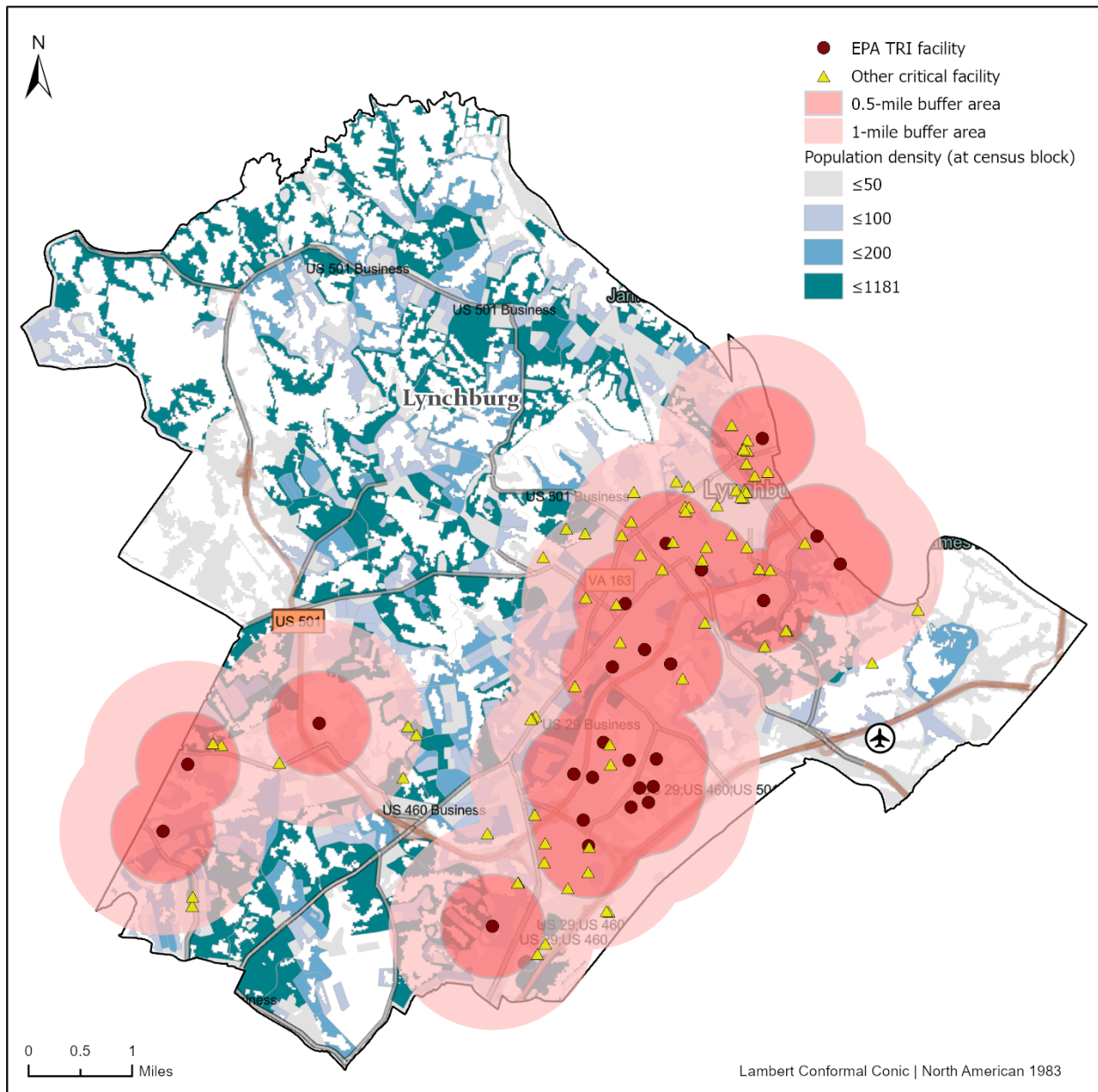
Figure 4-171 Fixed hazmat analysis locations and buffers in CVPDC Area (overlay with population density)



# Hazard Identification and Risk Assessment

## Fixed HazMat Analysis Locations and Buffers in City of Lynchburg

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: USGS; US Census 2010; Virginia RCL Dataset; EPA Toxic Release Inventory (TRI)  
Center for Geospatial Information Technology at Virginia Tech. 04/2020



Figure 4-172 Fixed hazmat analysis locations and buffers in City of Lynchburg





# Hazard Identification and Risk Assessment

Table 4-163 Potential affected population in impact areas of fixed hazmat analysis

Jurisdiction	Population in immediate impact area (0.5-mile buffer)	Population in secondary impact area (1-mile buffer)
Amherst County	6,169	6,169
Appomattox County	3,602	3,602
Bedford County	21,043	21,077
Campbell County	9,558	9,558
Lynchburg City	48,982	48,982
Total	89,354	89,388

Table 4-164 Critical facilities within potential immediate impact area (0.5-mile round buffer) of fixed hazmat analysis

Jurisdiction	Facility Type	Facility Name	Location	Coordinates
Amherst	Fire Stations	Greif Brothers Packaging Corporation - Riverville Mill Fire Brigade And Emergency Medical Services	861 Fibre Plant Road	37.5120, -78.9083
Appomattox	College	Central Virginia Community College - Appomattox Center		37.3611, -78.8292
Appomattox	Emergency Operations Center	Appomattox County Emergency Operations Center	339 Court Street	37.3559, -78.8296
Appomattox	Law Enforcement	Appomattox County Sheriffs Office / Appomattox County Jail	179 Morton Lane	37.3555, -78.8307
Appomattox	Schools	Appomattox Middle	2020 Church Street	37.3558, -78.8254
Appomattox	Schools	Appomattox Primary	185 Learning Lane	37.3594, -78.8340
Appomattox	Sewer Pump Station	Pump Station	419 Jones St, Appomattox, Va 24522	37.3656, -78.8299
Appomattox	Sewer Pump Station	Pump Station	State Rte 1036, Appomattox, Va 24522	37.3481, -78.8272
Appomattox	Sewer Pump Station	Sewer Pump Station	7901 Richmond Hwy, Appomattox, Va 24522	37.3662, -78.8433
Appomattox	Nursing Home	Appomattox Health & Rehabilitation Center	215 Evergreen Avenue	37.3466, -78.8254
Appomattox	Detention Facility	Appomattox County Jail	179 Morton Lane	37.3555, -78.8308
Bedford	College	Central Virginia Community College - Bedford Center		37.3446, -79.4987
Bedford	Communication Facility	Wslk - Am - Smile Broadcasting, LLC		37.1647, -79.6343



# Hazard Identification and Risk Assessment

Jurisdiction	Facility Type	Facility Name	Location	Coordinates
Bedford	Electrical Substation	Electrical Substation		37.3356, -79.5225
Bedford	Electrical Substation	Electrical Substation		37.3334, -79.5123
Bedford	Electrical Substation	Electrical Substation		37.3401, -79.5042
Bedford	Energy Facility	Georgia-Pacific Big Island Plant	9363 Lee Jackson Highway	37.5351, -79.3573
Bedford	Fire Stations	Bedford Fire Department	315 Bedford Avenue	37.3365, -79.5242
Bedford	Fire Stations	Big Island Volunteer Fire Department Incorporated	10770 Lee Jackson Highway	37.5346, -79.3606
Bedford	Fire Stations	Montvale Volunteer Fire Department	1271 Volunteer Road	37.3850, -79.7305
Bedford	Law Enforcement	Bedford Police Department	215 East Main Street	37.3342, -79.5213
Bedford	Law Enforcement	Virginia State Police Division 6 Area 41 - Bedford	874 Blue Ridge Avenue	37.3377, -79.5496
Bedford	Public Health	Surgery Center Of Central Virginia	1835 Graves Mill Road	37.3773, -79.2442
Bedford	Schools	Bedford Middle	503 Longwood Avenue	37.3394, -79.5217
Bedford	Schools	Forest Elementary	1 Scholar Lane	37.3757, -79.3079
Bedford	Schools	Forest Middle	100 Ashwood Drive	37.3693, -79.3096
Bedford	Schools	New London Academy Elementary	12400 East Lynchburg-Salem Turnpike	37.3066, -79.3056
Bedford	Sewer Pump Station	Pump Station #3		37.3388, -79.4941
Bedford	Sewer Pump Station	Pump Station #9		37.3412, -79.5171
Bedford	Nursing Home	Campbell Rest Home	1350 Longwood Ave	37.3446, -79.5075
Bedford	Nursing Home	Runk & Pratt Of Forest Inc.	208 Gristmill Road	37.3758, -79.2467
Bedford	Detention Facility	Bedford Adult Detention Center	1000 Broad St	37.3375, -79.5083
Bedford	Wastewater Treatment Plant	Bedford Wastewater Treatment Plant	852 Orange St	37.3336, -79.5067
Bedford	Water Storage Facility	Cascade Forest Lt 14 B-2 Water Tank	Cascade Forest Lt 14 B-2	37.2786, -79.8101
Campbell	Airport	Lynchburg Rgnl/Preston Glenn Fld Airport		37.3254, -79.2012



# Hazard Identification and Risk Assessment

Jurisdiction	Facility Type	Facility Name	Location	Coordinates
Campbell	Attractions	Avoca Museum	1514 Main St, Altavista, Va 24517	37.1300, -79.2697
Campbell	Communication Facility	Wkde - Am - D.J. Broadcasting, Inc.,		37.1225, -79.2890
Campbell	Electrical Substation	Electrical Substation		37.4043, -79.0595
Campbell	Energy Facility	Altavista Power Station	104 Wood Lane, Altavista	37.1188, -79.2735
Campbell	Fire Stations	Altavista Fire Company	1280 Main Street, Altavista	37.1199, -79.2755
Campbell	Fire Stations	Bwx Technologies Nuclear Operations Division Emergency Team	1570 Mount Athos Road	37.4006, -79.0568
Campbell	Fire Stations	Lynchburg Regional Airport Aircraft Rescue Fire Fighting	984 Airport Road	37.3289, -79.2016
Campbell	Historic Site	Mount Athos	General Location	37.4057, -79.0501
Campbell	Large Population Venue	Altavista Area Ymca Family Center	1000 Franklin Ave, Altavista, Va 24517	37.1140, -79.2889
Campbell	Law Enforcement	Altavista Police Department	510 7Th Street, Altavista	37.1103, -79.2899
Campbell	Law Enforcement	Lynchburg Regional Airport Police Department	4308 Wards Road	37.3304, -79.1938
Campbell	Schools	Altavista Elementary	1003 Lynch Mill Road	37.1324, -79.2831
Campbell	Schools	Brookneal Elementary	133 Charlotte Street	37.0521, -78.9443
Campbell	Sewer Pump Station	Sheetz Pump Station	601	37.3254, -79.1924
Campbell	Nursing Home	Autumn Care Of Altavista	1317 Lola Avenue	37.1240, -79.2881
Campbell	Wastewater Treatment Plant	Altavista Wastewater Plant	Ln Access Rd, Altavista	37.1123, -79.2740
Campbell	Wastewater Treatment Plant	Altavista Water Treatment Plant	20 Ricky Van Shelton Dr, Hurt, Va 24563	37.1045, -79.2833
Campbell	Water Storage Facility	Altavista Water Tower	Tardy Mtn Rd And Dearingford Rd	37.1437, -79.2665
Campbell	Water Storage Facility	Water Tank	Melinda Drive	37.1270, -79.2904
Campbell	Water Storage Facility	Water Tank	Clarion Road	37.1382, -79.2685
Campbell	Water Storage	Water Tank #2	Melinda Drive	37.1271,



# Hazard Identification and Risk Assessment

Jurisdiction	Facility Type	Facility Name	Location	Coordinates
	Facility			-79.2903
Lynchburg	Attractions	Amazement Square Child Museum	27 9Th St	37.4162, -79.1403
Lynchburg	Attractions	Ann Spencer House & Garden Museum	1313 Pierce St	37.4038, -79.1520
Lynchburg	Attractions	Point Of Honor Museum	112 Cabell St	37.4206, -79.1439
Lynchburg	College	Central Virginia Community College		37.3589, -79.1844
Lynchburg	College	Sylvain Melloul International Hair Academy		37.3644, -79.1797
Lynchburg	Electrical Substation	Electrical Substation		37.3754, -79.1681
Lynchburg	Electrical Substation	Electrical Substation		37.3873, -79.1555
Lynchburg	Electrical Substation	Electrical Substation		37.4062, -79.1339
Lynchburg	Electrical Substation	Electrical Substation		37.4194, -79.1447
Lynchburg	Electrical Substation	Electrical Substation		37.4192, -79.1439
Lynchburg	Electrical Substation	Electrical Substation		37.4194, -79.1446
Lynchburg	Electrical Substation	Electrical Substation		37.3617, -79.1798
Lynchburg	Electrical Substation	Electrical Substation		37.4093, -79.1644
Lynchburg	Emergency Operations Center	Lynchburg City Emergency Communication Center	3621 Candler's Mountain Road	37.3638, -79.1720
Lynchburg	Fire Stations	Lynchburg Fire Department Station 2 - Grace Street	2006 Grace Street	37.4025, -79.1400
Lynchburg	Fire Stations	Lynchburg Fire Department Station 6 - Miller Park	2084 Fort Avenue	37.4026, -79.1590
Lynchburg	Fire Stations	R R Donnelley Incorporated Fire Brigade	4201 Murray Place	37.3782, -79.1683
Lynchburg	Large Population Venue	Academy Center Of The Arts	600 Main St, Lynchburg, Va 24504	37.4174, -79.1441
Lynchburg	Large Population Venue	City Stadium	3176 Fort Ave, Lynchburg, Va 24501	37.3924, -79.1664
Lynchburg	Law Enforcement	Babcock And Wilcox Police Department	800 Main Street	37.4156, -79.1427
Lynchburg	Law	Central Virginia Community	3506 Wards Road	37.3589,





# Hazard Identification and Risk Assessment

Jurisdiction	Facility Type	Facility Name	Location	Coordinates
	Enforcement	College Police		-79.1845
Lynchburg	Law Enforcement	Liberty University Police Department	1971 University Boulevard	37.3581, -79.1757
Lynchburg	Public Shelter - Cooling Center	Salvation Army	2215 Park Ave, Lynchburg, Va 24501	37.4047, -79.1628
Lynchburg	Schools	Crossroads / Single Point Of Entry	405 Cabell Street	37.4227, -79.1467
Lynchburg	Schools	E.C. Glass High	2111 Memorial Avenue	37.4074, -79.1660
Lynchburg	Schools	Fort Hill Community School	1350 Liggates Road	37.3863, -79.1744
Lynchburg	Schools	Liberty Christian Academy	100 Mountain View Road	37.3603, -79.1722
Lynchburg	Schools	Lynchburg Day Services	1517 Jackson Street	37.4057, -79.1441
Lynchburg	Schools	Lynchburg Juvenile Detention Home	1400 Florida Avenue	37.3940, -79.1373
Lynchburg	Schools	New Vistas School	520 Eldon St	37.3987, -79.1724
Lynchburg	Schools	Paul Laurence Dunbar Middle For Innovation	1208 Polk Street	37.4074, -79.1467
Lynchburg	Schools	Robert S. Payne Elementary	1201 Floyd Street	37.4057, -79.1512
Lynchburg	Schools	T.C. Miller Elementary For Innovation	600 Mansfield Avenue	37.3978, -79.1670
Lynchburg	Schools	William M. Bass Elementary	1730 Seabury Avenue	37.3918, -79.1410
Lynchburg	Nursing Home	Bentley Commons At Lynchburg	1604 Graves Mill Road	37.3782, -79.2364
Lynchburg	Nursing Home	Guggenheimer Health And Rehab Center	1902 Grace Street	37.4026, -79.1419
Lynchburg	Nursing Home	Heritage Green Assisted Living	201 Lillian Lane	37.3785, -79.2379
Lynchburg	Nursing Home	Lynchburg Health & Rehabilitation Center	5615 Seminole Avenue	37.3684, -79.1815
Lynchburg	Detention Facility	Lynchburg Regional Juvenile Detention Center	1400 Florida Ave	37.3940, -79.1371
Lynchburg	Transportation Hub	Kemper Street Station	825 Kemper St	37.4065, -79.1571
Lynchburg	Water Storage Facility	Ground Storage Tank, 1,400,000 Gallon	525 Taylor Street	37.4114, -79.1549
Lynchburg	Water Storage Facility	Ground Storage Tank, 4,500,000 Gallon	525 Taylor Street	37.4107, -79.1548
Lynchburg	Water Storage Facility	Reservoir 10,500,000 Gallon	525 Taylor Street	37.4113, -79.1542



# Hazard Identification and Risk Assessment

## 4.18.4 Probability of Future Occurrences

Based on the frequency of historical incidents of pipeline and ground transportation hazmat release in the CVPDC area, hazmat release hazard is highly likely to occur, meaning that an event is probable within the next year.

## 4.18.5 References

- Ale Rohr. *CSX fined over Lynchburg train derailment, oil spill*. [www.newsadvance.com](http://www.newsadvance.com). March 30, 2015. [https://www.newsadvance.com/news/local/csx-fined-over-lynchburg-train-derailment-oil-spill/article\\_eb126518-d708-11e4-b163-17911f8b40aa.html](https://www.newsadvance.com/news/local/csx-fined-over-lynchburg-train-derailment-oil-spill/article_eb126518-d708-11e4-b163-17911f8b40aa.html). (Accessed on June 18, 2019)
- FEMA. *Fact Sheet - Hazardous Materials*. June 2007. [https://www.fema.gov/media-library-data/20130726-1622-20490-9118/hazardousmaterialsfactsheet\\_final.pdf](https://www.fema.gov/media-library-data/20130726-1622-20490-9118/hazardousmaterialsfactsheet_final.pdf)
- Local Emergency Planning Committee of Lynchburg, Virginia. *Lynchburg Hazardous Materials Commodity Flow Study*. August 2017. <http://www.lynchburgva.gov/sites/default/files/COFILES/Emergency-Services/Documents/Lynchburg%20HMCFS%20Report-Final%20September%202017.pdf>
- U. S. Department of Transportation. *Highway Routing of Hazardous Materials: Guidelines for Applying Criteria*. (Publication No. FHWA-HI-97-003). November 1996. page 33
- White Pine and Eureka County, Nevada. *Multi-Jurisdictional Hazard Mitigation Plan*. 2019. <http://www.co.eureka.nv.us/public/Draft%20MultiJurisdictional%20Hazard%20Mitigation%20Plan%201.11.19.pdf>



# Hazard Identification and Risk Assessment

## 4.19 Urban Fire / Conflagration

### 4.19.1 Hazard Profile

An urban fire involves a structure or property within an urban or developed area. For hazard mitigation purposes, major urban fires involving large buildings and/or multiple properties are of primary concern. The effects of a major urban fire include minor to significant property damage, loss of life, and residential or business displacement. Explosions are extremely rapid releases of energy that usually generate high temperatures and often lead to fires. The risk of severe explosions can be reduced through careful management of flammable and explosive hazardous materials.

Urban areas defined by the US Census Bureau represent densely developed territory, and encompass residential, commercial, and other non-residential urban land uses. As defined, an urban area comprises a densely settled core of census tracts and/or census blocks that meet minimum population density requirements, along with adjacent territory containing non-residential urban land uses, as well as territory with low population density included to link outlying densely settled territory with the densely settled core. The Census Bureau identifies two types of urban areas: (a) Urbanized Areas (UAs) of 50,000 or more people; and (b) Urban Clusters (UCs) of at least 2,500 and less than 50,000 people. There are three urban areas identified in the CVPDC area: Lynchburg urbanized area, Bedford urban cluster, and Altavista urban cluster (US Census Bureau).<sup>97</sup>

#### 4.19.1.1 Geographic Location/ Extent

Three urban areas occur within the CVPDC area. The City of Lynchburg is located at the center of the surrounding four counties that comprise the area and is significantly the largest urban area. The current population is approximately 82,000 and has a density of 1,677 people per square mile (World Population Review).<sup>98</sup> The other two classified urban areas include the Town of Bedford with a population of approximately 6,600 and the Town of Altavista with a population of approximately 3,400.

#### 4.19.1.2 Magnitude/ Severity

In general, the extensive networks of roads and streets coupled with the number of local fire departments should provide swift access to fire events. It is anticipated that blockage by damage, debris, and operations will be localized and temporary. However, urban fires have the potential to cause extensive damage to residential, commercial, or public property. Damage ranges from minor smoke and/or water damage to the destruction of buildings. People are often displaced for several months to years, depending on the magnitude of the event. Urban fires and explosions can also cause injuries and death. In Virginia, the fire mortality rate is approximately 2.4 deaths and 15.4 injuries per 1,000 fires. This is slightly higher than the national average of 2.3 deaths and 9.3 injuries per 1,000 fires (NFIRS/FEMA).<sup>99</sup> In the most serious urban fire events, the extreme heat of a fire event can damage the underlying infrastructure such as a bridge or tall building.

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<sup>97</sup> 2010 Census Urban and Rural Classification and Urban Area Criteria. <https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural/2010-urban-rural.html>

<sup>98</sup> World Population Review. <http://worldpopulationreview.com/us-cities/lynchburg-va-population/>

<sup>99</sup> Virginia fire loss/fire department profile. NFIRS/FEMA. <https://www.usfa.fema.gov/data/statistics/states/virginia.html>



# Hazard Identification and Risk Assessment

## 4.19.1.3 Previous Occurrences

Urban fire events occur daily across the CVPDC area. The Virginia Department of Forestry provided fire statistics recorded in Virginia Fire Incident Reporting System (VFIRS) from January 2008 to December 2018 for the area. The report contains incident type, rescue calls, severe weather, false calls, casualty summary, and fire dollar loss, etc. Table 4-165 is a summary of the VFIRS fire statistics regarding urban fire for the CVPDC area.

Table 4-165 Urban Fire Incidents in CVPDC Area, 2008 - 2018.

Locality	Total Fires	Total Building Fires	Total Rescue Calls	Total Fire Loss (\$)	Civilian Injuries	Civilian Deaths
Amherst	1,385	464	1,964	11,191,292	19	5
Appomattox	518	156	312	4,401,300	0	7
Bedford	2,929	1,062	18,529	28,829,159	54	40
Campbell	2,416	771	5,163	24,306,613	9	18
Lynchburg	3,221	1,289	105,995	24,844,265	86	15
<b>Total</b>	<b>10,469</b>	<b>3,742</b>	<b>131,963</b>	<b>93,572,629</b>	<b>168</b>	<b>85</b>

(Source: Virginia Department of Forestry, Virginia Fire Incident Reporting System)

## 4.19.1.4 Relationship to Other Hazards

Urban fires often begin as a result of other hazards—particularly storms, lightning strikes, drought, transportation accidents, hazardous materials releases, criminal activity (arson), and terrorism. Figure 4-173 shows the interrelationship (causation, concurrence, etc.) between this hazard and other hazards discussed in this plan update.





# Hazard Identification and Risk Assessment

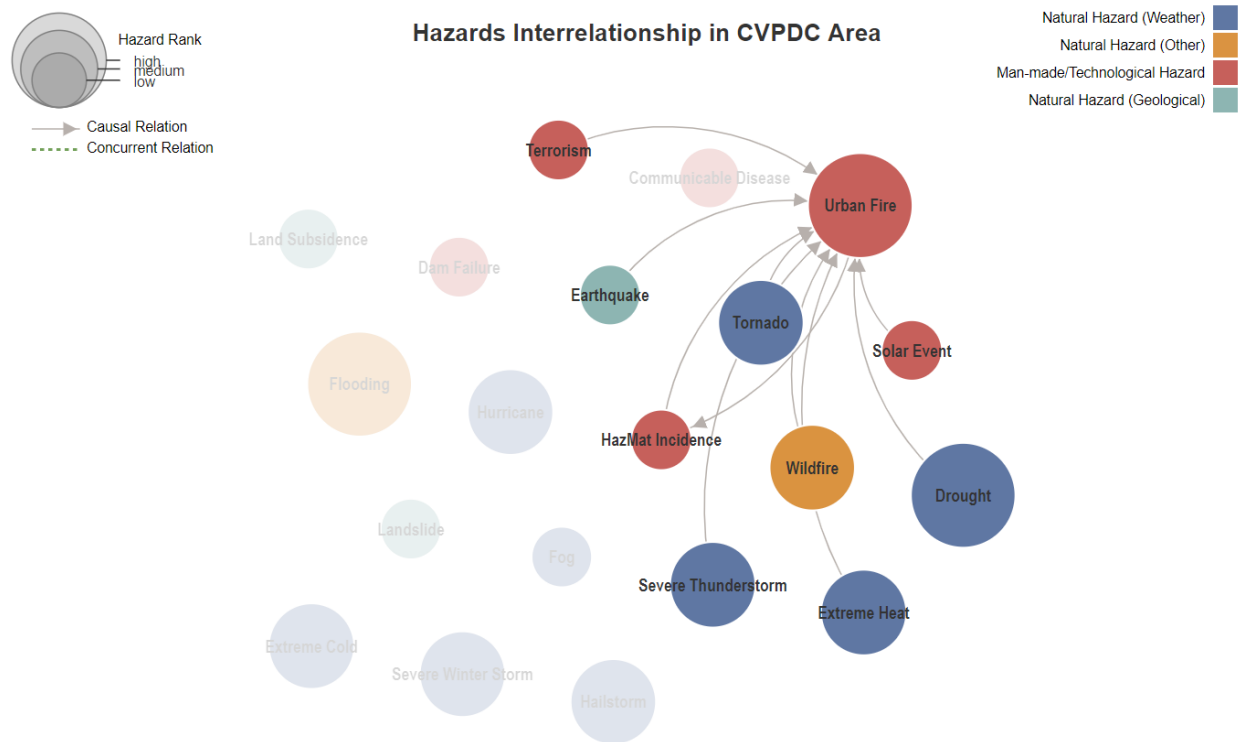


Figure 4-173 Hazards interrelationship

## 4.19.2 Impact and Vulnerability

In the United States, fires cause over 3,000 deaths and approximately 16,000 civilian injuries each year. In 2017, fires in residential structures were responsible for 2,630 deaths and 10,600 injuries, accounting for 77% of all fire deaths and 72% of all injuries (NFPA, 2018). In the CVPDC region, there were 3,742 structural fire incidents, causing 85 civilian deaths and 168 injuries from 2008 to 2018 (Table 4-165).

## 4.19.3 Risk Assessment and Jurisdictional Analysis

Urban fires tend to occur in denser, more urbanized areas like the City of Lynchburg and most often in residential structures. Furthermore, urban fires are a more significant threat in areas of the region with a significant proportion of old buildings, especially those constructed before 1973, which used less restrictive fire protection systems or fire resistance materials.

In 1973, §36-98 Code of Virginia became effective directing the promulgation of the Uniform Statewide Building Code (USBC) which superseded the Virginia Fire Safety Regulations (VFSR) for new construction. According to Virginia's current building and fire codes, an existing building is required to be maintained in accordance with the building code that was in effect at the time the building was constructed and with the requirements of any applicable maintenance provisions of Virginia's fire code. This means that many



# Hazard Identification and Risk Assessment

conditions identified in an older building that may not be in full compliance with today's codes are acceptable because these conditions were okay at the time the building was constructed.

## *History of Virginia Public Building Safety Regulations*

<b>Date</b>	<b>Event</b>
<i>April 12, 1949</i>	<i>Virginia Fire Hazards Law adopted, Title 27, Chapter 6, art. 2, Code of Virginia</i>
<i>December, 1953</i>	<i>First printing of Virginia Fire Safety Regulations (VFSR) adopted by State Corporation Commission</i>
<i>May 24, 1967</i>	<i>VFSR amended</i>
<i>September 1, 1973</i>	<i>Uniform Statewide Building Code (USBC) adopted by Board of Housing &amp; Community Development (BHCD). USBC supersedes VFSR for new construction.</i>
<i>January 15, 1979</i>	<i>VFSR amended</i>
<i>1981</i>	<i>Virginia Fire Safety Law amended, renamed to Virginia Public Building Safety Law. It requires buildings built after 1973 be maintained in accordance with fire safety provisions of the USBC</i>
<i>July 5, 1982</i>	<i>VFSR amended, Title changed to Virginia Public Building Safety Regulations (VPBSR); Added Part 3.</i>
<i>March 31, 1986</i>	<i>Virginia Fire Hazards Law is repealed. Virginia Statewide Fire Prevention Code Act, Title 27, Section 94-101, Code of Virginia is adopted. Creates Virginia Statewide Fire Prevention Code. (VSFPC)</i>
<i>March 1, 1988</i>	<i>VSFPC 1987 edition is adopted by BHCD. First edition of VSFPC includes an edited version of VPBSR in Addendum A.</i>

<http://www.vafire.com/content/uploads/2017/02/Virginia-Fire-Safety-Regulations.pdf>

Figure 4-174 shows the distribution of old buildings built before 1973 in three urban areas of the PDC area. A darker color pixel indicates more buildings that exist within a 10 acres land area, which represents an area that is at higher risk of urban fire occurrence. Table 4-166 provides the total number of old buildings within each urban area. Table 4-167 is the list of critical facilities constructed before 1973 in these urban areas. The location of fire and rescue stations are overlaid on top of the density map of these old buildings and facilities to identify gaps in fire service coverage (Figure 4-175). Based on this map, areas at high risk of urban fire in three urban areas are well covered by fire service.

*Table 4-166 Statistics of old buildings (constructed before 1973) by jurisdiction in CVPDC Area*

<b>Urban Jurisdiction</b>	<b>A: Total buildings *</b>	<b>B: Total buildings (with known year-of-built)</b>	<b>C: Old buildings (built before 1973)</b>	<b>Ratio C/A</b>	<b>Ratio C/B</b>
Lynchburg Urban Area	50,960	41,862	25,042	49.1%	59.8%
Bedford Urban Cluster	3,250	2,428	1,546	47.6%	63.7%



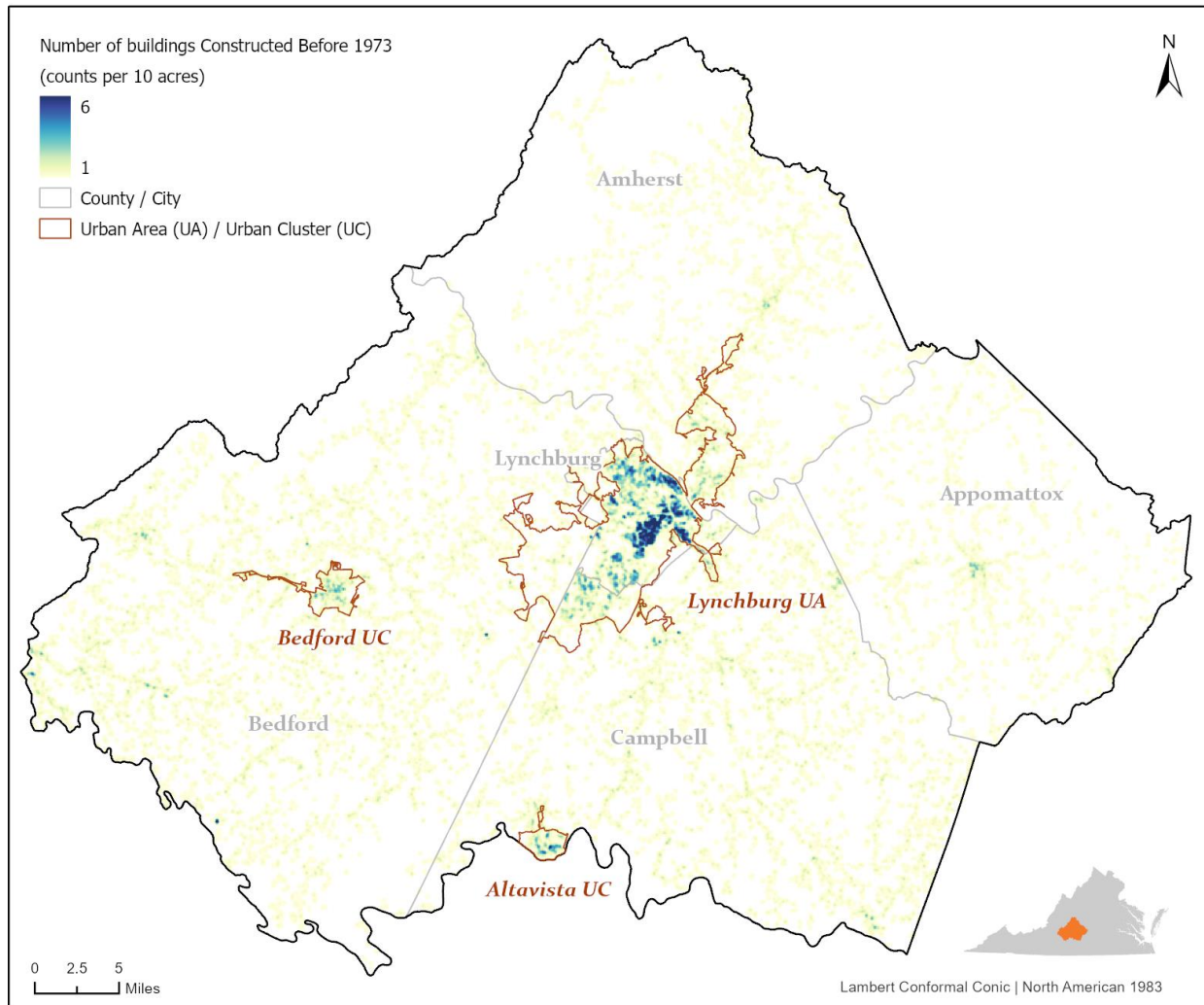
# Hazard Identification and Risk Assessment

Altavista Urban Cluster	2,327	1,554	1,165	50.1%	75.0%
CVPDC	175,860	135,751	65,649	37.3%	48.4%

(\* Only the primary structure in each parcel is considered; Building information derives from parcel data of each locality, some structures have missing or invalid year-of-built information.)

## Distribution of Old Buildings (Constructed Before 1973) in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Density map of buildings constructed before 1973 in Central Virginia PDC. Darker color represents more buildings exist within a 10 acres land area. Urban fires are a more significant threat in areas of the region with a significant proportion of buildings built before 1973.

Data source: Locality parcel GIS data; Lynchburg eTRACK system; 2010 Census Urban Area  
Center for Geospatial Information Technology at Virginia Tech. 04/2020



Figure 4-174 Distribution of old buildings (constructed before 1973) in CVPDC Area

Table 4-167 Critical facilities constructed before 1973 in Urban areas of CVPDC Area

Locality	Facility Name	Facility Type	Location	Coordinates
Amherst	Sweet Briar College	College	Sweet Briar	37.5563, -79.0797
Amherst	Wamv - Am - Community First	Communication		37.5397, -79.0917



# Hazard Identification and Risk Assessment

Locality	Facility Name	Facility Type	Location	Coordinates
	Broadcasters, Inc.	Facility		
Amherst	Wbrg - Am - Tri-County Broadcasting, Inc.	Communication Facility		37.4208, -79.1152
Amherst	W283Az - Fx - Brent Epperson	Communication Facility		37.4208, -79.1152
Amherst	Wrmv-Lp - FI - Fellowship Community Church And Christian Schools	Communication Facility		37.4201, -79.1317
Amherst	Solid Rock Baptist Church	Schools	131 Old Colony Rd	37.4200, -79.1220
Amherst	Central Virginia Training Center	Schools	521 Colony Road	37.4155, -79.1196
Amherst	Amherst County Service Authority Water Office	Service Authority	St Rt 675	37.4313, -79.1229
Bedford	Bedford Fire Department	Fire Stations	315 Bedford Avenue	37.3365, -79.5242
Bedford	Sam Moore Furniture Llc	HazMat Facility	1556 Dawn Dr	37.3388, -79.5035
Bedford	Gran Tee Investments	HazMat Facility	906 Adams St.	37.3350, -79.5093
Bedford	Bedford Police Department	Law Enforcement	215 East Main Street	37.3342, -79.5213
Bedford	Bedford Memorial Hospital	Public Health	1613 Oakwood Street	37.3513, -79.5172
Bedford	Bedford Middle	Schools	503 Longwood Avenue	37.3394, -79.5217
Bedford	Bedford Primary	Schools	807 College Street	37.3407, -79.5320
Bedford	Forest Elementary	Schools	1 Scholar Lane	37.3757, -79.3079
Bedford	Pump Station #9	Sewer Pump Station		37.3412, -79.5171
Bedford	Pump Station #4	Sewer Pump Station		37.3501, -79.5097
Bedford	Pump Station #8	Sewer Pump Station		37.3537, -79.5212
Bedford	Bedford Adult Detention Center	Detention Facility	1000 Broad St	37.3375, -79.5083
Campbell	Lynchburg Rgnl/Preston Glenn Fld Airport	Airport		37.3254, -79.2012
Campbell	Lynchburg Regional Airport Aircraft Rescue Fire Fighting	Fire Stations	984 Airport Road	37.3289, -79.2016
Campbell	Bgf Industries	HazMat Facility	401 Amherst Avenue, Altavista	37.1122, -79.2782
Campbell	Banker Steel Co Llc	HazMat Facility	351 Rangoon Rd	37.3269, -79.1939
Campbell	Schrader-Bridgeport International	HazMat Facility	205 Frazier Rd	37.1253, -79.2856
Campbell	Federal Hill	Historic Site	724 Turkey Foot Rd	37.3106, -79.2837
Campbell	Grove Plantation	Historic Site	151 Closeburn Manor Dr	37.3111, -79.2691
Campbell	Altavista Area Ymca Family Center	Large Population Venue	1000 Franklin Ave, Altavista	37.1140, -79.2889
Campbell	Lynchburg Regional Airport Police Department	Law Enforcement	4308 Wards Road	37.3304, -79.1938
Campbell	Timberlake Christian Schools	Schools	202 Horizon Dr	37.3394, -79.2598
Campbell	Altavista High	Schools	904 Bedford	37.1095, -79.2953





# Hazard Identification and Risk Assessment

Locality	Facility Name	Facility Type	Location	Coordinates
			Avenue	
Campbell	Brookville High	Schools	100 Laxton Road	37.3457, -79.2355
Campbell	Brookville Middle	Schools	320 Bee Drive	37.3458, -79.2396
Campbell	Leesville Road Elementary	Schools	19965 Leesville Road	37.3278, -79.2186
Campbell	Tomahawk Elementary	Schools	155 Bee Drive	37.3438, -79.2375
Campbell	Timberlake Baptist Church Pump Station	Sewer Pump Station	460	37.3308, -79.2464
Lynchburg	Lynchburg Museum	Attractions	901 Court St	37.4137, -79.1443
Lynchburg	Point Of Honor Museum	Attractions	112 Cabell St	37.4206, -79.1439
Lynchburg	Legacy Museum Of African American History	Attractions	403 Monroe St	37.4142, -79.1543
Lynchburg	Ann Spencer House & Garden Museum	Attractions	1313 Pierce St	37.4038, -79.1520
Lynchburg	Maier Museum Of Art	Attractions	1 Quinlan St	37.4393, -79.1699
Lynchburg	Old City Cemetery	Attractions	301 Monroe St	37.4149, -79.1565
Lynchburg	Historic Sandusky Foundation - Civil War Museum	Attractions	757 Sandusky Dr	37.3803, -79.1963
Lynchburg	Amazement Square Child Museum	Attractions	27 9Th St	37.4162, -79.1403
Lynchburg	Virginia University Of Lynchburg	College		37.3951, -79.1515
Lynchburg	Lynchburg College	College		37.3977, -79.1842
Lynchburg	Randolph College	College		37.4374, -79.1708
Lynchburg	Central Virginia Community College	College		37.3589, -79.1844
Lynchburg	Liberty University	College		37.3503, -79.1797
Lynchburg	Centra College Of Nursing	College		37.4169, -79.1714
Lynchburg	Lynchburg Fire Department Station 5 - Peakland	Fire Stations	4800 Boonsboro Road	37.4461, -79.2148
Lynchburg	Lynchburg Fire Department Station 2 - Grace Street	Fire Stations	2006 Grace Street	37.4025, -79.1400
Lynchburg	Lynchburg Fire Department Station 3 - Fort Hill	Fire Stations	4701 Fort Avenue	37.3821, -79.1813
Lynchburg	Lynchburg Fire Department Station 6 - Miller Park	Fire Stations	2084 Fort Avenue	37.4026, -79.1590
Lynchburg	R R Donnelley Incorporated Fire Brigade	Fire Stations	4201 Murray Place	37.3782, -79.1683
Lynchburg	Westrock Converting Company	HazMat Facility	1801 Concord Turnpike	37.4032, -79.1277
Lynchburg	Hanson Industries Inc	HazMat Facility	3300 John Capron Rd.	37.3721, -79.1607
Lynchburg	U.S. Pipe	HazMat Facility	10 Adams Street	37.4208, -79.1413
Lynchburg	Gnb Inc	HazMat Facility	2800 Carroll Ave.	37.3893, -79.1575
Lynchburg	Slocum Adhesives Corporation	HazMat Facility	1409 Buchanan Street	37.4024, -79.1521
Lynchburg	Old Dominion Wood Products	HazMat Facility	800 Craddock Street	37.4061, -79.1583
Lynchburg	Allen-Morrison Signage Company	HazMat Facility	319 Rutherford Street	37.3889, -79.1678
Lynchburg	Parker Hannifin Corporation -	HazMat Facility	3700 Mayflower Dr	37.3719, -79.1631



# Hazard Identification and Risk Assessment

Locality	Facility Name	Facility Type	Location	Coordinates
	Powertrain Division			
Lynchburg	Lynchburg Foundry Co Lower Basin Plant	HazMat Facility	Garnet Street And Concord Turnpike	37.4071, -79.1318
Lynchburg	Banker Steel Co Llc - 30997	HazMat Facility	1619 Wythe Rd	37.3913, -79.1621
Lynchburg	Delta Star Inc.	HazMat Facility	3550 Mayflower Drive	37.3693, -79.1646
Lynchburg	Simplimatic Eng Co	HazMat Facility	1320 Wards Ferry Road	37.3527, -79.1890
Lynchburg	Davis Frost Inc	HazMat Facility	3420 Candler's Mountain Rd	37.3675, -79.1730
Lynchburg	Cb Fleet Co	HazMat Facility	4615 Murray Place	37.3735, -79.1713
Lynchburg	Westover Dairy	HazMat Facility	2801 Fort Ave	37.3977, -79.1655
Lynchburg	Rr Donnelley Printing Company	HazMat Facility	4201 Murray Place	37.3783, -79.1694
Lynchburg	Porters Group Llc	HazMat Facility	3726 Cohen Pl	37.3699, -79.1615
Lynchburg	Flowserve Corporation	HazMat Facility	5114 Woodall Road	37.3739, -79.1746
Lynchburg	Tri Tech Laboratories Inc	HazMat Facility	1000 Robins Rd	37.3981, -79.1412
Lynchburg	City Stadium	Large Population Venue	3176 Fort Ave, Lynchburg	37.3924, -79.1664
Lynchburg	Liberty Vines Convocation Center	Large Population Venue	1971 University Blvd, Lynchburg	37.3489, -79.1811
Lynchburg	Academy Center Of The Arts	Large Population Venue	600 Main St, Lynchburg, Va 24504	37.4174, -79.1441
Lynchburg	Liberty University Police Department	Law Enforcement	1971 University Boulevard	37.3581, -79.1757
Lynchburg	Lynchburg Police Department	Law Enforcement	905 Court Street	37.4134, -79.1442
Lynchburg	Central Virginia Community College Police	Law Enforcement	3506 Wards Road	37.3589, -79.1845
Lynchburg	Lynchburg General Hospital	Public Health	1901 Tate Springs Road	37.4171, -79.1711
Lynchburg	Salvation Army	Cooling Center	2215 Park Ave, Lynchburg, Va 24501	37.4047, -79.1628
Lynchburg	Virginia Episcopal School	Schools	400 V E S Rd	37.4533, -79.1909
Lynchburg	Holy Cross Regional Catholic School	Schools	2125 Langhorne Rd	37.4125, -79.1778
Lynchburg	James River Day School	Schools	5039 Boonsboro Rd	37.4446, -79.2268
Lynchburg	New Vistas School	Schools	520 Eldon St	37.3987, -79.1724
Lynchburg	Rivermont School	Schools	3024 Forest Hills Cir	37.4171, -79.2055
Lynchburg	Lynchburg Day Services	Schools	1517 Jackson Street	37.4057, -79.1441
Lynchburg	Laurel Regional Special Education Center	Schools	401 Monticello Avenue	37.4044, -79.1798
Lynchburg	Fort Hill Community School	Schools	1350 Liggates Road	37.3863, -79.1744
Lynchburg	Hutcherson Early Learning Center	Schools	409 Perrymont Avenue	37.3895, -79.1882
Lynchburg	Linkhorne Elementary	Schools	2501 Linkhorne Drive	37.4184, -79.1953
Lynchburg	Linkhorne Middle	Schools	2525 Linkhorne	37.4167, -79.1931



# Hazard Identification and Risk Assessment

Locality	Facility Name	Facility Type	Location	Coordinates
			Drive	
Lynchburg	Paul Munro Elementary	Schools	4641 Locksview Road	37.4515, -79.2067
Lynchburg	Perrymont Elementary	Schools	409 Perrymont Avenue	37.3895, -79.1882
Lynchburg	Robert S. Payne Elementary	Schools	1201 Floyd Street	37.4057, -79.1512
Lynchburg	Sandusky Elementary	Schools	5828 Apache Lane	37.3808, -79.2037
Lynchburg	Sandusky Middle	Schools	805 Chinook Place	37.3796, -79.2022
Lynchburg	Sheffield Elementary School	Schools	115 Kenwood Place	37.3658, -79.1898
Lynchburg	T.C. Miller Elementary For Innovation	Schools	600 Mansfield Avenue	37.3978, -79.1670
Lynchburg	William M. Bass Elementary	Schools	1730 Seabury Avenue	37.3918, -79.1410
Lynchburg	Lynchburg Juvenile Detention Home	Schools	1400 Florida Avenue	37.3940, -79.1373
Lynchburg	Crossroads / Single Point Of Entry	Schools	405 Cabell Street	37.4227, -79.1467
Lynchburg	Bedford Hills Elementary	Schools	4330 Morningside Drive	37.4384, -79.2112
Lynchburg	E.C. Glass High	Schools	2111 Memorial Avenue	37.4074, -79.1660
Lynchburg	Medical Care Center	Nursing Home	2200 Landover Place	37.4127, -79.1760
Lynchburg	Guggenheimer Health And Rehab Center	Nursing Home	1902 Grace Street	37.4026, -79.1419
Lynchburg	Williams Home Incorporated	Nursing Home	1201 Langhorne Road	37.4358, -79.1848
Lynchburg	Avante At Lynchburg	Nursing Home	2081 Langhorne Road	37.4130, -79.1824
Lynchburg	Lynchburg Regional Juvenile Detention Center	Detention Facility	1400 Florida Ave	37.3940, -79.1371
Lynchburg	Kemper Street Station	Transportation Hub	825 Kemper St	37.4065, -79.1571
Lynchburg	Ground Storage Tank, 1,400,000 Gallon	Water Storage Facility	525 Taylor Street	37.4114, -79.1549
Lynchburg	Reservoir 10,500,000 Gallon	Water Storage Facility	525 Taylor Street	37.4113, -79.1542
Lynchburg	Ground Storage Tank, 4,500,000 Gallon	Water Storage Facility	525 Taylor Street	37.4107, -79.1548
Lynchburg	Fort Avenue Storage Tank #1, 2,000,000	Water Storage Facility	Fort Avenue	37.3819, -79.1819
Lynchburg	Storage Tank #2, 500,000 Gallons	Water Storage Facility	Fort Avenue	37.3817, -79.1821



# Hazard Identification and Risk Assessment

## Location of Fire Stations in Urban Area / Urban Cluster in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020

Distribution of old buildings (constructed before 1973) in Central Virginia PDC. Darker color represents more buildings exist within a 10 acres land area. Urban fires are a more significant threat in areas of the region with a significant proportion of old buildings.

Data source: Locality parcel GIS data; Lynchburg eTRACK system; 2010 Census Urban Area Center for Geospatial Information Technology at Virginia Tech. 04/2020

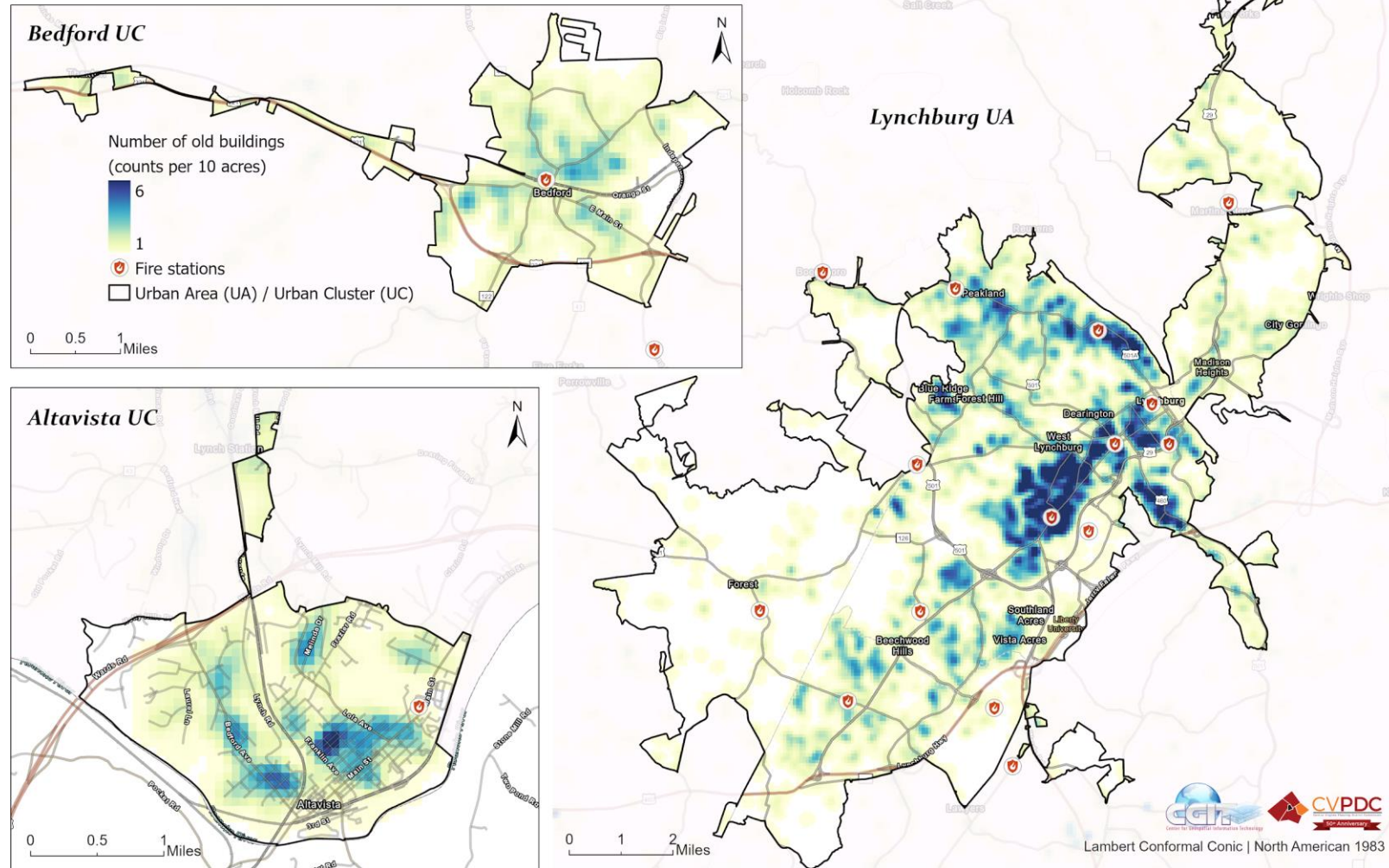


Figure 4-175 Location of fire stations in urban area / urban cluster in CVPDC Area

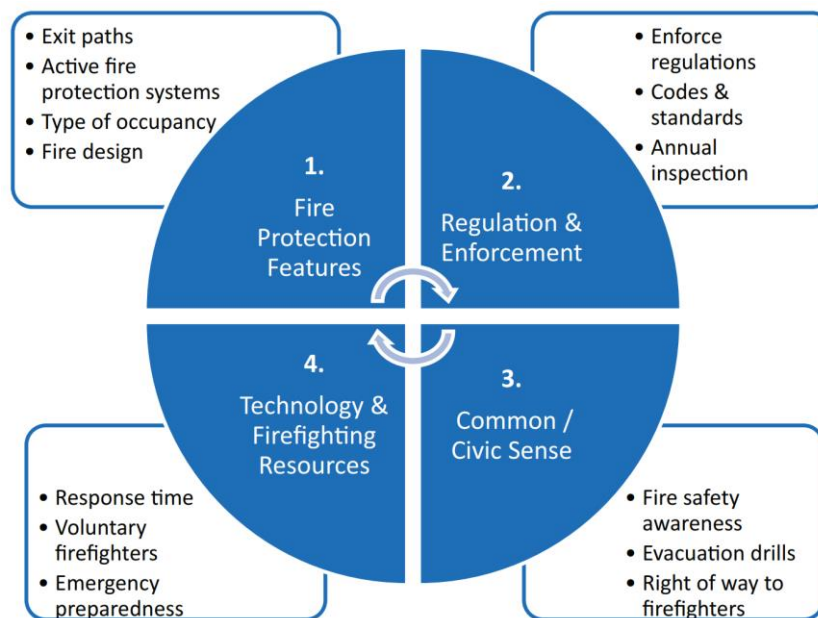




# Hazard Identification and Risk Assessment

## 4.19.4 Probability of Future Occurrences

There are many factors that contribute to the cause of urban fires. Minor urban fires can be expected every day in the CVPDC area, while major fires could occur several times a year, particularly in dense, urban areas with aging building stock. However, the probability of future occurrences may decrease with the construction of new buildings to building codes that address fire prevention, detection, and extinguishment. Also, continued efforts to increase public awareness of the dangers of urban fires will help to mitigate injury, death, and property loss. (See Figure 4-176 for more fire safety improvement strategies.)



(Source: Kodur, et. al. 2019)

Figure 4-176 Integrated framework to implement strategies for improving fire safety in buildings.

Generally, the probability of future occurrence may increase in communities whose populations are growing and where new areas are developed.

## 4.19.5 References

- Evarts, Ben, and National Fire Protection Association (NFPA). *Fire Loss in the United States During 2017*. Quincy, MA: National Fire Protection Association, October 2018. <https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/US-Fire-Problem/osFireLoss.pdf>.
- Pennsylvania Emergency Management Agency (PEMA). *Pennsylvania 2018 State Hazard Mitigation Plan Update*. Harrisburg, PA, 2018. <https://pahmp.com/wp-content/uploads/2018/07/PA-2018-HMP-FEMA-Review-Full-Plan.pdf>.



# Hazard Identification and Risk Assessment

- NFIRS/FEMA. *Virginia fire loss/fire department profile*. <https://www.usfa.fema.gov/data/statistics/states/virginia.html>. (Accessed on June 18, 2019)
- U.S. Census Bureau. *2010 Census Urban and Rural Classification and Urban Area Criteria*. <https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural/2010-urban-rural.html>
- Venkatesh Kodur, Puneet Kumar, and Muhammad Masood Rafi. *Fire hazard in buildings: review, assessment and strategies for improving fire safety*. PSU Research Review. 2019
- Virginia Department of Fire Programs. *VFIRS Facts and Figures*. <https://www.vafire.com/vfirs-facts-and-figures/>. (Accessed on June 18, 2019)
- World Population Review. *Population Density statistics*. <http://worldpopulationreview.com/us-cities/lynchburg-va-population/>. (Accessed on September 26, 2019)



# Hazard Identification and Risk Assessment

## 4.20 Contagious / Communicable Diseases

### 4.20.1 Hazard Profile

A communicable disease is an illness caused by an infectious agent or its toxic products that develops when the agent or its product is transmitted from an infected person, animal, or arthropod to a susceptible host. Infectious agents include viruses, bacteria, fungi, parasites, or aberrant proteins called prions. The infectious agent might spread by one of several mechanisms, including contact with the infected individual or his or her bodily fluids, contact with contaminated items or a vector, or contact with droplets or aerosols. An infection, which is the actual spread of the infectious agent or its toxic product, is not synonymous with disease because an infection may not lead to the development of clinical signs or symptoms.

#### 4.20.1.1 Geographic Location and Previous Occurrences

##### 4.20.1.1.1 Human Diseases

Table 4-168 shows the top reportable communicable human diseases by incidence rate in the CVPDC area. Compared to the top communicable disease conditions in Virginia in 2018, campylobacteriosis, Lyme Disease, salmonellosis, giardiasis, chickenpox, and cryptosporidiosis were shared as most commonly occurring both statewide and locally for the CVPDC (excluding Chronic Hepatitis) (Figure 4-177).<sup>100</sup>

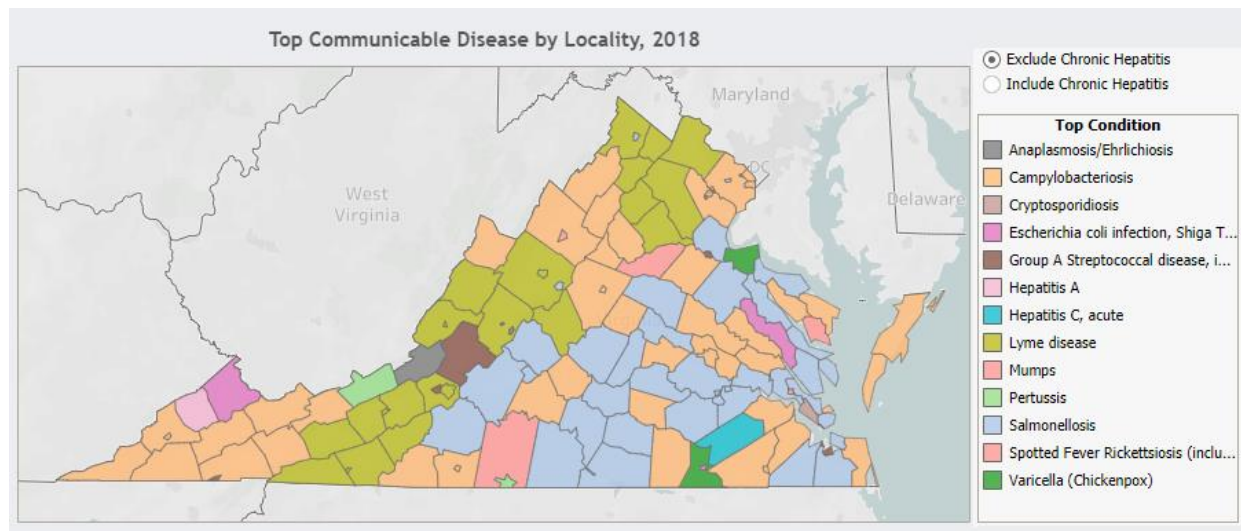


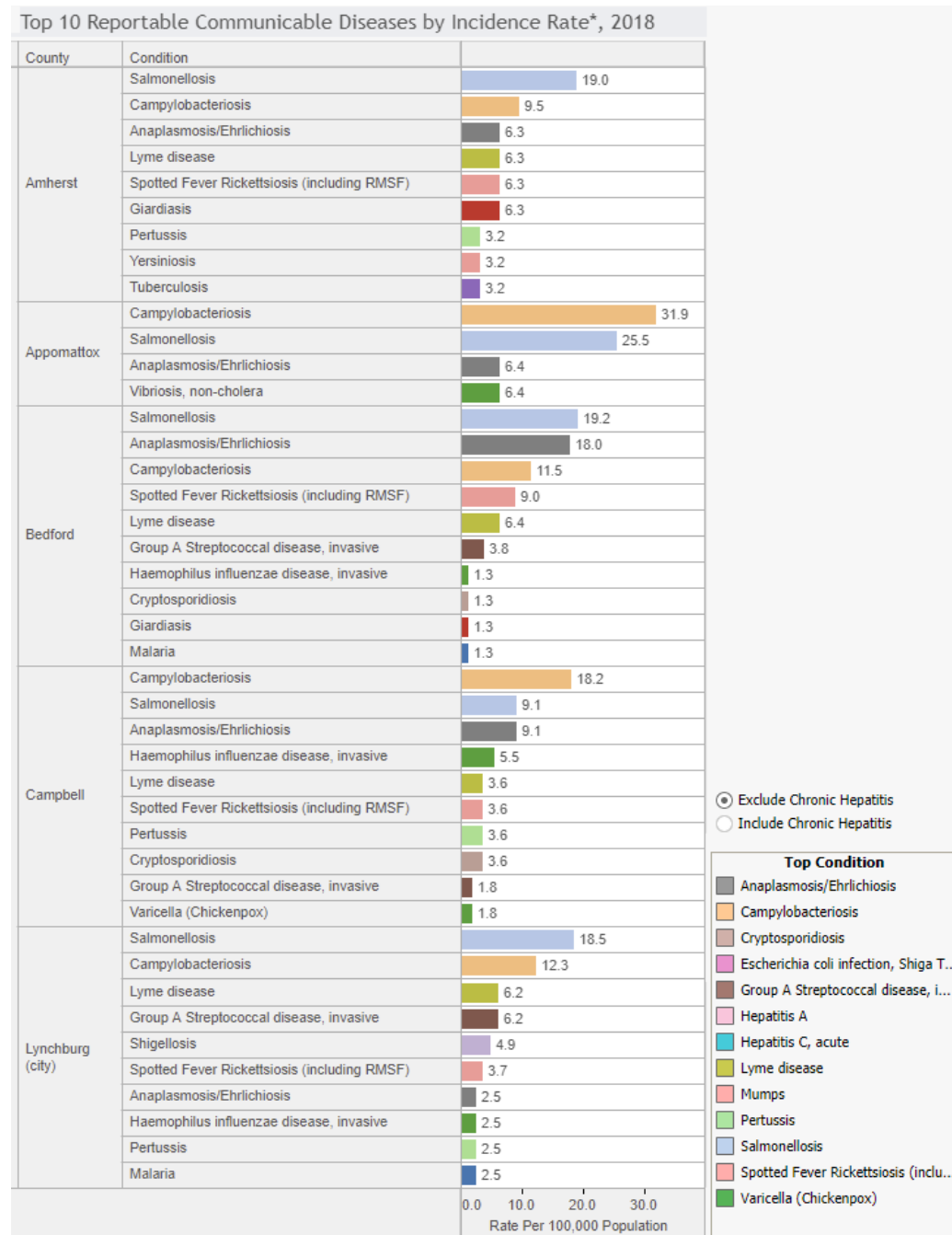
Figure 4-177 Top communicable diseases in Virginia by Locality, 2018 (exclude Chronic Hepatitis)

<sup>100</sup> Virginia: Vector-borne Diseases Profile (2004-2016) <http://www.vdh.virginia.gov/data/communicable-diseases/>



# Hazard Identification and Risk Assessment

Table 4-168 Top Reportable Communicable Diseases by Incidence Rate in CVPDC in 2018



(Source: Virginia Department of Health, 2020)

According to Centers for Disease Control and Prevention (CDC), there were a total of 2003 reported vector-borne disease cases in Virginia in 2016.<sup>101</sup> The most reported mosquito-borne disease is **Zika Virus**, and the top tick-borne disease is Lyme disease. There have been 115 reported cases of Zika virus disease

<sup>101</sup> <https://www.cdc.gov/nceid/dvbd/vital-signs/virginia.html>





# Hazard Identification and Risk Assessment

in Virginia since December 2015. Mosquito-borne Zika reached the Americas in May 2015, and by January of 2016, the CDC opened its emergency operations center to prepare for potential domestic impacts caused by the global outbreak. Across the United States, the Zika virus was the most common disease borne by ticks, mosquitoes and fleas reported in 2016, with 41,680 cases reported, followed by Lyme disease, with 36,429 cases. As of 2018 and 2019, no mosquito-borne Zika virus transmission has been reported in the CVPDC area.

**Influenza** (flu) spreads mainly from person to person by droplets from the nose or throat that are released when an infected person coughs or sneezes. It happens every year and is more common in the fall and winter. An estimated 19 million influenza illnesses occur in the United States each year. During the 2017-2018 flu season, approximately 710,000 people across the United States were hospitalized from the flu, of which, thousands died.<sup>102</sup> People at highest risk for flu-related complications include children younger than 5 years (especially those younger than 2 years old), adults 65 years of age and older, pregnant women, and people who have certain medical conditions such as asthma, heart disease, chronic lung disease, kidney disease, or weakened immune systems due to disease or medication. During the 2018-2019 flu season, Virginia has spent 16 weeks at widespread activity level, which indicates that lab activity has had either elevated influenza-like illness reports or more than one outbreak in three or more regions. Virginia Department of Health (VDH) reported 4,310 distinct infections, 4 influenza-associated pediatric deaths, and 1,813 pneumonia and influenza-associated deaths<sup>103</sup>.

A new **Coronavirus** (COVID-19) was detected in Wuhan City, Hubei Province, China and is causing an outbreak of respiratory illness. The COVID-19 outbreak began in December 2019, and there are now millions of reported cases around the world, including the United States. Cases of COVID-19 have been confirmed in all jurisdictions in the CVPDC area. According to VHD, by July 2020, there were over 90 thousands confirmed cases in Virginia, and over one thousand cases in CVPDC.<sup>104</sup> COVID-19 symptoms can range from mild (or no symptoms) to severe illness. There is currently no vaccine to protect against COVID-19. Everyone is at risk of getting COVID-19. Older adults and people of any age who have serious underlying medical conditions may be at higher risk for more severe illness.

#### 4.20.1.1.2 Animal Diseases

Virginia Animal and Food Industry Services maintains surveillance and control of infectious and contagious animal diseases throughout the Commonwealth. The most common communicable diseases found in Virginia include Eastern Equine Encephalitis, Equine Herpes Virus, West Nile Virus, and Avian Influenza.<sup>105</sup> While Zoonotic diseases (those transmissible between humans and animals or via an animal vector) are also a concern for the region, those events are best addressed in a pandemic or contagious disease plan rather than this hazard mitigation plan.

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<sup>102</sup> Summary of the 2017-2018 Influenza Season. Centers for Disease Control and Prevention.  
<https://www.cdc.gov/flu/about/season/flu-season-2017-2018.htm>

<sup>103</sup> Virginia Department of Health Weekly Influenza Activity Report. (Report generated on June 20, 2019)  
<http://www.vdh.virginia.gov/epidemiology/influenza-flu-in-virginia/influenza-surveillance/>

<sup>104</sup> <https://www.vdh.virginia.gov/coronavirus/covid-19-daily-dashboard/>

<sup>105</sup> <https://www.vdacs.virginia.gov/animals-animal-health.shtml>



# Hazard Identification and Risk Assessment

## 4.20.1.2 Relationship to Other Hazards

Figure 4-178 shows the interrelationship (causation, concurrence, etc.) between this hazard and other hazards discussed in this plan update.

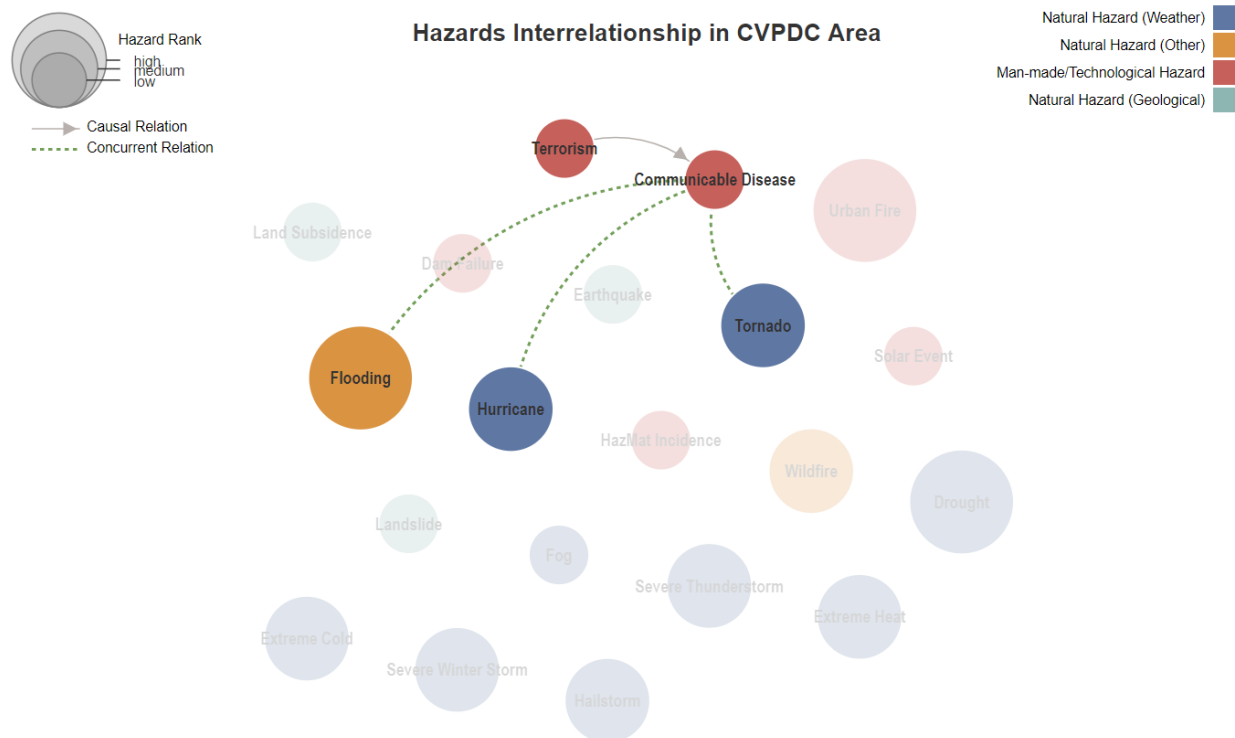


Figure 4-178 Hazards interrelationship

## 4.20.2 Impact and Vulnerability

### 4.20.2.1 Communicable Diseases Associated with Natural Disasters

The risk associated with communicable disease in the region has not been formally quantified, due to the difficulty in predicting specific occurrences, and the lack of complete data on impacts. However, the potential risk and impact of communicable diseases is often presumed to be very high in the chaos that follows natural disasters (WHO, 2006).<sup>106</sup>

Natural disasters, particularly meteorological and geological events such as hurricanes, floods and earthquakes, can bring about serious health consequences. These disasters can affect vector breeding sites and vector-borne disease transmission. In a flood hazard area, initial flooding may wash away existing mosquito breeding sites, but standing-water caused by heavy rainfall or overflow of rivers can create new breeding sites. This can result (with typically some weeks delay) in an increase of the vector population and potential for disease transmission, depending on the local mosquito vector species and its preferred habitat. The crowding of infected and susceptible hosts, a weakened public health infrastructure and interruptions of ongoing control programs are all risk factors for vector-borne disease transmission.

<sup>106</sup> [https://www.who.int/diseasecontrol\\_emergencies/guidelines/CD\\_Disasters\\_26\\_06.pdf](https://www.who.int/diseasecontrol_emergencies/guidelines/CD_Disasters_26_06.pdf)



# Hazard Identification and Risk Assessment

High death counts during a natural disaster (either human or animal) can indicate an increased risk of outbreaks associated with the size, health status, and living conditions of the population displaced by the natural disaster. Crowding, inadequate water and sanitation, and poor access to health services, often characteristic of sudden population displacement, increase the risk of communicable disease transmission.<sup>107</sup>

The major causes of communicable disease from natural disasters can be categorized into four areas: Infections due to contaminated food and water, respiratory infections, vector and insect borne diseases, and infections due to wounds and injuries. The most common causes of morbidity and mortality in this situation are diarrheal disease and acute respiratory infections.<sup>108</sup>

- Waterborne diseases: Diarrheal disease outbreaks can arise subsequent to drinking-water contamination, and have been reported after flooding and related movement. Hepatitis A and E have fecal-oral transmission in areas with poor water sanitation.
- Diseases associated with crowding: Acute respiratory infections are the main cause of morbidity and mortality among unsettled people and are seen predominantly in children less than 5 years old.
- Vector-borne diseases: The most common vector-borne diseases in Virginia, according to the Virginia Department of Health, are carried by mosquitoes and ticks and include Lyme Disease, Rocky Mountain Spotted Fever, West Nile Virus, and Eastern equine encephalitis. Environmental changes after disaster could increase vector breeding sites and proliferation of disease vectors.
- Infections due to wounds and injuries: The potentially significant threats to persons suffering a wound are tetanus, staphylococci, and streptococci.

#### **4.20.2.2 Critical Facilities**

All human-occupied critical facilities are assumed to be at risk of contamination from a communicable disease. If facilities supporting emergency response lost their functionality because of contamination, delays in emergency services could result. Additionally, with a significant human disease outbreak, resources of health care systems such as ambulance services, hospitals, and medical clinics could quickly become overwhelmed. For example, during the 2018-2019 flu season, the Virginia Department of Health reported a peak of 11.6% of emergency department and urgent care facility visits were for influenza-like illness during the week ending February 10, 2018.<sup>109</sup> In most cases, critical infrastructure would not be affected by communicable disease. Scenarios that would affect infrastructure include the contamination of the water supplies and diseases that require special provisions in the treatment of wastewater. Should an epidemic necessitate quarantine or incapacitate a significant portion of the population, support of and physical repairs to infrastructure may be delayed, and services may be disrupted for a time due to limitations in getting affected employees to work.

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<sup>107</sup> [https://wwwnc.cdc.gov/eid/article/13/1/06-0779\\_article](https://wwwnc.cdc.gov/eid/article/13/1/06-0779_article)

<sup>108</sup> <https://www.ncbi.nlm.nih.gov/pubmed/22279466>

<sup>109</sup> [http://www.vdh.virginia.gov/content/uploads/sites/3/2018/11/Weekly-Influenza-Activity-Report\\_2017-18-Season.pdf](http://www.vdh.virginia.gov/content/uploads/sites/3/2018/11/Weekly-Influenza-Activity-Report_2017-18-Season.pdf)



# Hazard Identification and Risk Assessment

## 4.20.2.3 Bioterrorism and pandemics

Communicable disease disasters involve a biological agent/disease and that can result in mass casualties, such as a bioterrorism attack, a pandemic, or an outbreak of an emerging infectious disease. Human epidemics may lead to quarantines, large-scale medical needs, and mass fatalities. The elderly, young children, and those with suppressed immune systems are usually at the greatest risk. Natural illnesses of particular concern include Influenza, Meningitis, Pertussis, Measles, Severe Acute Respiratory Syndrome (SARS), and food-borne illnesses such as E. Coli and Salmonella outbreaks, among others. These diseases can infect populations rapidly, particularly through groups of people in close proximity such as schools, assisted living facilities, and workplaces.

Bioterrorism is a concern in all areas. According to CDC, the following biological agents are considered the highest bioterrorism threats (Category A) due to their ease of dissemination or person-to-person transmission, high mortality rate with potential for major public health impacts, and potential for public panic and social disruption: Anthrax, Botulism, Plague, Smallpox, Tularemia, and Viral Hemorrhagic Fevers.

<sup>110</sup>

Unlike a bioterrorism attack or outbreak of an emerging infection, a pandemic is usually not an event that occurs suddenly. The World Health Organization (WHO) describes six phases of a pandemic, starting with the period in which there are few to no human cases from the organism/disease to the period in which there is efficient and sustained disease spread from person to person. The six WHO pandemic phases are outlined in Table 4-169.

Table 4-169 WHO pandemic phase descriptions and main actions by phase

Phase	Estimated probability of pandemic	Description of the phase	Main action in affected area	Main action in not-yet affected area
1	Uncertain	Low risk of human cases	Producing, implementing, exercising, and harmonizing pandemic preparedness and response plans with emergency preparedness and response plans.	
2	Uncertain	Higher risk of human cases		
3	Uncertain	No or very limited human-to-human transmission		
4	Medium to high	Evidence of increased human-to-human transmission	Rapid containment	Readiness for pandemic response
5	High to certain	Evidence of significant human-to-human transmission	Pandemic response	Readiness for imminent response
6	Pandemic in progress	Efficient and sustained human-to-human transmission and community-level outbreaks		

(Adapted from *Pandemic Influenza Preparedness and Response: A WHO Guidance Document*. Geneva: World Health Organization; 2009. <https://www.ncbi.nlm.nih.gov/books/NBK143061/> and <https://www.who.int/csr/disease/swineflu/phase/en/> )

<sup>110</sup> <https://emergency.cdc.gov/agent/agentlist-category.asp#catdef>





# Hazard Identification and Risk Assessment

## 4.20.3 Risk Assessment

Populations that are vulnerable to communicable diseases include the economically disadvantaged, racial and ethnic minorities, the uninsured, low-income children, the elderly, the homeless, and those with other chronic health conditions, including severe mental illness. It may also include rural residents, who often encounter barriers to accessing healthcare services, transportations, or the internet. Figure 4-179 and Figure 4-180 provide demographic and socioeconomic profiles of the vulnerable groups in the CVPDC area.



# Hazard Identification and Risk Assessment

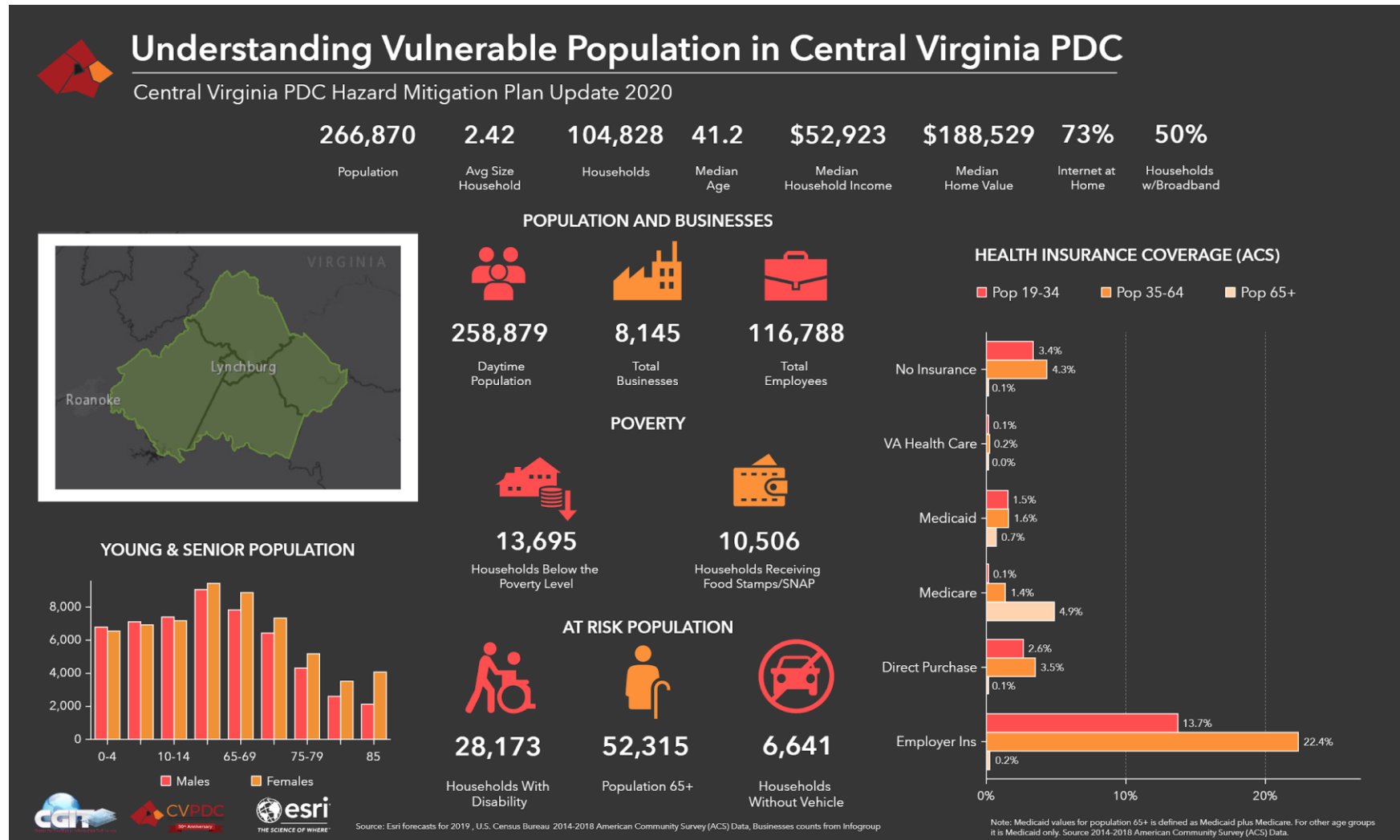


Figure 4-179 Demographic and Socioeconomic Profiles of the Vulnerable Groups to Communicable Diseases in the CVPDC Area (Panel A)



# Hazard Identification and Risk Assessment

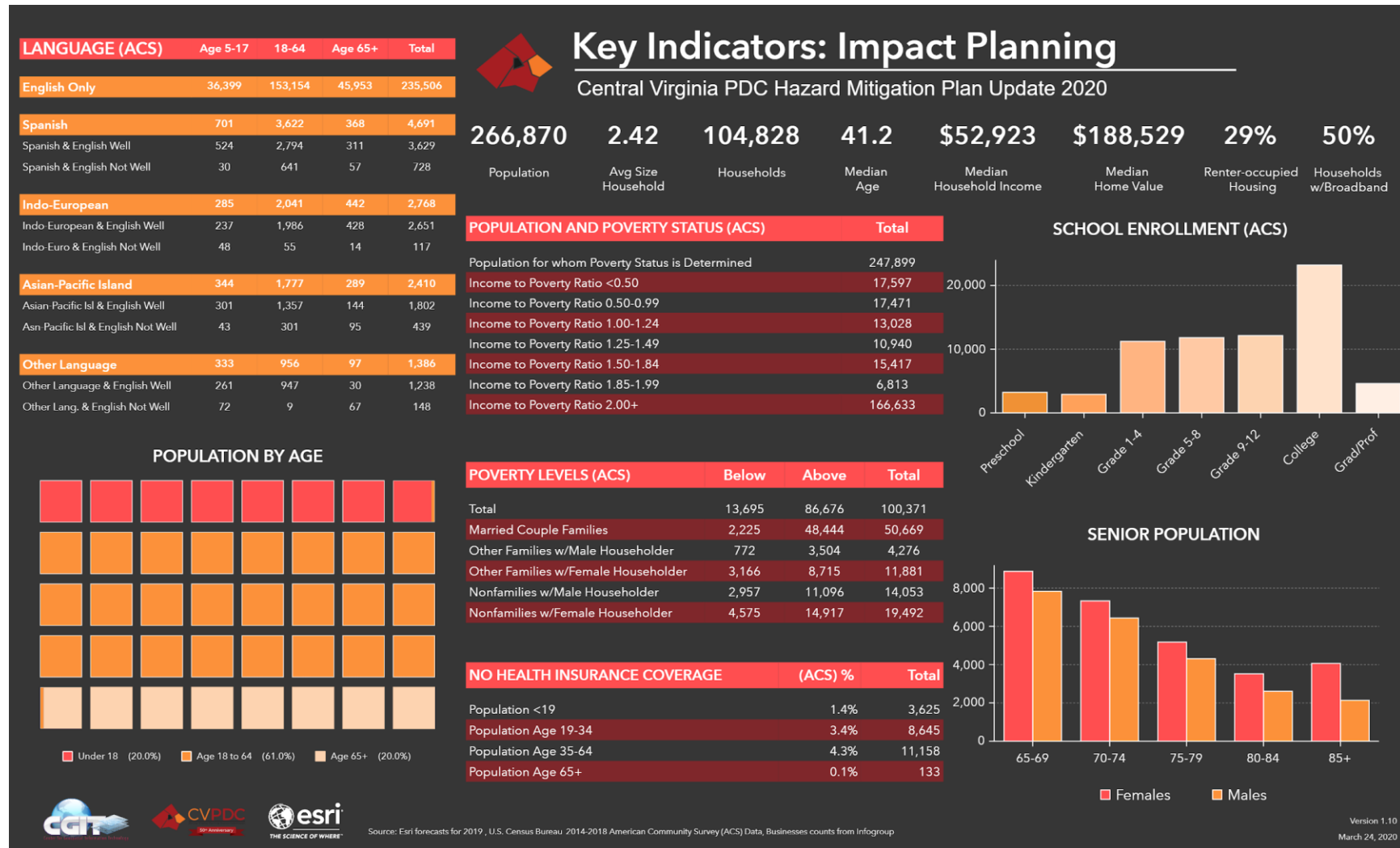


Figure 4-180 Demographic and Socioeconomic Profiles of the Vulnerable Groups to Communicable Diseases in the CVPDC Area (Panel B)



# Hazard Identification and Risk Assessment

## 4.20.4 Probability of Future Occurrences

The future incidence of communicable disease is highly unpredictable and may be localized, which makes it difficult to assess the probability of a future occurrence. Unlike other hazards, near-term conditions cannot reliably be extrapolated from past trends.

Infectious agents that can cause communicable diseases are constantly transmitted across the region, thus the real challenge is to assess the timing, location, and severity of the outbreak. No sources of information on long-term historic frequency of communicable disease or future probability of communicable disease were identified for inclusion in this plan.

## 4.20.5 References

- Aday LA. *Who are the vulnerable?* In: *At Risk in America: The Health and Health Care Needs of Vulnerable Populations in the United States*. 2nd ed. San Francisco, Calif: Jossey-Bass; 1991:1-15.
- Terri Rebmann. *Infectious Disease Disasters: Bioterrorism, Emerging Infections, and Pandemics*. St. Louis, MO: Saint Louis University, School of Public Health--Institute for Biosecurity, October 3, 2014. [https://apic.org/Resource\\_/TinyMceFileManager/Topic-specific/47901\\_CH120\\_R1.pdf](https://apic.org/Resource_/TinyMceFileManager/Topic-specific/47901_CH120_R1.pdf).
- Watson, John T., Michelle Gayer, and Maire A. Connolly. *Epidemics after Natural Disasters*. *Emerging Infectious Diseases* 13, no. 1 (January 2007): 1–5. <https://doi.org/10.3201/eid1301.060779>.
- World Health Organization. *Communicable Diseases Following Natural Disasters - Risk Assessment and Priority Interventions*. Switzerland: World Health Organization, 2006. [https://www.who.int/diseasecontrol\\_emergencies/guidelines/CD\\_Disasters\\_26\\_06.pdf](https://www.who.int/diseasecontrol_emergencies/guidelines/CD_Disasters_26_06.pdf).
- World Health Organization. WHO Programme on Disease Control in Humanitarian Emergencies, Communicable Diseases Cluster. *Communicable Diseases Following Natural Disasters - Risk Assessment and Priority Interventions*. Switzerland: World Health Organization, 2006. [https://www.who.int/diseasecontrol\\_emergencies/guidelines/CD\\_Disasters\\_26\\_06.pdf](https://www.who.int/diseasecontrol_emergencies/guidelines/CD_Disasters_26_06.pdf).





# Hazard Identification and Risk Assessment

## 4.21 Terrorism / Homeland Security Incident

### 4.21.1 Hazard Profile

The U.S. Department of Justice defines terrorism as the unlawful use of force or violence committed by a group or individual against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.

For the purpose of this profile, a terrorism, or homeland security hazards includes chemical attack, explosive attack, radiological attack, nuclear attack, food / food production attack, armed assault, vehicle attack, bioterrorism, cyber-attack, and civil unrest. See the following Magnitude section for details. However, terror can be exhibited through many different forms and may be more subtle using non-traditional methods.

#### 4.21.1.1 Geographic Location/ Extent

Acts perpetrated by violent extremists have far-reaching consequences in the United States, including structural and infrastructure damage, mass casualty and fatality incidents, environmental harm, decreased national morale, heightened perceived risk and fear by the public, and economic impacts.

Terrorism threat extent is determined using the National Terrorism Advisory System (NTAS). This system provides three levels of alert, including: elevated, intermediate, or imminent. It also provides a summary of the terrorism threat, additional details regarding the threat, a duration for the threat, and information for how the public can help and be prepared.

Local Emergency Operation Plans are beginning to address annexations and terrorism areas of concern. Consult these plans for further information.

#### 4.21.1.2 Magnitude/ Severity

The severity of a terrorism incident depends on the method used, the proximity of a device to people, animals, or other assets and duration of the incident. Terrorists use several methods of attack, including the following.

#### 4.21.1.3 Chemical attack

Chemical terrorism is the use of chemical agents to poison, kill, or incapacitate the population or animals, destroy crops or natural resources, or deny access to certain areas. Chemical agents can be broken into five different categories: nerve agents, vesicants, cyanide, pulmonary agents, and incapacitating agents.

#### 4.21.1.4 Explosive attack

Terrorism using explosive and incendiary devices includes bombs and any other technique that creates an explosive, destructive effect. Bombs can take many forms from a vehicle-borne Improvised Explosive Device (IED) to a mail bomb.

#### 4.21.1.5 Bioterrorism

Biological terrorism, or bioterrorism, is the use of biological agents to infect the population, plants, or animals with disease. The impacts of bioterrorism are discussed in the Communicable Diseases Hazard profile.



# Hazard Identification and Risk Assessment

## **4.21.1.6 Radiological / Nuclear attack**

Radiological/nuclear terrorism involves the use of radiological dispersal devices, nuclear weapons, or nuclear facilities to attack the population. Exposure to radiation can cause radiation sickness, long-term illness, and even death.

## **4.21.1.7 Cyber attack**

Cyber terrorism is the attack or hijack of the information technology infrastructure that is critical to the functions controlled by computer networks such as: operating, financial, communications, and trade systems. Any cyber-attack that creates unrest, instability, or negatively impacts confidence of citizens/consumers can be considered cyber terrorism. Common types and methods of cyberattacks include botnet, card skimming, denial-of-service attack, malicious code, pharming, phishing, spam, spear phishing, spoofing, spyware, trojan horse, virus, and worm. Computer security incidents are an ongoing threat and require due diligence to address accordingly in order to mitigate any potential disruption to critical infrastructure. In order to ensure a quick and proper response to cyber-attacks, systems vulnerable to cyber terrorism should have an incident response plan to minimize negative impacts.

## **4.21.1.8 Food / food production attack**

An attack on food or food production can be considered agroterrorism, or "the deliberate introduction of an animal or plant disease for the purpose of generating fear, causing economic losses, or undermining social stability." An agroterrorism attack might target agricultural facilities, impact food production and food supply, affect restaurants and grocery stores, and have detrimental effects on public health.

## **4.21.1.9 Armed assault**

An armed assault is defined as a hostile non-state actor(s) using assault tactics to conduct strikes on vulnerable target(s) within the U.S. resulting in at least one fatality or injury (DHS, 2011)

## **4.21.1.10 Vehicle attack**

A vehicle attack is characterized by the use of a vehicle to cause death, injury, and damage. Such attacks may be directed at large gatherings of people and/or buildings in areas of limited mobility due to the terrain or crowd mass.

## **4.21.1.11 Civil unrest**

Civil unrest and violence typically occur on a smaller scale than other types of terrorism. Civil unrest can occur when large groups, organizations, or distraught individuals take action with potentially disastrous or disruptive results. Civil unrest can result following a disaster that creates panic in the community. Forms of civil unrest can range from groups blocking sidewalks, roadways, and buildings to mobs rioting and looting to gang activity. These types of incidents typically do not escalate to the traditional definition of a disaster, but can have significant impacts on the community and require additional resources to manage.

## **4.21.1.12 Previous Occurrences**

No terrorism history was available for CVPDC at the time of the update. Several of the communities in the CVPDC provided information about their Emergency Operation Plans (EOP). These plans are beginning to address terrorism as a concern in operation. Please consult local EOPs for further guidance.



# Hazard Identification and Risk Assessment

## 4.21.1.13 Relationship to Other Hazards

Figure 4-181 shows the interrelationship (causation, concurrence, etc.) between this hazard and other hazards discussed in this plan update.

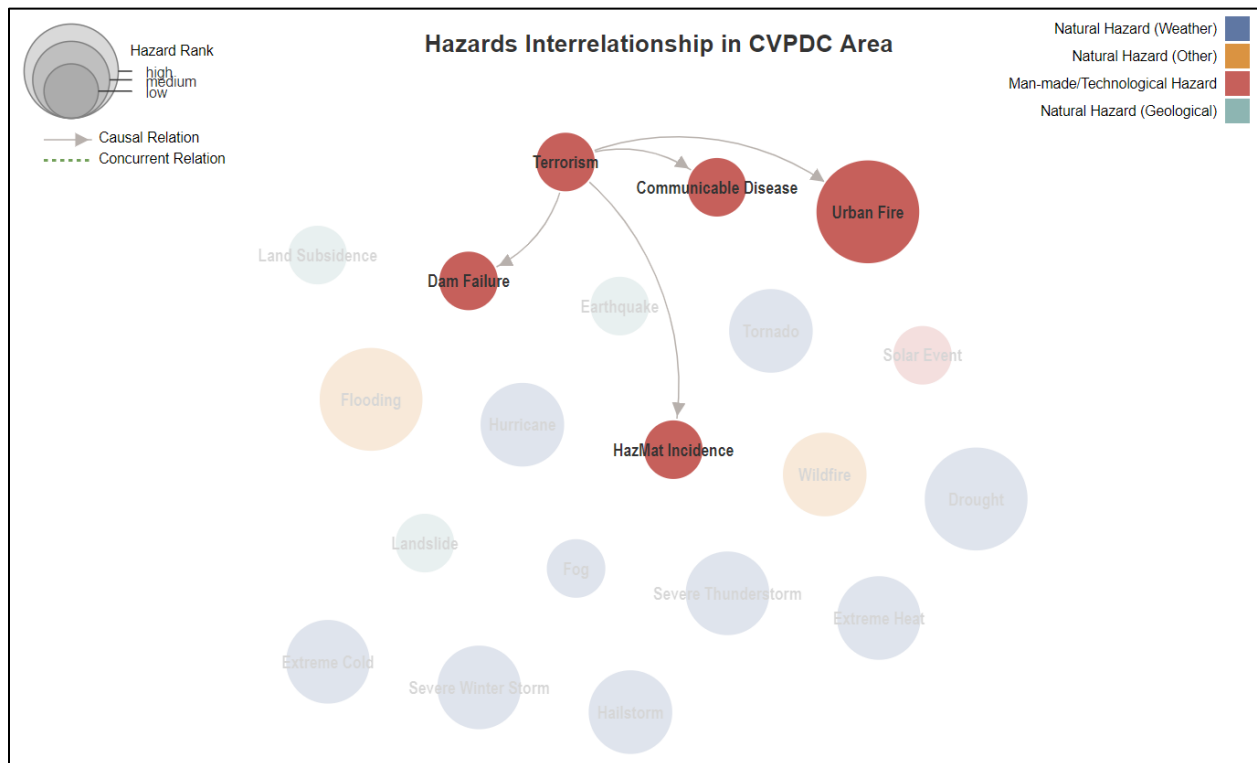


Figure 4-181 Hazards interrelationship

## 4.21.2 Impact and Vulnerability

The economic and financial impacts of a terrorist event on local government will depend on the scale of the event, what is damaged, costs of repair or replacement, lost business days in impacted areas, and how quickly repairs to critical components of the economy can be implemented. Vulnerability analysis, when available, has been conducted by the different localities. This information has been addressed in local Emergency Operation Plans.

### Vulnerability to people

During attacks and times of unrest, the greatest risk is to human lives. Terrorists typically try to make a dramatic statement that will generate media interest. Attacking the population through a large loss of life is a common tactic. Depending on the type of attack, casualties can encompass much of an urban population.

### Vulnerability to property

Nearly every type of structures is vulnerable to conventional terrorism incidents. Government facilities can become targets if an individual or group disagrees with actions they associate with the facility.



# Hazard Identification and Risk Assessment

Certainly, some state-owned buildings and property may be more vulnerable to incidents than others due to the activities performed at the facility or the level of security at the building.

The FEMA risk management series on mitigating potential terrorist attacks against buildings provides information on developing a realistic prioritization of human-caused hazards. The mitigation strategies section on this report should provide projects to address human caused hazard vulnerability. Future concepts to consider include:

1. Communities determine the relative importance of various critical and non-critical facilities and the assets of these systems
2. Determine the vulnerability to the specified hazard
3. Determine what threats are known to exist in the communities

## **Vulnerability to critical infrastructures**

The potential impact posed to critical infrastructure through the use of explosives is significant. Communication and power supply infrastructure are highly susceptible to this type of attack, which results in adverse impacts to businesses, residences, and critical facilities. As aforementioned, critical infrastructure has become more and more susceptible to acts of cyber terrorism. While cyber terrorism would not necessarily destroy the physical presence of critical infrastructure, it has the potential to shut down operations, which could in turn destroy physical structures if cyber terrorists were able to compromise internal systems and programs which provide service delivery.

### **4.21.3 Risk Assessment and Jurisdictional Analysis**

Terrorist attacks can occur anywhere. Area with a dense population and location relative to major urban areas would be an attractive target of a potential terrorist activity (Figure 4-182). While it is not possible to predict the location of terrorist attack, large venue locations such as stadiums, civic centers and locations with correctional facilities are somewhat more likely to be susceptible to such incidents. Figure 4-183 and Table 4-170 shows several large population venues situated in the CVPDC area: Lynchburg City Stadium, Liberty Vines Convocation Center, Academy Center of The Arts, Altavista Area YMCA Family Center, and National D-Day Memorial. A potential worst-case scenario for the CVPDC would be a terrorist attack at one of these

### ***Critical Facility and SCADA***

*In April 2017, the Virginia State Police network suffered a malware attack that caused the agency to lose access to Internet and vital systems. Critical facilities and infrastructures like public safety, energy, transportation or water are vulnerable targets and increasingly under risk from cyber-attack. The key components of critical infrastructure issues in cyberspace are the industrial control system (ICS) and supervisory control and data acquisition (SCADA) systems. These systems provide real-time, two-way data flow between sensors, workstations, and other networked devices throughout a system. In the age of the Internet of Things (IoT), the smooth and reliable operation of ICS and SCADA systems is vital for critical infrastructures where both data acquisition and control are critically important. The possibility of an attack on the SCADA system's critical infrastructure could undermine the safety of millions of individuals and can compromise homeland security. Therefore, defense security of critical infrastructures require an "all-hazards" perspective, encompassing service failure, natural disasters and terrorism altogether.*

[https://www.pilotonline.com/news/article\\_195797af-a41c-5ec7-96f4-282b5f706ee6.html](https://www.pilotonline.com/news/article_195797af-a41c-5ec7-96f4-282b5f706ee6.html)



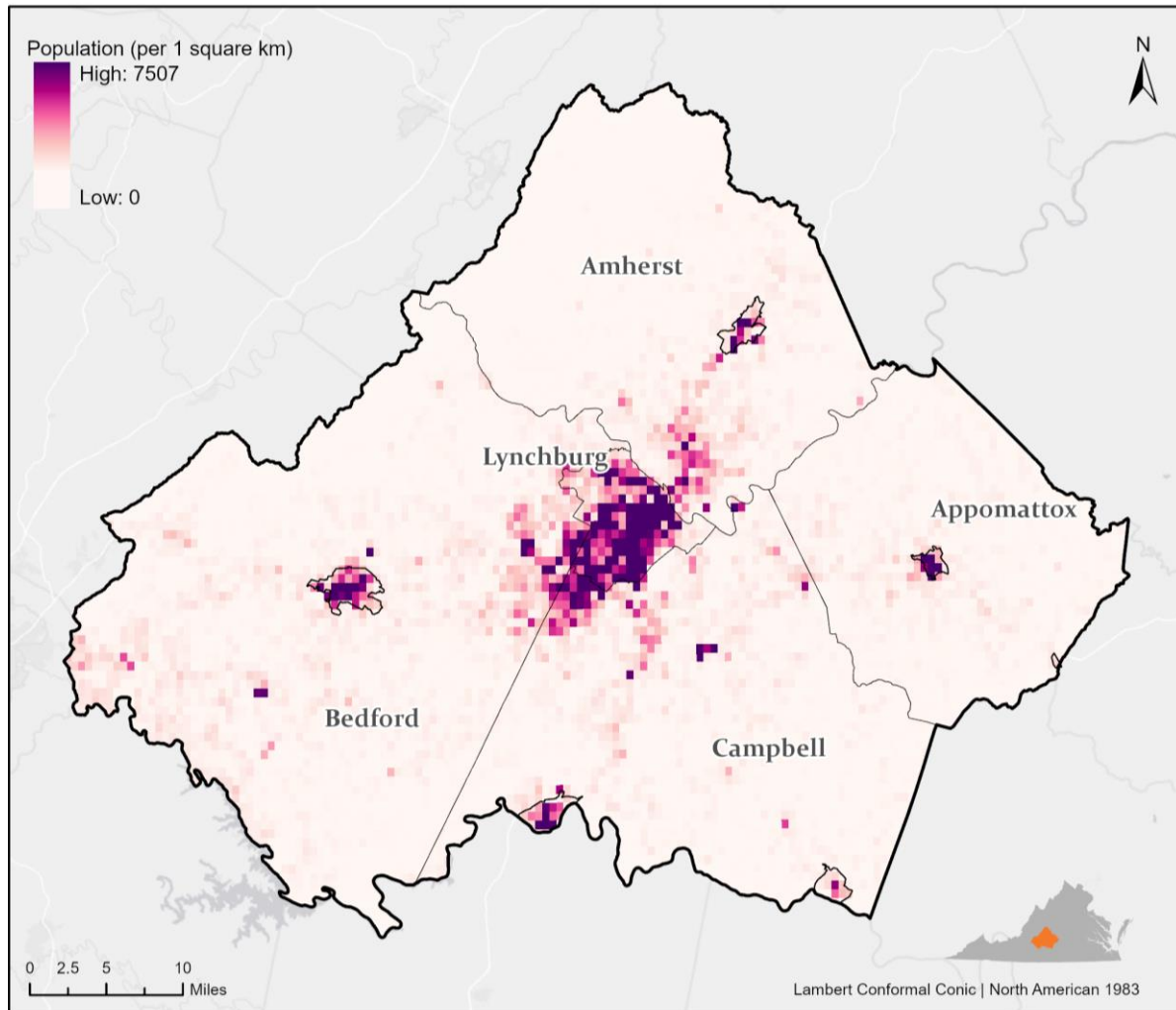


# Hazard Identification and Risk Assessment

venues, especially the Vines Center which has a capacity of over 9,500 seats.<sup>111</sup> Additional targets could be the PDC's critical infrastructure such as utilities, roadways, bridges, tunnels, hospitals, and schools.

## Population Density in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: LandScan 2017  
Center for Geospatial Information Technology at Virginia Tech. 06/2019



(Source: LandScan 2017)

Figure 4-182 Population density in CVPDC Area

<sup>111</sup> <https://www.liberty.edu/flames/index.cfm?PID=38028>



# Hazard Identification and Risk Assessment

Table 4-170 Large population venues in CVPDC

Locality	Facility Name	Location	Coordinates
Campbell	Altavista Area YMCA Family Center	1000 Franklin Ave, Altavista	37.1140, -79.2889
Bedford	National D-Day Memorial	3 Overlord Cir, Bedford	37.3305, -79.5360
Lynchburg	City Stadium	3176 Fort Ave, Lynchburg	37.3924, -79.1664
Lynchburg	Liberty Vines Convocation Center	1971 University Blvd, Lynchburg	37.3489, -79.1811
Lynchburg	Academy Center Of The Arts	600 Main St, Lynchburg	37.4174, -79.1441

According to the National Institute of Corrections, prisons are also potential terrorist targets—densely populated structures that are difficult both to defend and to evacuate. In addition to their attractiveness as terrorist targets, prisons may be involved with terrorists in other ways: <sup>112</sup>

- Terrorists may exist within the prison population and could be identified.
- The prison population offers terrorists a promising pool from which to recruit new members, allies, or mercenaries.
- The prison population is a potential source of intelligence about terrorist groups.

Figure 4-183 and Table 4-171 present the 8 county jails (detention facilities) located in the CVPDC area.

Table 4-171. Detention facilities in CVPDC

Locality	Town	Facility Name	Location	Coordinates
Amherst		Amherst County Adult Detention Center	219 Riverview Rd	37.4088, -79.0947
Amherst	Town of Amherst	Amherst County Jail / Sheriff	115 Taylor St	37.5854, -79.0498
Appomattox	Town of Appomattox	Appomattox County Jail	179 Morton Lane	37.3555, -78.8308
Bedford	Town of Bedford	Bedford Adult Detention Center	1000 Broad St	37.3375, -79.5083
Campbell		Rustburg Correctional Unit #9	479 Camp Nine Rd	37.2673, -79.0678
Campbell		Campbell County Adult Detention Center	90 Courthouse Lane	37.2774, -79.1029
Lynchburg		Lynchburg Regional Juvenile Detention Center	1400 Florida Ave	37.3940, -79.1371
Lynchburg		Lynchburg Adult Detention Center	510 9Th St	37.4127, -79.1451

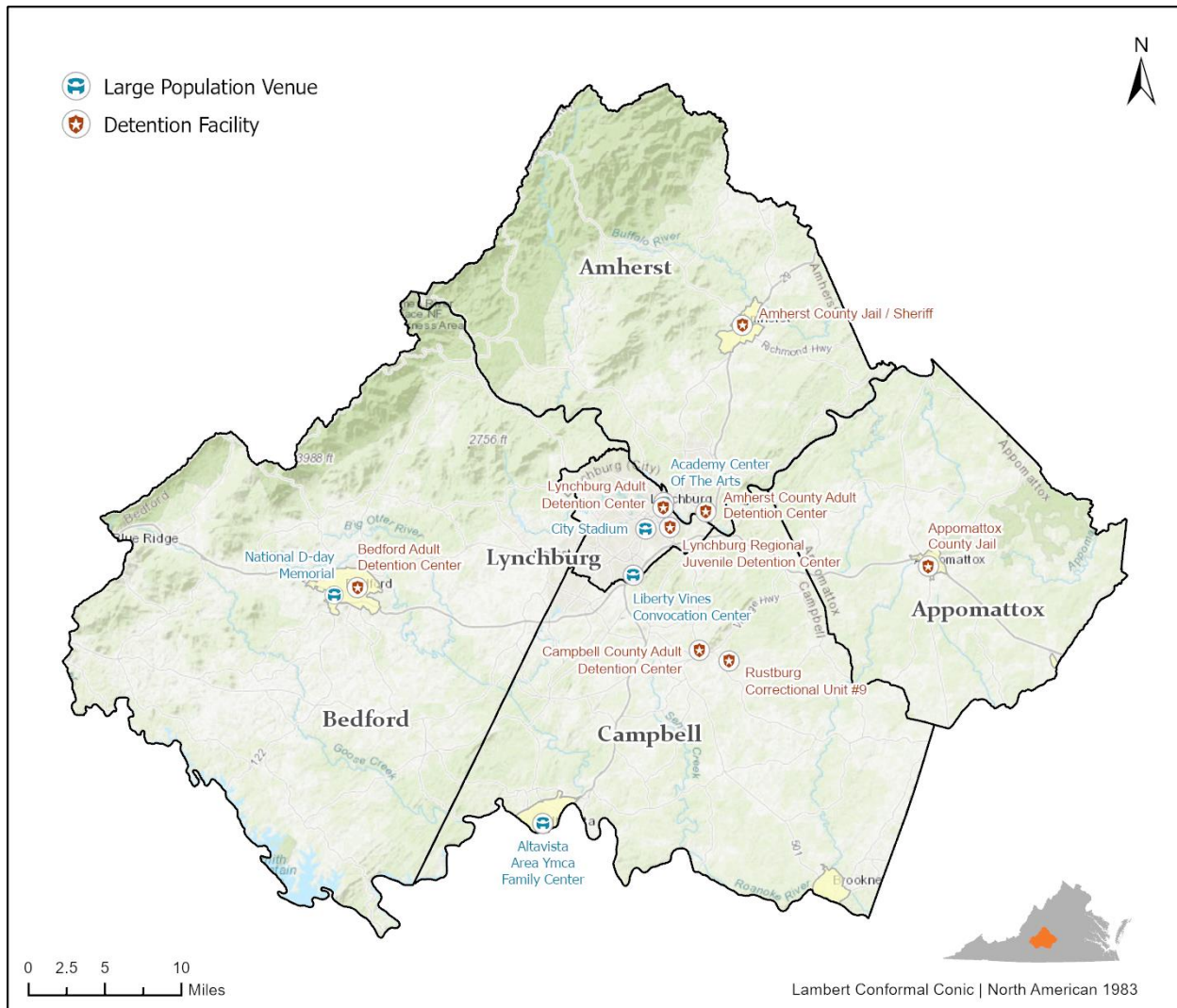
<sup>112</sup> <https://info.nicic.gov/nicrp/system/files/020293.pdf>



# Hazard Identification and Risk Assessment

## Detention Facilities and Large Population Venues in Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: HIFLD Open GP - Law Enforcement, as of 09/2018  
Center for Geospatial Information Technology at Virginia Tech. 05/2020



Figure 4-183 Detention facilities and large population venues in CVPDC

### 4.21.4 Probability of Future Occurrences

Terrorism can also take many forms and involves a range of political and personal agendas. The potential for future terrorism incidents in CVPDC is difficult to predict.

### 4.21.5 References

- Amir Vera. *Malware causes Virginia State Police to shutdown email service*. The Virginian-Pilot. April 26, 2017. [https://www.pilotonline.com/news/article\\_195797af-a41c-5ec7-96f4-282b5f706ee6.html](https://www.pilotonline.com/news/article_195797af-a41c-5ec7-96f4-282b5f706ee6.html)



# Hazard Identification and Risk Assessment

- Scott A. Weed. *US Policy Response to Cyber Attack on SCADA Systems Supporting Critical National Infrastructure*. Air University Press. 2017.  
[https://media.defense.gov/2017/Nov/20/2001846609/-1/-1/0/CPP0007\\_WEED\\_SCADA.PDF](https://media.defense.gov/2017/Nov/20/2001846609/-1/-1/0/CPP0007_WEED_SCADA.PDF)
- Jeffrey A. Schwartz. *A Guide to Preparing for and Responding to Prison Emergencies*. U.S. Department of Justice, National Institute of Corrections. Page 239. June 2005.  
<https://info.nicic.gov/nicrp/system/files/020293.pdf>





# Hazard Identification and Risk Assessment

## 4.22 Solar Events

### 4.22.1 Hazard Profile

There are many different types of space weather that can result in what is referred to as a “solar event”. These naturally occurring hazards are relatively new to the sphere of hazard mitigation planning, and include concerns raised by geomagnetic storms, coronal mass ejections, solar radiation storms, and solar flares (radio blackouts) that are relevant to local hazard mitigation planning teams.

**Solar wind** is the constant stream of plasma and charged particles from the sun that escape out into space. A **geomagnetic storm** is a major disturbance of Earth's magnetosphere (the magnetic field surrounding the planet) that occurs when there is a very efficient exchange of energy from the solar wind into the space environment surrounding Earth. Geomagnetic storms result from variations in the solar wind that produces major changes in the currents, plasmas, and fields in Earth's magnetosphere. The solar wind conditions that are effective for creating geomagnetic storms are sustained (for several to many hours) periods of high-speed solar wind, and most importantly, a southward directed solar wind magnetic field (opposite the direction of Earth's field) at the dayside of the magnetosphere. This condition is effective for transferring energy from the solar wind into Earth's magnetosphere.<sup>113</sup>

The largest storms that result from these conditions are associated with **Coronal Mass Ejections (CMEs)**. These events are large expulsions of plasma and magnetic field from the Sun's corona. They can eject billions of tons of coronal material and carry an embedded magnetic field (frozen in flux) that is stronger than the background solar wind interplanetary magnetic field (IMF) strength. CMEs travel outward from the Sun at speeds ranging from slower than 250 kilometers per second (km/s) to as fast as near 3000 km/s. The fastest Earth-directed CMEs can reach our planet in as little as 15-18 hours. Slower CMEs can take several days to arrive. They expand in size as they propagate away from the Sun and larger CMEs can reach a size comprising nearly a quarter of the space between Earth and the Sun by the time it reaches our planet.<sup>114</sup>

Imminent CME arrival is first observed by the Deep Space Climate Observatory (DSCOVR) satellite, located at the L1 orbital area. Sudden increases in density, total interplanetary magnetic field (IMF) strength, and solar wind speed at the DSCOVR spacecraft indicate arrival of the CME-associated interplanetary shock ahead of the magnetic cloud. This can often provide 15 to 60 minutes advanced warning of shock arrival at Earth – and any possible sudden impulse or sudden storm commencement; as registered by Earth-based magnetometers.<sup>2</sup>

During storms, the currents in the ionosphere, as well as the energetic particles that precipitate into the ionosphere add energy in the form of heat that can increase the density and distribution of density in the upper atmosphere, causing extra drag on satellites in low-earth orbit. The local heating also creates strong horizontal variations in the ionospheric density that can modify the path of radio signals and create errors in the positioning information provided by GPS. While the storms create beautiful aurora, they also can

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<sup>113</sup> Geomagnetic Storms: <https://www.swpc.noaa.gov/phenomena/geomagnetic-storms>

<sup>114</sup> Coronal Mass Ejections: <https://www.swpc.noaa.gov/phenomena/coronal-mass-ejections>



# Hazard Identification and Risk Assessment

disrupt navigation systems such as the Global Navigation Satellite System (GNSS) and create harmful geomagnetic induced currents (GICs) in the power grid and pipelines.<sup>1</sup>

**Solar flares** are large eruptions of electromagnetic radiation from the Sun lasting from minutes to hours. The sudden outburst of electromagnetic energy travels at the speed of light, therefore any effect upon the sunlit side of Earth's exposed outer atmosphere occurs at the same time the event is observed. The increased level of X-ray and extreme ultraviolet (EUV) radiation results in ionization in the lower layers of the ionosphere on the sunlit side of Earth. Under normal conditions, high frequency (HF) radio waves are able to support communication over long distances by refraction via the upper layers of the ionosphere. When a strong enough solar flare occurs, ionization is produced in the lower, more dense layers of the ionosphere, which causes HF radio signals to become degraded or completely absorbed. This results in a radio blackout – the absence of HF communication, primarily impacting the 3 to 30 MHz band. Solar flares usually take place in active regions, which are areas on the Sun marked by the presence of strong magnetic fields; typically associated with sunspot groups. As these magnetic fields evolve, they can reach a point of instability and release energy in a variety of forms. These include electromagnetic radiation, which are observed as solar flares.<sup>115</sup>

**Solar Radiation Storms** occur when a large-scale magnetic eruption, often causing a coronal mass ejection and associated solar flare, accelerates charged particles in the solar atmosphere to very high velocities. The most important particles are protons which can get accelerated to large fractions of the speed of light. At these velocities, the protons can traverse the 150 million km from the sun to the Earth in just 10's of minutes or less. When they reach Earth, the fast moving protons penetrate the magnetosphere that shields Earth from lower energy charged particles. Once inside the magnetosphere, the particles are guided down the magnetic field lines and penetrate into the atmosphere near the North and South Pole. A Solar Radiation Storm can persist for time periods ranging from hours to days.<sup>116</sup>

Solar Radiation Storms cause several impacts near Earth. When energetic protons collide with satellites or humans in space, they can penetrate deep into the object that they collide with and cause damage to electronic circuits or biological DNA. During the more extreme Solar Radiation Storms, passengers and crew in high flying aircraft at high latitudes may be exposed to radiation risk. Also, when the energetic protons collide with the atmosphere, they ionize the atoms and molecules thus creating free electrons. These electrons create a layer near the bottom of the ionosphere that can absorb High Frequency (HF) radio waves making radio communication difficult or impossible.<sup>4</sup>

#### 4.22.1.1 Geographic Location/Extent

Geomagnetic disturbances in the atmosphere occur all the time, but infrequently are they strong enough to be classified as a storm, and even more infrequently strong enough to cause problems. Geomagnetic storms and their resulting auroras are more common near the poles due to increased magnetism, but space weather events can occur locally all over the globe. Satellites can also easily be affected by the various forms of space weather, and while not local to the United States or the CVPDC, damaging effects on one or several of these would be widespread.

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<sup>115</sup> Solar Flares: <https://www.swpc.noaa.gov/phenomena/solar-flares-radio-blackouts>

<sup>116</sup> Solar Radiation Storm: <https://www.swpc.noaa.gov/phenomena/solar-radiation-storm>



# Hazard Identification and Risk Assessment

## 4.22.1.2 Magnitude/Severity

### 4.22.1.2.1 Planetary K-index

Currently, regional-level space weather warnings and alerts are provided by the Space Weather Prediction Center (SWPC) at the National Oceanic and Atmospheric Administration. The Planetary K-index ( $K_p$ ), are used to characterize the magnitude of geomagnetic storms.  $K_p$  is an excellent indicator of disturbances in the Earth's magnetic field and is used by SWPC to decide whether geomagnetic alerts and warnings need to be issued for users who are affected by these disturbances. It quantifies disturbances in the horizontal component of earth's magnetic field with an integer in the range 0-9 with 1 being calm and 5 or more indicating a geomagnetic storm. It is derived from the maximum fluctuations of horizontal components observed on a magnetometer during a three-hour interval.<sup>117</sup> The planetary 3-hour-range index  $K_p$  is the mean standardized K-index from 13 geomagnetic observatories between 44 degrees and 60 degrees northern or southern geomagnetic latitude. The label 'K' comes from the German word 'Kennziffer' meaning 'characteristic digit'. The K-index was introduced by Julius Bartels in 1938. SWPC has used the K-index since the forecast center began operations. An estimated current  $K_p$  index chart can be found on the SWPC's website, and a recent example can be seen below (Figure 4-184).<sup>118</sup>

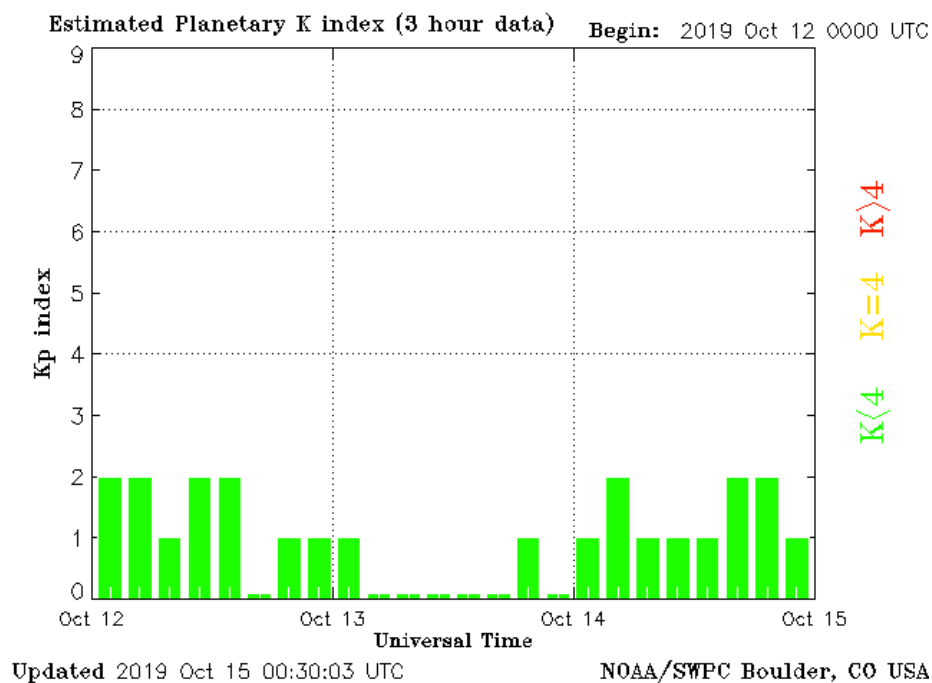


Figure 4-184 Estimated 3-hour Planetary Kp-index ( $K_p$ ) on Oct 12, 2019

### 4.22.1.2.2 NOAA G-scale

The  $K_p$  scale is a reasonable way to summarize the global level of geomagnetic activity, but it has not always been easy for those affected by the space environment to understand its significance. The NOAA

<sup>117</sup> <https://www.swpc.noaa.gov/sites/default/files/images/u2/TheK-index.pdf>

<sup>118</sup> <https://www.swpc.noaa.gov/products/planetary-k-index>



# Hazard Identification and Risk Assessment

G-scale was designed to correspond, in a straightforward way, to the significance of effects of geomagnetic storms (Table 4-172). The relationship between the NOAA G-scale and Kp is also shown in Table 4-172.

Storm watches are issued when the highest predicted NOAA estimated Kp-indices for a day are  $K = 5$ ,  $6$ ,  $7$ , or  $\geq 8$  and are reported in terms of the NOAA G scale. K-index Warnings are issued when NOAA estimated Kp-indices of  $4$ ,  $5$ ,  $6$ , and  $7$  or greater are expected. K-index Alerts are issued when the NOAA estimated Kp-indices reach  $4$ ,  $5$ ,  $6$ ,  $7$ ,  $8$ , or  $9$ .

**Solar Radiation Storms** are categorized using the NOAA Space Weather Scale on a scale from S1 - S5. The scale is based on measurements of energetic protons taken by the Geostationary Operational Environmental Satellite system GOES satellite in geosynchronous orbit (Table 4-173).

SWPC currently forecasts the probability of S1 (Minor Radiation Storm) occurrence as part of our 3-day forecast and forecast discussion products and issues a warning for an expected S1 or higher event; as well as a warning for when the 100 MeV (megaelectronvolt) proton level is expected to reach 1 pfu (proton flux unit). Additionally, SWPC issues alerts for when each NOAA Space Weather Scale Radiation Storm level is reached (S1-S5) and/or when the 100 MeV protons reach 1 pfu.<sup>4</sup>

**Solar flare** intensities cover a large range and are classified in terms of peak emission in the  $0.1 - 0.8$  nm spectral band (soft x-rays) of the NOAA/GOES XRS. The X-ray flux levels start with the "A" level (nominally starting at  $10^{-8}$  W/m<sup>2</sup>). The next level, ten times higher, is the "B" level ( $\geq 10^{-7}$  W/m<sup>2</sup>); followed by "C" flares ( $10^{-6}$  W/m<sup>2</sup>), "M" flares ( $10^{-5}$  W/m<sup>2</sup>), and finally "X" flares ( $10^{-4}$  W/m<sup>2</sup>).

**Radio blackouts** are classified using a five-level NOAA Space Weather Scale, directly related to the flare's max peak in soft X-rays reached or expected (Table 4-174). NOAA's Space Weather Prediction Center (SWPC) currently forecasts the probability of C, M, and X-class flares and relates it to the probability of an R1-R2, and R3 or greater events as part of our 3-day forecast and forecast discussion products. SWPC also issues an alert when an M5 (R2) flare occurs.<sup>3</sup>





# Hazard Identification and Risk Assessment

Table 4-172 NOAA Space Weather Scale for Geomagnetic Storms

Scale	Description	Effect	Physical measure	Average Frequency (1 cycle = 11 years)
G 5	Extreme	<p>Power systems: Widespread voltage control problems and protective system problems can occur, some grid systems may experience complete collapse or blackouts. Transformers may experience damage.</p> <p>Spacecraft operations: May experience extensive surface charging, problems with orientation, uplink/downlink and tracking satellites.</p> <p>Other systems: Pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low as Florida and southern Texas (typically 40° geomagnetic lat.).</p>	Kp = 9	4 per cycle (4 days per cycle)
G 4	Severe	<p>Power systems: Possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid.</p> <p>Spacecraft operations: May experience surface charging and tracking problems, corrections may be needed for orientation problems.</p> <p>Other systems: Induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as Alabama and northern California (typically 45° geomagnetic lat.).</p>	Kp = 8, including a 9-	100 per cycle (60 days per cycle)
G 3	Strong	<p>Power systems: Voltage corrections may be required, false alarms triggered on some protection devices.</p> <p>Spacecraft operations: Surface charging may occur on satellite components, drag may increase on low-Earth-orbit satellites, and corrections may be needed for orientation problems.</p> <p>Other systems: Intermittent satellite navigation and low-frequency radio navigation problems may occur, HF radio may be intermittent, and aurora has been seen as low as Illinois and Oregon (typically 50° geomagnetic lat.).</p>	Kp = 7	200 per cycle (130 days per cycle)



# Hazard Identification and Risk Assessment

Scale	Description	Effect	Physical measure	Average Frequency (1 cycle = 11 years)
G 2	Moderate	Power systems: High-latitude power systems may experience voltage alarms, long-duration storms may cause transformer damage. Spacecraft operations: Corrective actions to orientation may be required by ground control; possible changes in drag affect orbit predictions. Other systems: HF radio propagation can fade at higher latitudes, and aurora has been seen as low as New York and Idaho (typically 55° geomagnetic lat.).	Kp = 6	600 per cycle (360 days per cycle)
G 1	Minor	Power systems: Weak power grid fluctuations can occur. Spacecraft operations: Minor impact on satellite operations possible. Other systems: Migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes (northern Michigan and Maine).	Kp = 5	1700 per cycle (900 days per cycle)

(Kp of 0 to 4 is below storm, which we label as G0. Source: NOAA's Space Weather Prediction Center)<sup>119</sup>

Table 4-173 NOAA Space Weather Scale for Solar Radiation Storms

Scale	Description	Effect	Physical measure (Flux level of $\geq 10$ MeV particles)	Average Frequency (1 cycle = 11 years)
S 5	Extreme	Biological: Unavoidable high radiation hazard to astronauts on EVA (extra-vehicular activity); passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. Satellite operations: Satellites may be rendered useless, memory impacts can cause loss of control, may cause serious noise in image data, star-trackers may be unable to locate	$10^5$	Fewer than 1 per cycle

<sup>119</sup> <https://www.swpc.noaa.gov/noaa-scales-explanation>



# Hazard Identification and Risk Assessment

Scale	Description	Effect	Physical measure (Flux level of $\geq 10$ MeV particles)	Average Frequency (1 cycle = 11 years)
		sources; permanent damage to solar panels possible. Other systems: Complete blackout of HF (high frequency) communications possible through the polar regions, and position errors make navigation operations extremely difficult.		
S 4	Severe	Biological: Unavoidable radiation hazard to astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. Satellite operations: May experience memory device problems and noise on imaging systems; star-tracker problems may cause orientation problems, and solar panel efficiency can be degraded. Other systems: Blackout of HF radio communications through the polar regions and increased navigation errors over several days are likely.	$10^4$	3 per cycle
S 3	Strong	Biological: Radiation hazard avoidance recommended for astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. Satellite operations: Single-event upsets, noise in imaging systems, and slight reduction of efficiency in solar panel are likely. Other systems: Degraded HF radio propagation through the polar regions and navigation position errors likely.	$10^3$	10 per cycle
S 2	Moderate	Biological: Passengers and crew in high-flying aircraft at high latitudes may be exposed to elevated radiation risk. Satellite operations: Infrequent single-event upsets possible. Other systems: Small effects on HF propagation through the polar regions and navigation at polar cap locations possibly affected.	$10^2$	25 per cycle
S 1	Minor	Biological: None. Satellite operations: None. Other systems: Minor impacts on HF radio in the polar regions.	10	50 per cycle



# Hazard Identification and Risk Assessment

Table 4-174 NOAA Space Weather Scale for Radio Blackouts

Scale	Description	Effect	Physical measure	Average Frequency (1 cycle = 11 years)
R 5	Extreme	HF Radio: Complete HF (high frequency) radio blackout on the entire sunlit side of the Earth lasting for a number of hours. This results in no HF radio contact with mariners and in route aviators in this sector. Navigation: Low-frequency navigation signals used by maritime and general aviation systems experience outages on the sunlit side of the Earth for many hours, causing loss in positioning. Increased satellite navigation errors in positioning for several hours on the sunlit side of Earth, which may spread into the night side.	X20 ( $2 \times 10^{-3}$ )	Less than 1 per cycle
R 4	Severe	HF Radio: HF radio communication blackout on most of the sunlit side of Earth for one to two hours. HF radio contact lost during this time. Navigation: Outages of low-frequency navigation signals cause increased error in positioning for one to two hours. Minor disruptions of satellite navigation possible on the sunlit side of Earth.	X10 ( $10^{-3}$ )	8 per cycle (8 days per cycle)
R 3	Strong	HF Radio: Wide area blackout of HF radio communication, loss of radio contact for about an hour on sunlit side of Earth. Navigation: Low-frequency navigation signals degraded for about an hour.	X1 ( $10^{-4}$ )	175 per cycle (140 days per cycle)
R 2	Moderate	HF Radio: Limited blackout of HF radio communication on sunlit side, loss of radio contact for tens of minutes. Navigation: Degradation of low-frequency navigation signals for tens of minutes.	M5 ( $5 \times 10^{-5}$ )	350 per cycle (300 days per cycle)
R 1	Minor	HF Radio: Weak or minor degradation of HF radio communication on sunlit side, occasional loss of radio contact. Navigation: Low-frequency navigation signals degraded for brief intervals.	M1 ( $10^{-5}$ )	2000 per cycle (950 days per cycle)





# Hazard Identification and Risk Assessment

## 4.22.1.3 Previous Occurrences

The largest measured CME event hit earth in 1859 causing massive magnetic fluctuations in the Earth's magnetosphere and sent electrified gas and subatomic particles toward the earth with the energy of 10 billion atomic bombs. Known as the Carrington Event, named after the scientist who first saw the solar flare, telegraph communication around the world failed as wires shorted out and caught fire. Colorful auroras also illuminated skies all over the world and were seen as far south as Cuba and Hawaii.<sup>120, 121</sup>

In 1921, another strong geomagnetic storm (caused by a CME) produced the lowest-latitude (13.83°S) observation of an aurora in Apia, Samoa. This event also caused significant disruption of telegraph services in the United States and as well as reportedly more severe fires.<sup>122</sup> Extensive interconnectivity of electrical systems and general electrical dependencies across infrastructures were low at the time, so the effects were restricted to certain sectors. One example occurred following an aurora caused fire at the 57th street control tower of the New York Central Railroad, which knocked out the entire signal and switching system below 125th street.<sup>123</sup>

More recently, in 1989, the greatest damage caused by CME was observed on the Earth. A solar storm event wiped out electrical power to the entire province of Quebec, Canada, and affected 6 million people. Astronomers witnessed this powerful explosion on the sun which sent a billion-ton cloud of gas toward the earth at a million miles an hour. Almost immediately, the resulting solar flare caused short-wave radio interference. Two days later the geomagnetic storm reached earth and again caused widely seen aurora in southern areas. The magnetic disturbance also created electrical currents in the ground beneath much of North America, which in less than two minutes, caused the entire Quebec power grid to lose power. Across the United States, this event resulted in over 200 power grid problems, but luckily at the time (2:44 am), the U.S. had power to spare.<sup>124, 125</sup>

In December 2005, X-rays from a solar flare disrupted satellite-to-ground communication and the GPS system for about 10 minutes and as a result threatened satellite-guided air, sea, and land travel. In April 2017, a moderate G2 (Kp=6) event occurred and caused a simultaneous power grid failure in San Francisco, New York, and Los Angeles.<sup>126</sup>

## 4.22.1.4 Relationship to other hazards

Figure 4-185 shows the interrelationship (causation, concurrence, etc.) between this hazard and other hazards discussed in this plan update.

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<sup>120</sup> 150 Years Ago: The Worst Solar Storm Ever: <https://www.space.com/7224-150-years-worst-solar-storm.html>

<sup>121</sup> A Perfect Solar Superstorm: The 1859 Carrington Event: <https://www.history.com/news/a-perfect-solar-superstorm-the-1859-carrington-event>

<sup>122</sup> The 1859 space weather event revisited: limits of extreme activity: <https://www.swsc-journal.org/articles/swsc/pdf/2013/01/swsc130015.pdf>

<sup>123</sup> New York Railroad Storm: <http://www.solarstorms.org/SS1921.html>

<sup>124</sup> The Day the Sun Brought Darkness: [https://www.nasa.gov/topics/earth/features/sun\\_darkness.html](https://www.nasa.gov/topics/earth/features/sun_darkness.html)

<sup>125</sup> Here's What Would Happen if a Solar Storm Wiped Out Technology as We Know It: <https://www.sciencealert.com/here-s-what-would-happen-if-solar-storm-wiped-out-technology-geomagnetic-carrington-event-coronal-mass-ejection>

<sup>126</sup> Yesterday's Broad Power Outage Likely Caused By Geomagnetic Storm: <https://www.zerohedge.com/news/2017-04-22/yesterdays-broad-power-outage-likely-caused-geomagnetic-storm>



# Hazard Identification and Risk Assessment

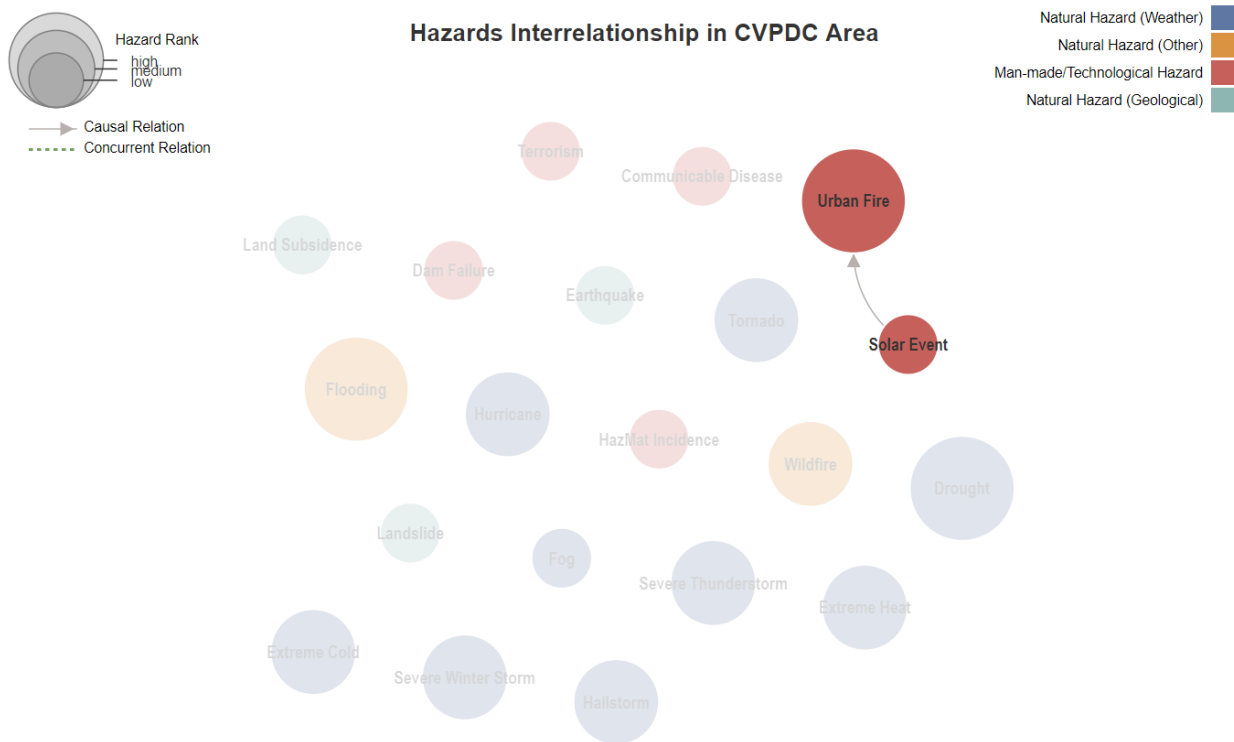


Figure 4-185 Hazards interrelationship

## 4.22.2 Impact and Vulnerability

Modern electric and communication systems are much different now than in 1859. Everything from electricity, water, and heat to 911 calls, cell networks, banking, and the internet, is even more deeply interconnected. Estimates suggest a modern Carrington Event could cost humanity between \$1 and \$20 trillion dollars and could take up to a decade for the worldwide recovery effort. The focus on space related catastrophes used to be on asteroids, however now, due to modern technology and greater interconnectedness, other scenarios must be considered.

### 4.22.2.1 Electric grid

The geo-magnetically induced currents (GICs) created from solar storms can cause widespread electric grid outages in two ways: First, they can cause permanent damage of critical grid components, such as high-voltage power transformers. This is of particular concern as high voltage transformers are not easily replaceable. Second, the GICs can cause voltage instability in the grid and cause the system voltage to collapse, resulting in a widespread but temporary outage.<sup>127</sup>

<sup>127</sup> DHS Science and Technology Directorate: Solar Storm Mitigation:  
[https://www.dhs.gov/sites/default/files/publications/Solar%20Storm%20Mitigation-508\\_0.pdf](https://www.dhs.gov/sites/default/files/publications/Solar%20Storm%20Mitigation-508_0.pdf)



# Hazard Identification and Risk Assessment

## **4.22.2.2 Navigation system**

The use of Global Navigation Satellite Systems (GNSS), including the Global Positioning System (GPS), has grown dramatically in the last decade. GPS receivers are now in nearly every cell phone and in many automobiles, trucks, and any equipment that moves and needs precision location measurements.

Space weather events can impact GPS functioning in a variety of ways. GPS radio signals travel from the satellite to the receiver on the ground, passing through the Earth's ionosphere. In the absence of space weather, GPS systems compensate for the "average" or "quiet" ionosphere, using a model to calculate its effect on the accuracy of the positioning information. But when the ionosphere is disturbed by a space weather event, the models are no longer accurate, and the receivers are unable to calculate an accurate position based on the satellites overhead.<sup>128</sup>

## **4.22.2.3 Oil, Gas, and Other Pipeline**

Solar storms can affect pipe-to-soil voltages, leading to currents that disturb flow meter signals, which can result in false pipeline flow rate data. The induced currents can also increase pipeline corrosion rates. Insulating flanges, meant to interrupt current flow, creates an additional point where electric potential can result in current flow to ground, increasing the risk for corrosion.

## **4.22.2.4 Control system**

Solar storm interference may impact rail supervisory control and data acquisition (SCADA) system dispatch operations and communication networks that employ wireless technologies, especially those dependent on GPS timing signals.

## **4.22.2.5 Solar event impact to Smart City**

Smart City is a concept of utilizing technologies and connected data sensors to enhance a city's infrastructure and operations. This includes monitoring and managing of public assets, transportation systems, citizens, power plants, water supplies, information systems, civil bodies, and other community services. All of these technological systems are becoming more interconnected, and all require a constant supply of electric power. This fact makes them incredibly vulnerable to a single CME event and should therefore be importantly considered as the desire for "smarter" cities rapidly increases.<sup>129</sup>

## **4.22.3 Risk Assessment**

In January 2008, the American National Academy of Sciences (NAS) prepared a report entitled: "Severe Space Weather Events - Understanding Societal and Economic Impacts: A Workshop Report" (2008). The paper contained a calculation of the economic effect of an estimated CME event in 2012. They used historical data on the major CME event in 1921 to run their hypothetical scenario. If a similar impact hit the Earth, the total economic cost would be:

- Future severe geomagnetic storm scenario: \$1 trillion to \$2 trillion in the first year,
- Depending on damage, full recovery could take 4 to 10 years.

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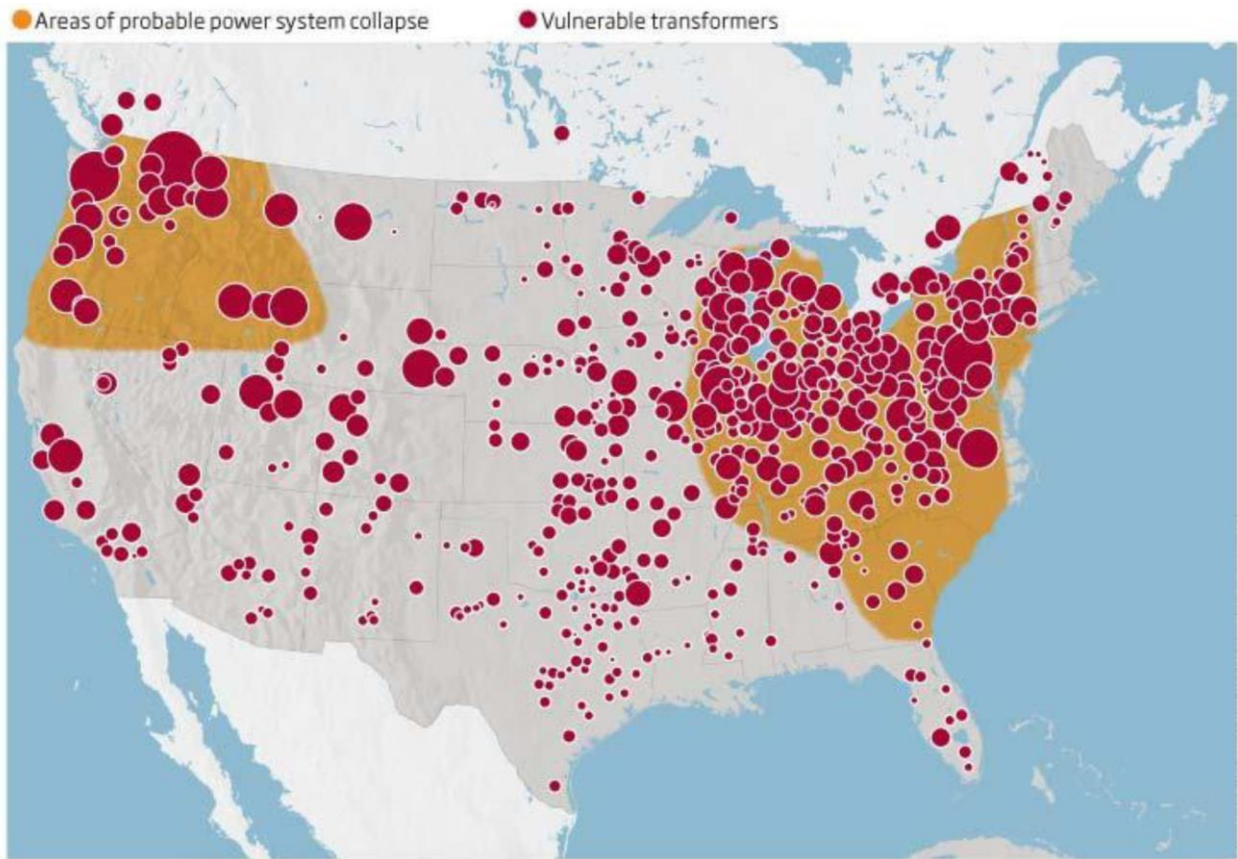
<sup>128</sup> Space Weather and GPS Systems: <https://www.swpc.noaa.gov/impacts/space-weather-and-gps-systems>

<sup>129</sup> Protection of the Smart City against CME: <https://www.sciencedirect.com/science/article/pii/S2352146516306433>



# Hazard Identification and Risk Assessment

In the report, the expected result was shown for the American electrical network system. In NAS' opinion, a severe space weather event in the US could induce ground currents that would knock out 300 key transformers within about 90 seconds, cutting off the power for more than 130 million people (Figure 4-186). The CVPDC is within the areas of probable power system collapse.



(Blackout Warning. A severe geomagnetic storm would damage transformers in the grid, leading to blackouts across wide areas of the U.S.)

Figure 4-186 Expected blackout regions after simulated CME with an impact level of 1921 (Brooks M. 2009)

## 4.22.4 Probability of Future Occurrences

While the occurrence of the next major CME event remains impossible to predict, especially for an area as small as the CVPDC, it remains important to mention because the effects can be so widespread. The forecasting of solar storms remains largely unpredictable, but the storms do originate from dark sunspots (areas of increased magnetic activity) which can be seen. Astronomers track sunspot activity on the sun using “solar cycles”. The current cycle (Solar Cycle 24) is forecasted to end between 2019 and 2020 which indicates a low point in solar sunspot activity. The peak of the next cycle is predicted to occur between 2023 and 2026. An active or weak cycle however, only refers to the total number of storms, not how powerful they are, and therefore the threat of another major CME event is always there.<sup>130</sup>

<sup>130</sup> Solar Cycle 25 Preliminary Forecast. <https://www.swpc.noaa.gov/news/solar-cycle-25-preliminary-forecast>





# Hazard Identification and Risk Assessment

## 4.22.5 References

- Christopher Klein. *A Perfect Solar Superstorm: The 1859 Carrington Event*. August 22, 2018. <https://www.history.com/news/a-perfect-solar-superstorm-the-1859-carrington-event>. (Accessed on October 17, 2019)
- Cybersecurity and Infrastructure Security Agency. *Solar Magnetic Storm Impact on Control Systems*. <https://www.us-cert.gov/ics/advisories/ICSA-11-084-01>. (Accessed on October 14, 2019)
- Department of Homeland Security. *DHS Science and Technology Directorate - Solar Storm Mitigation*. April 15, 2015. [https://www.dhs.gov/sites/default/files/publications/Solar%20Storm%20Mitigation-508\\_0.pdf](https://www.dhs.gov/sites/default/files/publications/Solar%20Storm%20Mitigation-508_0.pdf)
- JASON Program Office, MITRE Corporation. *Impacts of Severe Space Weather on the Electric Grid*. Report JSR-11-320. November 2011. <https://fas.org/irp/agency/dod/jason/spaceweather.pdf>
- National Research Council. 2008. *Severe Space Weather Events: Understanding Societal and Economic Impacts: A Workshop Report*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/12507>.
- National Research Council. 2009. *Severe Space Weather Events—Understanding Societal and Economic Impacts: A Workshop Report: Extended Summary*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/12643>.
- Peter Dockrill. *Here's What Would Happen if a Solar Storm Wiped Out Technology as We Know It*. ScienceAlert. June 21, 2018. <https://www.sciencealert.com/here-s-what-would-happen-if-solar-storm-wiped-out-technology-geomagnetic-carrington-event-coronal-mass-ejection>
- Rafi Letzter. *How a Massive Solar Storm Could Wipe out Modern Technology*. Business Insider. September 9, 2016. <https://www.sciencealert.com/how-a-massive-solar-storm-could-wipe-out-modern-technology>. (Accessed on Oct 16, 2019)
- Robert Roy Britt. *150 Years Ago: The Worst Solar Storm Ever*. September 02, 2009. <https://www.space.com/7224-150-years-worst-solar-storm.html>. (Accessed on October 2, 2019)
- NOAA. *The Day the Sun Brought Darkness*. March 13, 2009. [https://www.nasa.gov/topics/earth/features/sun\\_darkness.html](https://www.nasa.gov/topics/earth/features/sun_darkness.html). (Accessed on October 2, 2019)
- NOAA Space Weather Prediction Center. *Geomagnetic Storms*. <https://www.swpc.noaa.gov/phenomena/geomagnetic-storms>. (Accessed on October 4, 2019)
- NOAA Space Weather Prediction Center. *Solar Cycle 25 Forecast*. June 11, 2019. <https://www.swpc.noaa.gov/news/solar-cycle-25-preliminary-forecast>. (Accessed on October 4, 2019)
- NOAA Space Weather Prediction Center. *Solar Radiation Storm*. <https://www.swpc.noaa.gov/phenomena/solar-radiation-storm>. (Accessed on October 2, 2019)
- NOAA Space Weather Prediction Center. *Solar Magnetic Storm Impact on Control Systems*. <https://www.swpc.noaa.gov/phenomena/coronal-mass-ejections>. (Accessed on October 4, 2019)



# Hazard Identification and Risk Assessment

## 4.23 Conclusion

There are several hazards which may impact the CVPDC region and with limited budgets it is important to identify those hazards which have the most impact. Some hazards may occur more frequently but have a minor impact while other hazards may only occur less often but have a major impact. There are different ways to evaluate and compare these hazards to each other. For this Plan, the average annual loss and average annual casualties and injuries are calculated. These values are then used to help quantify impacts in a multi-criteria ranking system to identify the high-priority hazards.

The average annual loss (AAL) is calculated by taking all the losses that have occurred in an area over the timeframe in which data has been collected and dividing those losses by the number of years in that timeframe. For example, in the CVPDC region, there have been 29 tornadoes over the past 70 years resulting in \$39,472,500 in total losses. To find the AAL, divide \$39,472,500 by 70 years to get \$563,893 of loss per year. This calculation allows for a better comparison between the hazards, but it can be difficult to calculate this value due to insufficient data. For example, fog events may not be recorded or earthquake events occurring more than one hundred years ago may not have documented damages and losses. The average annual casualties and average annual injuries will also be calculated if the data is available. Some hazards, like extreme heat, may not create large economic losses but may create social losses.

For the hazard ranking analysis, all natural hazards and select man-made and technological hazards were used. Table 4-175 provides the AAL calculations for each of the selected hazards in the CVPDC. For the earthquake, flood, and hurricane hazards, Hazus was used to model the AAL. Table 4-176 provides the average annual casualty and injury values for each hazard.

*Table 4-175 Average Annual Loss for the CVPDC Region by Hazard*

Hazards	Years of Data	Property Loss (\$k)	Agriculture Loss (\$k)	Total Loss (\$k)	AAL (\$k)
Drought	26	0	13,400	13,400	\$515.38
Earthquake	247	0	0	0	\$307.00 <sup>1</sup>
Extreme Cold	23	0	539	539	\$23.43
Extreme Heat	33	0	0	0	\$0.00
Flooding	24	22,775	775	23,550	\$4,373.53 <sup>1</sup>
Fog	-	Unknown	0	Unknown	Minimal
Hailstorm	71	120	No Data	119.8	>\$1.69
Hurricane	168	0	0	0	\$760.00 <sup>1</sup>
Land Subsidence/Karst	52	0	0	0	\$0.00
Landslide	52	1 significant event	0	Unknown	>0
Severe Thunderstorm	62	15,091	40.5	15,131.96	\$244.06
Sever Winter Storm	25	130	0	130	\$5.20
Tornado	70	39,473	0	39,472.5	\$563.89
Wildfire	15	0	3,777 <sup>2</sup>	3,777 <sup>2</sup>	\$251.80
Dam Failure	35	300	0	300	\$8.57



# Hazard Identification and Risk Assessment

Hazards	Years of Data	Property Loss (\$k)	Agriculture Loss (\$k)	Total Loss (\$k)	AAL (\$k)
Hazmat Incident	28	2,551	0	127	\$91.09
Urban Fire	11	93,573	0	93,572.629	\$8,506.60

<sup>1</sup> Hazus was used to model the AAL instead of using the historical values.

<sup>2</sup> For the wildfire hazard, average timber values and volumes for each jurisdiction were used from Virginia Department of Forestry <http://www.dof.virginia.gov/harvest/data/harvest-volume-name.htm>.

Table 4-176 Average Annual Casualty and Injuries for the CVPDC Region by Hazard

Hazards	Years of Data	Total Casualties	Total Injuries	Average Annual Casualty	Average Annual Injuries
Drought	26	0	0	0	0
Earthquake	247	0	0	0 <sup>1</sup>	0 <sup>1</sup>
Extreme Cold	23	0	0	0	0
Extreme Heat	33	Few	Several	>0	>0
Flooding	24	Some	Some	>0	>0
Fog	-	0	0	0	0
Hailstorm	71	0	0	0	No Data
Hurricane	168	0	0	0	0
Land Subsidence/Karst	52	0	0	0	0
Landslide	52	Some	Some	>0	>0
Severe Thunderstorm	62	0	8	0	0.13
Sever Winter Storm	25	0	0	0	0
Tornado	70	1	31	0.01	0.44
Wildfire	15	0	0	0	0
Dam Failure	35	0	0	0	0
Hazmat Incident	28	0	0	0	0
Urban Fire	11	85	168	7.7	15.3

<sup>1</sup> Hazus was used to model the casualties and injuries instead of using the historical values.

Table 4-177 provides the final hazard ranking for the CVPDC. Each hazard characteristic is assigned a value between 1 (lowest value) and 4 (highest value). When the risk values were calculated, if the value was greater than 3, it was assigned as a high risk hazard. If the value was greater than 2 and less than or equal to 3, it was assigned as a moderate risk. If the value was less than or equal to 2, it was assigned as a low risk hazard. The drought, flooding, and urban fire hazards were ranked highest although it should be noted that the urban fire hazard may not be a priority for non-urban jurisdictions. The extreme temperatures, hailstorm, hurricane, severe thunderstorm, severe winter storm, tornado, wildfire, dam failure, and hazmat incident are all ranked as moderate. The earthquake, fog, land subsidence/karst, and landslide hazards are ranked as low.



# Hazard Identification and Risk Assessment

Table 4-177 Final Hazard Ranking of Hazards for the CVPDC Region

Hazards	Probability	Impact	Spatial Extent	Warning Time	Duration	Value	Rank
Drought	3	3	4	1	4	3.1	High
Earthquake	1	1	4	4	1	1.9	Low
Extreme Cold	3	2	4	1	3	2.7	Mod.
Extreme Heat	4	2	4	1	3	3	Mod.
Flooding	4	4	2	4	2	3.4	High
Fog	4	1	1	2	1	2	Low
Hailstorm	4	2	4	3	1	3	Mod.
Hurricane	2	3	4	1	1	2.5	Mod.
Land Subsidence/ Karst	1	1	1	4	1	1.3	Low
Landslide	2	2	1	4	1	1.9	Low
Severe Thunderstorm	4	2	4	2	1	2.9	Mod.
Sever Winter Storm	4	2	4	1	3	3	Mod.
Tornado	3	3	1	4	1	2.5	Mod.
Wildfire	4	2	1	4	3	2.7	Mod.
Dam Failure	2	3	1	4	2	2.3	Mod.
Hazmat Incident	3	2	1	4	2	2.3	Mod.
Urban Fire	4	4	2	4	1	3.3	High





**CAPABILITIES**





## 5.0 Capabilities

The capability assessment is a way to quantify the ability of the communities and CVPDC to carry out actions that have been proposed in the hazard identification and risk assessment and the mitigation actions sections. Jurisdictions already have in place budgets, programs, plans, authorities, and staff to respond to events and help to lessen their impacts.

This section serves as a guide to the communities on their limitations in implementing mitigation actions identified in this Plan. Local capabilities serve as the foundation for designing an effective hazard mitigation plan and action items. It not only helps establish the goals and objectives, but also assures that those actions are realistically achievable. The jurisdictional assessment should detect any existing gaps, shortfalls, or weaknesses within existing governmental activities that could exacerbate a community's vulnerability. The assessment also will highlight the positive measures already in place or being completed at the local level, which should continue to be supported and enhanced, if possible, through future mitigation efforts.

In this section, information is provided for the Federal, State, and Regional capabilities available to local governments and a local self-assessment is provided for each jurisdiction in the CVPDC.

### 5.1 Federal, State, and Regional Capabilities

There are several Federal, State, and Regional capabilities available for all jurisdictions within the CVPDC. This section provides information on the agencies and programs available to support local mitigation planning.



## FEMA

**Federal Emergency Management Agency (FEMA).** FEMA programs focus on responding to disasters and supporting state and local initiatives that will reduce the impacts of disasters. The programs provide technical assistance, regulatory standards, and financial assistance through grant programs. Some of the grant programs are provided after a disaster strikes and others are pre-disaster.

#### 5.1.1 FEMA National Flood Insurance Program (NFIP)

The NFIP offers flood insurance to property owners with insurable assets located in communities that adopt and enforce certain provisions that will help to minimize future flood losses. These measures apply to all proposed activities within the special flood hazard areas that are designated on maps provided by FEMA. All the jurisdictions described in this Plan are NFIP communities.

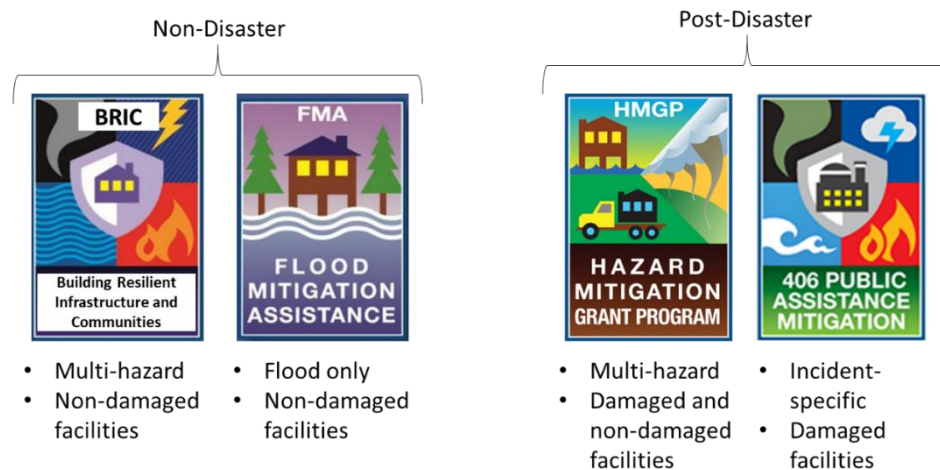
#### 5.1.2 FEMA Community Rating System (CRS)

The CRS is an incentive program that rewards communities that exceed NFIP regulations in ways that reduce damage and improve safety. The incentive is a reduction in the cost of flood insurance premiums. Communities must apply, annually certify their programs, and undergo periodic audits. Lynchburg City is currently the only locality within the CVPDC pursuing CRS certification.



# Capabilities

## 5.1.3 FEMA Grant Programs



## 5.1.4 FEMA Risk Mapping, Assessment, and Planning (Risk MAP)

The Risk MAP program was created to create collaboration with state, local, and Tribal entities to deliver quality risk data that increases public awareness and leads to action that reduces risk to life and property. It also helps create informed risk management decisions and actions to mitigate risk through a consistent risk-based approach to assessing potential vulnerability and losses. This program is currently tasked with updating the floodplain maps for James River.



### US Army Corps of Engineers®

**U.S. Army Corps of Engineers.** Within Virginia, USACE civil works projects for flood risk management, ecosystem restoration, and navigation activities and support are based on river basin watershed boundaries. For regulatory permitting activities, the Norfolk District oversees the entire state, but also coordinates with the other four USACE Districts in the State as needed. In addition to the main office in Norfolk, regional field offices are located around the state to provide regulatory assistance.

## 5.1.5 USACE Flood Plain Management Services Program

Under Section 206 of the 1960 Flood Control Act (PL 86-645) as amended, upon request, technical assistance and general planning guidance can be provided to state and local governments, Native American Indian tribes, and other non-federal public agencies without charge. Program services also are offered to non-water resources federal agencies and to the private sector on a 100% cost recovery basis. Technical assistance typically includes flood hazard evaluations for site specific locations, developing or interpreting flood flows, flood depths or stages; floodwater velocities; and the extent, duration, and frequency of flooding. General planning guidance can include development of special studies, guides, and pamphlets related to water resources.

## 5.1.6 USACE Continuing Authorities Program

Congress has provided USACE with standing authority to study, design, and construct small scale (less than \$10 million) water resource projects for various purposes without additional project specific congressional authorization. The sponsoring agency may be a state, county, city, tribe, or other group and must cost share in the project. Projects can include streambank and shoreline protection, flood risk management, navigation improvements, beneficial uses of dredged material, aquatic ecosystem restoration, and USACE project



# Capabilities

modifications for improvement to the environment. Cost-sharing for study and project costs can vary by business line.

## 5.1.7 USACE General Investigations Program

Congress can authorize USACE to study, design, and construct major flood risk management, navigation, and ecosystem restoration projects that may cost more than \$10 million. A feasibility study is cost-shared 50/50 between the federal government and non-federal sponsor, where the cost-sharing for other project costs can vary by business line.



**U.S. Department of Housing and Urban Development (HUD).** HUD programs are administered through the Virginia Department of Housing and Community Development (DHCD) and local entitlement communities and offer several programs to support local efforts to address hazards and implement mitigation actions.

## 5.1.8 HUD Community Development Block Grant (CDBG)

The CDBG program works to ensure decent affordable housing, to provide services to the most vulnerable in communities, and to create jobs through the expansion and retention of businesses. CDBG can be an important tool for helping local governments tackle serious challenges facing community and CDBG funds are routinely used in disaster-impacted areas for structure repair, elevation, and acquisition and demolition of damaged structures, particularly citizens that qualify for the FEMA HMGP program.



**U.S. Environmental Protection Agency (EPA).** The EPA's mission is to protect human health and the environment. It has created federal-state partnerships to support safe drinking water and water quality projects in the Commonwealth. The agency also supports responding to environmental disasters such as chemical spills and train derailments.

## 5.1.9 EPA Drinking Water State Revolving Fund (DWSRF) and Water Supply Assistance Grant (WSAG) Fund Program

The DWSRF and WSAG programs are federal-state partnership with Virginia Department of Health to help ensure safe drinking water. They were created by the 1996 Amendments to the Safe Drinking Water Act (SDWA) and provides financial support to water systems and to state safe water programs.

## 5.1.10 EPA Clean Water State Revolving Fund (CWSRF) Program

The CWSRF is a federal-state partnership with Virginia Department of Environmental Quality that provides communities with a low interest rate financing option to Virginia cities, towns, and wastewater authorities for the upgrade, expansion, extension, replacement, repair, rehabilitation, and/or additions to public wastewater collection and treatment facilities.



**U.S. Department of Commerce, Economic Development Administration (EDA).** EDA supports economic recovery strategies, in part by providing cost-shared funds for planning and technical assistance, emergency infrastructure grants, construction grants and a Revolving Loan Fund to assist communities and quasi-public entities such as local development corporations and public or private non-profit organizations. EDA funds have been used to retrofit or relocate public water supply or wastewater treatment facilities.





# Capabilities

After disasters, some communities use EDA long-term recovery funding to help businesses move to safer locations.



**Federal Highway Administration (FHWA).** The FHWA provides stewardship over the construction, maintenance, and preservation of the Nation's highways, bridges, and tunnels. It also conducts research and provides technical assistance to state and local agencies to improve safety and mobility.

## 5.1.11 FHWA Emergency Transportation Operations (ETO)

The ETO program provides tools, guidance, capacity building, and good practices that aid local and State DOTs and their partners in their efforts to improve transportation network efficiency and public/responder safety when a non-recurring event either interrupts or overwhelms transportation operations. Non-recurring events may range from traffic incidents to traffic Planning for Special Event (PSE) to disaster or emergency transportation operations. Work focuses on using highway operational tools to enhance mobility and motorist and responder safety. Partnerships can involve transportation, public safety (fire, rescue, emergency medical service, and law enforcement) and emergency management communities.

## 5.1.12 FHWA Federal-aid Highway Emergency Relief Program

The Emergency Relief (ER) program is intended to supplement the commitment of resources by States, counties, and cities (or other Federal agencies when appropriate) to help pay for unusually heavy expenses resulting from extraordinary conditions. Congress has authorized ER funding as part of the FHWA's Federal-aid highway program. ER funds are available for the repair of Federal-aid highways or roads on Federal lands that have been seriously damaged by natural disasters over a wide area or by catastrophic failures from an external cause. Examples of natural disasters include floods, hurricanes, earthquakes, tornadoes, tidal waves, severe storms, or landslides.



**U.S. Department of Agriculture (USDA).** The USDA has several loan and grant programs that may support mitigation initiatives and post-disaster recovery. The USDA's Natural Resources Conservation Service (NRCS) has additional programs which focus on providing technical and financial assistance to communities. These programs include:

- Rural Business-Cooperative Development Service Business and Industrial Loans help create jobs and stimulate rural economies by backing rural businesses.
- Rural Housing Service Community Facilities Loans and Grants can be used to construct, enlarge, or improve community services for health care, public safety, and public services.
- Water and Waste Grants and Loans are used to develop, replace, or repair water and waste disposal (including storm drainage) systems in rural areas and small towns.
- Farm Service Agency Emergency Conservation Program assistance can be used to rehabilitate certain farmland damaged by floods or other disasters.
- Farm Service Agency Tree Assistance provides cost-shared payments to orchardists, maple sugar producers, greenhouse operators and vineyard growers who incur losses due to damaging weather.
- Federal Multi-Peril Crop Insurance policies insure against losses due to natural causes such as drought, excessive moisture, hail, wind, frost, insects, and disease.
- Non-insured Crop Disaster Assistance Program helps growers of crops for which crop insurance is not available.



# Capabilities

- Farm Service Agency Flood Risk Reduction allows farmers to voluntarily execute contracts to receive payments on lands with high flood potential in return for foregoing certain USDA program benefits.
- Supplemental Revenue Assistance Payment Program (SURE) for crop losses in communities declared a disaster by the Secretary of Agriculture.
- Emergency Loans program provides loans to restore or replace essential property damaged in the disaster; finance production losses to crops and livestock; fund essential family living and farm operation expenses, or refinance certain debts.
- Emergency Conserve Program provides funding to address new conservation problems created by disaster that, if not treated, would impair or endanger the land. Funds can be used to rehabilitate farmland damaged by wind erosion, floods, hurricanes, or other natural disasters and to carry out water conservation measures during drought.
- Under authority in Public Law 566, the NRCS conducted numerous flood reduction projects to address problems in small watersheds. NRCS supports river basin and watershed planning initiatives undertaken by local jurisdictions.
- The Emergency Watershed Protection Program can provide technical and financial assistance to communities to repair and restore clogged and damaged waterways to pre-disaster conditions.
- The Emergency Conservation Program, coordinated with the USDA Farm Services Agency, provides technical assistance to the agricultural community after disasters.
- Wetland Reserve Program provides technical and financial support to help landowners implement wetland restoration, conservation, and wildlife practices.



**US Small Business Administration (SBA).** The SBA has the authority to declare disaster areas based on the number of homes and businesses that are affected, even if the event does not warrant a declaration by the President. SBA provides low interest loans and can authorize loan amounts up to 20% above the costs of restoration if the applicant agrees to implement mitigation measures. Individuals and businesses can use SBA funds to pay for the non-federal share of HMGP and FMA projects to elevate-in-place, relocate, or flood-proof buildings in flood hazard areas. The SBA uses the Business Physical Damage Loan Program to help businesses and nonprofit organizations repair or replace uninsured damaged property such as real estate, machinery and equipment, inventory, and supplies. SBA uses the Economic Injury Disaster Loan, or 'last resort loans' to provide working capital to small businesses and small agricultural cooperatives to help them through the recovery period. SBA uses the Disaster Assistance Program Loans to help eligible homeowners after a disaster including supporting mitigation measures such as drainage improvement, flood proofing, and hurricane shutter installation.



**Virginia Department of Emergency Management (VDEM).** VDEM is the primary coordinating state agency for emergency preparedness, response, recovery, and mitigation programs. Their responsibilities include a comprehensive, efficient, and effective response to emergencies and disasters throughout Virginia, including provision of assistance in the absence of events for which federal aid is made available. VDEM is charged with supporting mitigation planning and administers Hazard Mitigation Assistance (HMA) programs that provide grants to eligible entities to implement cost effective mitigation projects in the pre-disaster and post-disaster periods. VDEM also leads the Public Assistance Programs, which provide disaster assistance to state agencies, local jurisdictions, and certain private nonprofit entities to repair and restore



# Capabilities

damaged facilities. VDEM also supports the regional planning district commissions with their hazard mitigation plans.



**Virginia Department of Conservation & Recreation (DCR).** DCR supports the conservation, protection, and enhancement of Virginia lands and improves the quality of the Chesapeake Bay and our rivers and streams, promotes the stewardship and enjoyment of natural, cultural, and outdoor recreational resources, ensures the safety of Virginia's dams, and serves as the coordinator of all flood protection programs and activities in the Commonwealth. DCR is the State Coordinating Office for NFIP activities and administers the dam safety program. The Virginia Dam Safety, Flood Prevention, and Protection Assistance Fund helps local jurisdictions address problem areas by providing state funds to conduct engineering studies for both dams and floodplains. Some easement and other programs may support floodplain acquisition projects, including Scenic Rivers Program, funding from the Virginia Outdoors Fund, Conservation Reserve & Enhancement Program, and Best Management Practices implemented with Water Quality Improvement grants.



**Virginia Department of Housing & Community Development (DHCD).** DHCD collaborates with communities to assist them in developing their economic potential, and creating a healthy, safe, and affordable living environment. Following natural disasters, DHCD grant staff coordinate with VDEM hazard mitigation and human service managers to target funds to communities hardest hit. After catastrophic disasters of regional proportions, DHCD assists VDEM in coordinating local Long-Term Disaster Recovery Task Forces. These task forces are critical to coordination of various economic assistance and redevelopment programs, volunteer efforts, donations, and redevelopment. Strong local recovery task forces have supported disaster recovery throughout Virginia including the CVPDC region.



**Virginia Department of Health (VDH).** The mission of the VDH is to promote and protect the health of all Virginians. The VDH office of Emergency Preparedness has two federal grants through the US Department of Health and Human Services' (HHS) Office of the Assistant Secretary for Preparedness and Response (ASPR) Hospital Preparedness Program (HPP) and Centers for Disease Control and Prevention (CDC) Public Health Emergency Preparedness (PHEP). HPP and PHEP are focused on development of all healthcare and public health capabilities and ensuring that federal preparedness funds are directed to priority areas as identified through strategic planning efforts. Preparedness activities funded by the PHEP program are targeted specifically for the development of emergency-ready public health departments that are flexible and adaptable. This funding helps health departments build and strengthen their abilities to effectively respond to a range of public health threats, including infectious diseases, natural disasters, and biological, chemical, nuclear, and radiological events. The Hospital Preparedness Program (HPP) provides leadership and funding through grants and cooperative agreements to improve surge capacity and enhance community and hospital preparedness for health care emergencies.



# Capabilities



**The Virginia Department of Forestry (VDOF).** VDOF is responsible for the protection of forest land from fire, insects, and disease. The principle goals of the Forest Protection Program are to prevent injury or loss of human life, minimize property damage, and protect resources. The ability to adapt to emergencies enables a small formal fire suppression force to limit annual fire losses through coordination with local fire departments, forest industry, federal agencies, other state agencies, and VDOF organized volunteer fire crews. VDOF promotes FireWise practices for landscaping, creating defensible space, and construction. There are several FireWise communities in Bedford County. VDOF also maintains a statewide wildland fire risk assessment GIS database.



**Virginia Department of Transportation (VDOT).** VDOT is responsible for building, maintaining, and operating the state's roads, bridges, and tunnels, including repairs and replacements required after natural disasters. In accordance with requirements of the Federal Highway Administration, VDOT routinely factors flood hazards into the planning and design of transportation infrastructure.



**Department of Mines, Minerals, and Energy (DMME).** The primary goal of the Division of Geology and Mineral Resources is to enhance the safe and environmentally sound use of Virginia's resources. This includes an objective to reduce the impact of geologic hazards that pose safety and environmental problems, such as landslides and karst. The Division provides maps and digital data to local jurisdictions to be included in local hazard mitigation plans. For this Plan, DMME provided seismic activity maps of the region.



**Department of Environmental Quality (DEQ).** DEQ is the lead agency for the Virginia Drought Monitoring Task Force and compile Drought Status Reports using information from several state and federal agencies. The reports, which are distributed by VDEM, contain sections relating to current climatologically conditions and situation reports regarding water supplies, water quality, forest fire risks, and agriculture and crop reports. DEQ also has major responsibility for the environmental consequences of accidents and disasters. The agency plays a major role in hazardous materials containment, testing and abatement and provides oversight to the permitting process that oversees any activity with potential impacts to rivers, streams, or wetlands.



**Central Virginia Planning District Commission (CVPDC).** The Mission of the CVPDC is to be a dynamic public forum for matters of regional significance; to create solutions by coordinating plans and building coalitions; and, to provide service excellence to the localities and to the Commonwealth. The CVPDC is one of 21 Planning District Commissions in the Commonwealth of Virginia. It is a political subdivision representing ten local governments. Planning District Commissions are voluntary associations created pursuant to the Virginia Area Development Act adopted in 1969. The purpose of planning district commissions, as set out in the Code of Virginia, Section 15.2-4207 is "...to encourage and facilitate local government cooperation and state-local cooperation in addressing on a regional basis problems of greater than local significance." The CVPDC serves as a resource of technical










# Capabilities

expertise to its member local governments. Specific programs affiliated with the CVPDC include regional all-hazards mitigation planning, transportation, ridesharing, and environmental concerns.

For more information concerning any of these programs, see Appendix I: Mitigation Funding Sources.

## 5.2 Capability Assessment

This assessment includes a comprehensive examination of the following local government capabilities:

Capabilities	Description
 Planning	Examines the plans, policies, and programs in place which can be used for hazard mitigation.
 Legal	Presents the authorities a jurisdiction can use to support hazard mitigation through regulations, acquisition, ordinances, and code enforcement.
 Administrative	Describes the local government and departments in a jurisdiction focusing on those entities that would be involved with hazard mitigation.
 Fiscal	Identifies the local budgets, taxation, and potential sources of funding.
 Technical	Provides information on the types and numbers of technical staff involved with hazard mitigation within the jurisdiction.



## 5.3 Planning Capabilities

Planning capability refers to the plans, ordinances, and programs in place that can support hazard mitigation. Many of a jurisdiction's plans can be linked to this hazard mitigation plan. Examples include the Comprehensive Plan, Capital Improvements Plan, Emergency Operations Plan, Disaster Recovery Plan, Economic Development Plan, Stormwater Management Plan, zoning ordinances, erosion and sediment control ordinance, historic preservation ordinance, floodplain management ordinance, transportation planning, subdivision ordinances, and building codes.

### 5.3.1 Comprehensive Plans

A community's comprehensive plan provides the future vision for the community regarding growth and development. Hazard mitigation planning is not specifically addressed as a goal or objective in any of the comprehensive plans in the study area. The plans include land use or environmental protection goals that could support future mitigation efforts and generally address flood-prone areas. There also are opportunities to include hazard mitigation in revisions to the comprehensive plans and to link to existing goals. For example,



# Capabilities

limiting development in the floodplain (which can be considered mitigation) also may help meet open space goals laid out in a plan.

## **5.3.2 Capital Improvement Plans**

A capital improvements plan guides how and when the community makes public improvements. It can serve as an important mechanism to guide future development away from identified hazard areas. Limiting public investment in hazardous areas is an effective long-term mitigation action available to local governments.

## **5.3.3 Zoning Ordinances**

Zoning represents the primary means by which land use is controlled by local governments. As part of a community's police power, zoning is used to protect the public health, safety, and welfare. Since zoning regulations enable municipal governments to limit the type and density of development, it can serve as a powerful tool when applied in identified hazard areas.

## **5.3.4 Building Codes, Permitting, and Inspections**

Building codes regulate design and construction standards. Permits are issued and inspections are conducted on new construction and building alterations. Permitting and inspection processes before and after a disaster can affect the level of hazard risk faced by a community.

## **5.3.5 Historic Preservation Plans**

A historic preservation plan preserves historic structures or districts within a community. An often-overlooked aspect of the historic preservation plan is the assessment of buildings and sites located in areas subject to natural hazards which may include the identification of the most effective way to reduce future damages. This could involve retrofitting or relocation techniques that account for the need to protect buildings that do not meet current building standards or are within a historic district that cannot be easily relocated out of harm's way.

## **5.3.6 Subdivision Ordinances**

A subdivision ordinance regulates development of housing, commercial, industrial, or other uses, including associated public infrastructure, as land is subdivided into buildable lots. Subdivision design that accounts for natural hazards can reduce the exposure of future development.

## **5.3.7 Stormwater Management Plans**

A stormwater management plan addresses flooding associated with stormwater runoff. It is typically focused on design and construction measures that are intended to reduce the impact of frequent urban nuisance flooding. Local governments in Virginia are required to administer stormwater management laws and regulations enacted by the State through local ordinances.

## **5.3.8 Emergency Operations Plans**

A comprehensive Emergency Operations Plan (EOP) typically predetermines actions to be taken by government agencies and private organizations in response to an emergency or disaster event. The plan describes the jurisdiction's capabilities to respond to emergencies and establishes the responsibilities and procedures for responding effectively to the disaster. Hazard mitigation is incorporated into the various operational phases of



# Capabilities

these plans. Hazard mitigation is included as a functional annex to the Emergency Operations Plans developed by many jurisdictions. Generally, the annex describes the responsibilities of various departments and agencies, private businesses, and the public. The annex outlines a concept of operations that explains what activities will be undertaken before and after a disaster. Specific tasks are assigned to the Board of Supervisors/City Council (or other local governing body), Department of Emergency Services, Department of Health, Building Officials/County Engineer/Planning and Zoning, Law Enforcement, Fire Department and Emergency Crew, Superintendent of Schools, and Public Information Officer.

## **5.3.9 Continuity of Operations/Continuity of Government Plans**

A continuity of operations plan (COOP) or continuity of government plan (COG) establishes a clear chain of command, line of succession, and plans for backup or alternate emergency facilities in case of an extreme emergency or disaster. This plan may be agency specific or cover the local government as a whole.

## **5.3.10 Disaster Recovery Plans**

A disaster recovery plan guides the physical, social, environmental, and economic recovery and reconstruction process following a disaster. In many instances, hazard mitigation principles and practices are incorporated into local disaster recovery plans with the intent of capitalizing on opportunities to break the cycle of repetitive disaster losses. Disaster recovery plans can also lead to the preparation of disaster redevelopment policies and ordinances to be enacted following a hazard event.

## **5.3.11 Floodplain Management**

Communities that regulate development in floodplains are able participate in the National Flood Insurance Program (NFIP). In return, the NFIP makes federally-backed flood insurance policies available for properties in the community. All the jurisdictions in the CVPDC meet NFIP requirements and are currently in the Program. Virginia statutes provide cities and counties the land use authority. In particular, issues such as floodwater control, are empowered through §15.2-2223 and §15.2-2280. All the jurisdictions in the planning area have adopted a local floodplain ordinance as a requirement of participation in the National Flood Insurance Program.

## **5.3.12 Floodplain Management Plan**

A floodplain management plan (or a flood mitigation plan) provides a framework for the identification and implementation of corrective and preventative measures specifically designed to reduce the impacts of floods.



## **5.4 Legal Capabilities**

This section will detail different legal considerations and their impact on local capability. In general, all CVPDC jurisdictions operate within the same legal environment, but there are some differences in the ordinances the jurisdictions have passed.

### **5.4.1 Dillon Rule**

The Commonwealth of Virginia is considered a Dillon Rule state, one of only five remaining in the nation along with Kentucky, Minnesota, North Carolina, and Pennsylvania. The Dillon Rule, named for John Forest Dillon, chief justice of the Iowa Supreme Court in the late 1800's, is used to interpret state law when there is a question



# Capabilities

of whether or not a local government has a certain power. Under the Dillon Rule, should reasonable doubt exist as to whether a power has been granted to a local government, then the power has not been granted. Therefore, a local government can exercise no power or authority not expressly conferred on the locality by the Virginia General Assembly via the Code of Virginia or the local charter.

Local governments in Virginia have a wide range of tools available to them for implementing mitigation programs, policies, and actions. A hazard mitigation program can utilize any or all the four broad types of government powers granted by the State of Virginia, which are: (a) regulation, (b) acquisition, (c) taxation, and (d) spending. All power is vested in the state and can only be exercised by local governments to the extent it is delegated.

## **5.4.2 Regulation**

Virginia local governments have been granted broad regulatory powers in their jurisdictions. Virginia State Statutes bestow the general police power on local governments, allowing them to enact and enforce ordinances which define, prohibit, regulate, or abate acts, omissions, or conditions detrimental to the health, safety, and welfare of the people, and to define and abate nuisances (including public health nuisances). Since hazard mitigation can be included under the police power (as protection of public health, safety, and welfare), towns, cities, and counties may include requirements for hazard mitigation in local ordinances. Local governments also may use their ordinance-making power to abate “nuisances,” which could include, by local definition, any activity or condition making people or property more vulnerable to any hazard.

## **5.4.3 Land Use**

Regulatory powers granted by the state to local governments are the most basic manner in which a local government can control the use of land within its jurisdiction. Through various land use regulatory powers, a local government can control the amount, timing, density, quality, and location of new development. All these characteristics of growth can determine the level of vulnerability of the community in the event of a natural hazard. Land use regulatory powers include the power to engage in planning, and enact and enforce zoning ordinances, floodplain ordinances, and subdivision controls. Each local community possesses the ability to prevent unsuitable development in hazard-prone areas.

## **5.4.4 Planning**

According to State Statutes, local governments in Virginia may create or designate a planning agency. The planning agency may perform a number of duties, including make studies of the area, determine objectives, prepare and adopt plans for achieving objectives, develop and recommend policies, ordinances, and administrative means to implement plans, and perform other related duties. The importance of the planning powers of local governments is illustrated by the requirement that zoning regulations be made in accordance with a comprehensive plan. While the ordinance itself may provide evidence that zoning is being conducted “in accordance with a plan,” the existence of a separate planning document ensures that the government is developing regulations and ordinances that are consistent with the overall goals of the community.

## **5.4.5 Zoning**

Zoning is the traditional and most common tool available to local governments to control the use of land. Broad enabling authority is granted for municipalities and counties in Virginia to engage in zoning. Land “uses” controlled by zoning include the type of use (e.g., residential, commercial, and industrial) as well as minimum





# Capabilities

specifications that control height and bulk such as lot size, building height and setbacks, and density of population. Local governments are authorized to divide their territorial jurisdiction into districts, and to regulate and restrict the erection, construction, reconstruction, alteration, repair or use of buildings, structures, or land within those districts. Districts may include general use districts, overlay districts, and special use or conditional use districts. Zoning ordinances consist of maps and written text. Every locality in the state that enacts a zoning ordinance is required to also establish a board of zoning appeals. The responsibilities of the Board of Zoning Appeals include the ability to hear and decide appeals of decisions made by the Zoning Administrator; the ability to grant variances to provisions of the Zoning Ordinance based on strict guidelines; and the ability to provide interpretations for zoning district boundaries where uncertainty exists. The Board of Zoning Appeals does not have the authority to rezone property or to rule upon or revoke conditional use permits, powers reserved for the Board of Supervisors. Decisions of the Board of Zoning Appeals may be appealed to the Circuit Court.

## **5.4.6 Subdivision Regulation**

Subdivision regulations control the division of land into parcels for the purpose of building development or sale. Flood-related subdivision controls typically require that sub-dividers install adequate drainage facilities and design water and sewer systems to minimize flood damage and contamination. They also may prohibit the subdivision of land subject to flooding unless flood hazards are overcome through filling or other measures, and they prohibit filling of floodway areas.

## **5.4.7 Floodplain Regulation**

All the communities in the study area have adopted floodplain regulations that meet the minimum requirements of the National Flood Insurance Program. All the communities have chosen to implement the floodplain ordinance as a zoning district (regular or overlay) including restrictions on manufactured homes. These restrictions include the need for manufactured homes to be elevated and/or anchored to a permanent foundation.

## **5.4.8 Building Codes and Building Inspection**

Many structural mitigation measures involve building and retrofitting homes, businesses, and other structures according to standards designed to make the buildings more resilient to the impacts of natural hazards. Many of these standards are imposed through building codes. All the jurisdictions have adopted the Uniform Virginia Statewide Building Code. Local governments in Virginia also are empowered to carry out building inspections. It empowers cities and counties to create an inspection department, and enumerates their duties and responsibilities, which include enforcing state and local laws relating to the construction of buildings, installation of plumbing, electrical, and heating systems; building maintenance; and other matters. Most of the jurisdictions in the planning area have established a Building Inspections Office or have designated a Building Official to carry out building inspections.

## **5.4.9 Acquisition**

The power of acquisition can be a useful tool for pursuing local mitigation goals. Local governments may find the most effective method for completely “hazard-proofing” a particular piece of property or area is to acquire the property (either in fee simple or a lesser interest, such as an easement), thus removing the property from the private market and eliminating or reducing the possibility of inappropriate development occurring. Virginia



# Capabilities

legislation empowers cities, towns, and counties to acquire property for public purpose by gift, grant, devise, bequest, exchange, purchase, lease, or eminent domain. Acquisition has not been used by any of the communities in the planning area though it has been used successfully in other parts of Virginia.

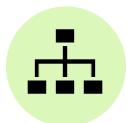
## 5.4.10 Taxation

The power to levy taxes and special assessments is an important tool delegated to local governments by Virginia law. The power of taxation extends beyond merely the collection of revenue and can have a profound impact on the pattern of development in the community. Communities have the power to set preferential tax rates for areas which are more suitable for development in order to discourage development in otherwise hazardous areas. Local units of government also have the authority to levy special assessments on property owners for all or part of the costs of acquiring, constructing, reconstructing, extending or otherwise building or improving flood protection works within a designated area. This can serve to increase the cost of building in such areas, thereby discouraging development. Because the usual methods of apportionment seem mechanical and arbitrary, and because the tax burden on a particular piece of property is often quite large, the major constraint in using special assessments is political. Special assessments seem to offer little in terms of control over land use in developing areas. They can, however, be used to finance the provision of necessary services within municipal or county boundaries. In addition, they are useful in distributing to the new property owners the costs of the infrastructure required by new development. Localities in Virginia collect a sales tax and all the jurisdictions in the planning area levy property taxes.

## 5.4.11 Spending

The fourth major power that has been delegated from the Virginia General Assembly to local governments is the power to make expenditures in the public interest. Hazard mitigation principles should be made a routine part of all spending decisions made by the local government, including the adoption of annual budgets and the Capital Improvement Plan (CIP). A CIP is a schedule for the provision of municipal or county services over a specified period of time. Capital programming, by itself, can be used as a growth management technique, with a view to hazard mitigation. By tentatively committing itself to a timetable for the provision of capital to extend services, a community can control growth to some extent, especially in areas where the provision of on-site sewage disposal and water supply are unusually expensive.

In addition to formulating a timetable for the provision of services, a local community can regulate the extension of and access to services. A CIP that is coordinated with extension and access policies can provide a significant degree of control over the location and timing of growth. These tools can also influence the cost of growth. If the CIP is effective in directing growth away from environmentally sensitive or high hazard areas, for example, it can reduce environmental costs.



## 5.5 Administrative Capabilities

There are three types of jurisdictions included in this Hazard Mitigation Plan: cities, counties, and towns. Cities are independent local government entities and have their own governing councils, constitutional officers, and administrative staff. Counties also are independent local government entities similar to cities but may contain



# Capabilities

incorporated towns within their boundaries. Incorporated towns are semi-independent local government entities, with taxing authority and other limited authority in addition to the surrounding county.

All the counties in CVPDC operate under a Traditional Form of government within the Commonwealth of Virginia. Under this form of government, an elected Board holds responsibility for the general legislative and administrative affairs of the jurisdiction. In the counties, a Board of Supervisors is elected, containing five to seven members from different districts within the county with a Chair and Vice Chair. The cities and towns in CVPDC use a Mayor-Council Form of government. For cities, a City Council are elected, with council members being at large or representing specific wards. Towns have a similar organization with a Town Council consisting of an elected Mayor and Council members.

For cities and counties, these forms of government also require the election of other officers, known as Constitutional Officers, who are responsible for the administration of certain specific aspects of community affairs. This usually includes the clerk of the court, commissioner of revenue, commonwealth's attorney, sheriff, and treasurer. The elected boards can also hire an administrator who oversees daily operations of the community and community staff. In counties, this is the county administrator, while in cities and towns this is the city or town manager. In counties and cities, the Board is responsible for establishing community policy via passage of resolutions and ordinances within limitations established by the General Assembly, approving an annual operating budget, setting tax rates, and making appointments to various boards and committees. The Board also approves land use plans and any subsequent amendments via rezonings.

The incorporated towns must have an elected governing body. Under the Mayor Council Form of government, the powers of government are vested in a Town Council. The Town Council is responsible for developing an annual Town budget, amending the Town Code, and developing policy to guide the activities of the Town. Council also has taxing authority and sets tax rates that are in addition to the County's rates for those citizens who live within the Town limits. A Mayor, not considered a member of Town Council, is also elected by all voters within the Town. The Mayor's duties include presiding over Council meetings and voting only in the event of a tie. The Mayor and Council Members are each elected to two-year terms.

The Town Council can choose to employ a Town Manager who is charged with overseeing the daily operations of the Town and carrying out the policy set forth by Council. Other functions of the Town Manager include communicating with the public and media, setting Council agendas and preparing associated materials, and assisting Council as needed. The Town Manager represents Council at many local, regional, and state functions and directs the activities of various departments. Towns have zoning and planning authority though they may choose to use the county planning commission as their town planning commission. Towns can issue general obligation and revenue bonds. In addition, towns of over 5,000 may appoint an emergency services director and exercise emergency powers separate from the county.

Under the County Administrator or the City or Town Manager, each jurisdiction has several departments and boards that are responsible for the various functions of local government. Although exact responsibilities differ from jurisdiction to jurisdiction, the general duties of the departments are described below.

- The Building Inspections office or department enforces the Virginia Uniform Statewide Building Code (VUSBC). This code includes many floodplain management considerations as it impacts site construction.



# Capabilities

- Community Development departments are typically responsible for managing grant programs funded by the U.S. Department of Housing and Urban Development. These grant programs include the Community Development Block Grant Program. Community Development departments also may develop residential and commercial revitalization plans for older areas, serve as a resource on housing and community development issues, and undertake special redevelopment projects.
- Economic Development departments concentrate on ensuring the growth and prosperity of existing businesses. These departments often administer small business loan programs, state economic development programs, and workforce training programs. They also may recruit new businesses.
- Emergency Management or Services departments are responsible for the mitigation, preparedness, response, and recovery operations that involve both natural and man-made disaster events. Often, these functions may be included in a department of Public Safety that encompasses building inspections, emergency management, and fire safety. Fire/EMS departments provide medical aid and fire suppression at the scene of accidents and emergencies. These departments are often responsible for responding to hazardous materials incidents.
- Parks and Recreation departments may be responsible for open space programs. If acquisition projects are undertaken, coordination with this department becomes critical. The Planning Department (or Department of Development) addresses land use planning. This department, depending on the jurisdiction, may enforce the National Flood Insurance Program requirements and other applicable local codes.
- Public Utilities Department oversees the maintenance of infrastructure including roadways; sewer and stormwater facilities; and the community's electric, gas, wastewater, and water treatment facilities. Depending on the jurisdiction, the Department of Public Works may enforce the National Flood Insurance Program requirements.

Hazard Mitigation cuts across all these departments. For a successful mitigation program, it is necessary to have a broad range of people involved with diverse backgrounds. These people include planners, engineers, building inspectors, zoning administrators, floodplain managers, grant writers, and people familiar with Geographic Information Systems (GIS). It is also important that mitigation be assigned a specific responsibility to a department or person.



## 5.6 Fiscal Capabilities

One major factor in determining whether hazard mitigation actions can be implemented is the amount of funds the jurisdiction has to spend on the actions. The funding may be spent directly on mitigation projects or on staff time and administrative costs associated with the action.

The local jurisdictions in the planning area receive most of their revenue through state and local sales tax, local services, and through restricted intergovernmental contributions (federal and state pass through dollars). Lynchburg City also has a stormwater utility fee based on a property's impervious area. For Fiscal Year 2019, the budgets of the participating jurisdictions range from about \$179M for Lynchburg City to \$41.9M for Appomattox County and smaller budgets for towns.





## 5.7 Technical Capabilities

Technical capability, in this plan, refers to the technology and skillsets available to the jurisdictions to support mitigation programs and projects as well as the technical certification programs achieved. Hazard specialists, such as floodplain managers, can bring a specialized set of skills to help with identifying and implementing flood mitigation. Grant writers are very useful when requesting grant funding to implement recommended mitigation actions. A Geographic Information System (GIS) is critical in identifying potential vulnerable areas and for managing spatial information. GIS systems can best be described as a set of tools (hardware, software, and people) used to collect, manage, analyze, and display spatial data.

### 5.7.1 The Community Rating System (CRS)

The Community Rating System (CRS) was implemented in 1990 as a program for recognizing and encouraging community floodplain management activities that exceed the minimum NFIP standards. Residents of communities that participate in CRS receive a reduction in the flood insurance premium. There are ten CRS classes: class 1 requires the most credit points and gives the largest premium reduction; class 10 receives no premium reduction. None of the jurisdictions in this hazard mitigation plan are members of the CRS. However, the City of Lynchburg is currently becoming certified.

### 5.7.2 NWS StormReady® Program

StormReady helps communities develop plans to handle all types of extreme weather—from tornadoes to winter storms. The program encourages communities to take a proactive approach to improving local hazardous weather operations by providing emergency managers with clear-cut guidelines on how to improve their hazardous weather operations. To be officially StormReady, a community must:

- Establish a 24-hour warning point and emergency operations center;
- Have more than one way to receive severe weather warnings and forecasts and to alert the public;
- Create a system that monitors weather conditions locally;
- Promote the importance of public readiness through community seminars; and
- Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.

### 5.7.3 Firewise Communities/USA Recognition Program®

To facilitate local solutions to wildfire preparedness goals, the Firewise Communities program recognizes communities for working together to protect residents and property from fire in the wildland/urban interface. To be officially Firewise, a community must:

- Form a board or committee that's comprised of residents and other applicable wildfire stakeholders,
- Obtain a written wildfire risk assessment from your state forestry agency or fire department and develop an action plan, and
- Host an outreach event and work with community members on addressing items in the action plan.



# Capabilities

## 5.7.4 Community Emergency Response Team (CERT)

The CERT program educates volunteers about disaster preparedness for the hazards that may impact their area and trains them in basic disaster response skills, such as fire safety, light search and rescue, team organization, and disaster medical operations. CERT offers a consistent, nationwide approach to volunteer training and organization that professional responders can rely on during disaster situations, allowing them to focus on more complex tasks. As of 2020, only the Town of Altavista participates in this program.

## 5.8 Local Capabilities – Amherst County and Town of Amherst

The Planning and Zoning department is responsible for updating and amending the Amherst County Comprehensive Plan. The plan covers, to varying degrees, all aspects of the cultural and physical landscape in Amherst County. The plan addresses land use types, roads, sewer and water services, public safety, public education, environmental issues, recreation, and even aesthetic issues. The plan has legal standing, in fact is required by Virginia law, but is used only to guide or influence actual courses of action by county government. Implementation of the plan usually takes the form of policy or law.

Through the Code of the County of Amherst, Virginia General Ordinances of the County (1987, codified through Ord. of April 19, 2005) Amherst County has adopted the Virginia Uniform Statewide Building Code and the State Erosion and Sediment Control Regulations. The purpose of these codes and regulations is to prevent the loss of property and life, health and safety hazards, the disruption of commerce and governmental services, the extraordinary and unnecessary expenditure of public funds for flood protection and relief, and the impairment of the tax base by:

- Regulating uses, activities, and development which, acting alone or in combination with other existing or future uses, activities, and development, will cause unacceptable increases in flood heights, velocities, and frequencies.
- Restricting or prohibiting certain uses, activities, and development from locating within areas subject to flooding.
- Requiring all those uses, activities, and developments that do occur in flood proofed against flooding and flood damage.
- Protecting individuals from buying lands and structures which are unsuited for intended purposes because of flood hazards.

Amherst County provided an assessment of their capabilities in Table 5-1.

*Table 5-1 Amherst County Capabilities*

Amherst County Capabilities			Capacity Notes
Planning	Comprehensive Plan	Yes	
	Date Updated	2017	
	Time Horizon	2027	
	Land Use Plan	Yes	
	Emergency Operations Plan	Yes	



# Capabilities

Amherst County Capabilities			Capacity Notes
	Continuity of Operations Plan	No	County does have elements of a COOP within the Emergency Operating Plan.
	Disaster Recovery Plan	Yes	Amherst County Public Schools completed; County plan coordinating departmental plans underway
	Economic Development Plan	Yes	
	Stormwater Management Plan	No	Program managed by DEQ; County has watershed protection plans for each watershed.
Legal	Subdivision Ordinance	Yes	
	Zoning Ordinance	Yes	
	Erosion and Sediment Control Ordinance	Yes	Separate watershed management ordinance.
	Floodplain Management Ordinance	Yes	
	Historic Preservation Ordinance	No	
Administration	Zoning Staff	Yes	
	Building Inspectors	Yes	
	Public Works Staff	Yes	
	Emergency Planners	Yes	
	GIS Staff	Yes	Contracted services
	Public Water/Wastewater Staff (ACSA)	Yes	
	Dedicated Floodplain Management Staff	No	Contracted services
	Dedicated Grant Writers	No	Contracted services
Fiscal	Total Annual Budget (2019)	\$50M	
	Public Safety Budget (2019)	\$11.6M	
	Public Works Budget (2019)	\$3.9M	
	Total Annual Budget/ACSA (2020)	\$5M	
	Stormwater Utility Fees	No	
	Water/Sewer Fees	Yes	Fees for public water/sewer services managed/paid to ACSA
	Gas/Electric Fees	No	
	Special Purpose Taxes	No	
	Development Impact Fees	No	
	General Obligation Bonds	Yes	
Technical	Certified Floodplain Manager	No	Community Development Director serves as Floodplain Manager
	CRS Program	No	
	Stormwater Program	Yes	Program Managed by DEQ
	Maintain Elevation Certificates	Yes	



# Capabilities

Amherst County Capabilities			Capacity Notes
	Storm Ready Certified	No	
	FireWise Certified	No	
	Warning System	No	
	Emergency Notification System	Yes	

The Town of Amherst provided an assessment of their capabilities in Table 5-2.

*Table 5-2 Town of Amherst Capabilities*

Town of Amherst Capabilities			Capacity Notes
Planning	Comprehensive Plan	Yes	
	Date Updated	2017	
	Time Horizon	2040	
	Land Use Plan	Yes	
	Emergency Operations Plan	Yes	
	Continuity of Operations Plan	No	
	Disaster Recovery Plan	No	
	Economic Development Plan	Yes	Virginia's Region 2000 Comprehensive Economic Development Strategy (CEDS); EDA approved 2018
	Stormwater Management Plan	No	
Legal	Subdivision Ordinance	Yes	
	Zoning Ordinance	Yes	
	Erosion and Sediment Control Ordinance	Yes	
	Floodplain Management Ordinance	Yes	
	Historic Preservation Ordinance	Yes	
Administration	Zoning Staff	Yes	
	Building Inspectors	Yes	
	Public Works Staff	Yes	
	Emergency Planners	Yes	
	GIS Staff	Yes	Contracted





# Capabilities

Town of Amherst Capabilities			Capacity Notes
	Dedicated Floodplain Management Staff	No	
	Dedicated Grant Writers	No	
Fiscal	Total Annual Budget (2020)	\$3.4M	
	Public Safety Budget (2020)	\$0.076M	
	Public Works Budget (2020)	\$0.223M	
	Stormwater Utility Fees	No	
	Water/Sewer Fees	Yes	
	Gas/Electric Fees	No	
	Special Purpose Taxes	No	
	Development Impact Fees	No	
	General Obligation Bonds	Yes	
Technical	Certified Floodplain Manager	No	
	CRS Program	No	
	Stormwater Program	No	
	Maintain Elevation Certificates	No	
	Storm Ready Certified	No	
	FireWise Certified	No	
	CERT Program	No	
	Warning System	No	
	Emergency Notification System	Yes	

## 5.9 Local Capabilities – Appomattox County and Town of Appomattox

The local government staff along with the Joint Appomattox Planning Commission is responsible for updating and amending the community development plan. The Natural Environment section of the plan details objectives to minimize risks to personal safety and property from natural hazards as well as protect environmentally sensitive and/or scenic areas of the County. The Zoning Ordinances in Appomattox County include floodplain regulations. The purpose of the plan includes:



# Capabilities

- Establishes government policy used to help guide public and private activities as they relate to land use and resource utilization.
- Basis for land development regulations and decisions (i.e. re-zonings and conditional use permits), capital improvement programming (i.e. public projects such as schools, parks and libraries), transportation, environmental, and historical resource protection initiatives, new County programs and decisions concerning the distribution of County budget dollars to a multitude of programs and agencies.
- Serves as the community's guide for future development and as the vision for what the County should look like in twenty years.

Appomattox County provided an assessment of their capabilities in Table 5-3.

*Table 5-3 Appomattox County Capabilities*

Appomattox County Capabilities			Capability Notes
Planning	Comprehensive Plan	Yes	
	Date Updated	2016	
	Time Horizon	2040	
	Land Use Plan	Yes	
	Emergency Operations Plan	Yes	
	Continuity of Operations Plan	No	
	Disaster Recovery Plan	No	
	Economic Development Plan	Yes	Virginia's Region 2000 Comprehensive Economic Development Strategy (CEDS); EDA approved 2018
	Stormwater Management Plan	No	
Legal	Subdivision Ordinance	Yes	
	Zoning Ordinance	Yes	
	Erosion and Sediment Control Ordinance	Yes	
	Floodplain Management Ordinance	Yes	
	Historic Preservation Ordinance	Yes	Applicable to the Town only; overseen by Town
Administration	Zoning Staff	Yes	
	Building Inspectors	Yes	
	Public Works Staff	Yes	Contract with the Town
	Emergency Planners	Yes	Incorporated within staff capacities
	GIS Staff	Yes	Contracted
	Dedicated Floodplain Management Staff	No	Incorporated within Community Development Director duties
	Dedicated Grant Writers	No	Incorporated within Community Development Director duties
Fiscal	Total Annual Budget (2020)	\$41.9M	
	Public Safety Budget (2020)	\$4.1M	



# Capabilities

Appomattox County Capabilities			Capability Notes
	Public Works Budget (2020)	\$1.6M	
	Stormwater Utility Fees	No	
	Water/Sewer Fees	Yes	County adopted water fees, but all revenue goes to and is managed by Appomattox Town
	Gas/Electric Fees	No	
	Special Purpose Taxes	No	
	Development Impact Fees	No	
	General Obligation Bonds	No	
Technical	Certified Floodplain Manager	No	
	CRS Program	No	
	Stormwater Program	No	Managed by DEQ.
	Maintain Elevation Certificates	No	
	Storm Ready Certified	Yes	
	FireWise Certified	No	
	Warning System	Yes	Within Town of Appomattox, siren managed via County's emergency staff. 3-5 mile radius audio capability
	Emergency Notification System	Yes	

The Town of Appomattox provided an assessment of their capabilities in Table 5-4.

*Table 5-4 Town of Appomattox Capabilities*

Town of Appomattox Capabilities			Capability Notes
Planning	Comprehensive Plan	Yes	Yes
	Date Updated	2015	Update process underway; anticipated approval 9/2020
	Time Horizon	2035	Pending Plan horizon 2040
	Land Use Plan	Yes	Yes
	Emergency Operations Plan	Yes	Yes
	Continuity of Operations Plan	No	No
	Disaster Recovery Plan	No	No
	Economic Development Plan	Yes	Virginia's Region 2000 Comprehensive Economic Development Strategy (CEDs); EDA approved 2018
	Stormwater Management Plan	No	No
Legal	Subdivision Ordinance	No	
	Zoning Ordinance	Yes	
	Erosion and Sediment Control Ordinance	Yes	



# Capabilities

	Floodplain Management Ordinance	Yes	
	Historic Preservation Ordinance	Yes	
Administration	Zoning Staff	Yes	Yes
	Building Inspectors	Yes	Use the County's Building Official
	Public Works Staff	Yes	Yes
	Emergency Planners	Yes	No Town emergency staff; all services via the County
	GIS Staff	Yes	Contracted
	Dedicated Floodplain Management Staff	No	
	Dedicated Grant Writers	No	
Fiscal	Total Annual Budget (2020)	\$2.7M	\$2.7M
	Public Safety Budget (2020)	\$1.36M	\$1.36M
	Public Works Budget (2020)	\$0.93M	\$0.93M
	Stormwater Utility Fees	No	No
	Water/Sewer Fees	Yes	Yes
	Gas/Electric Fees	No	No
	Special Purpose Taxes	No	
	Development Impact Fees	No	
	General Obligation Bonds	Yes	Town does have the authority
Technical	Certified Floodplain Manager	No	
	CRS Program	No	
	Stormwater Program	No	
	Maintain Elevation Certificates	No	
	Storm Ready Certified	No	No
	FireWise Certified	No	No
	Warning System	Yes	Within Town of Appomattox, siren managed via County's emergency staff. Does require power; 3-5 mile radius audio capability
	Emergency Notification System	Yes	Yes

## 5.10 Local Capabilities – Bedford County and Town of Bedford

The Bedford County Department of Planning is responsible for updating the Comprehensive Plan for the County. The County administrator or their designee serves as the zoning administrator. The zoning administrator is responsible for the enforcement of the zoning ordinance. The zoning ordinance in Bedford County includes floodplain regulations.

The zoning regulations and districts set forth in this ordinance are for the general purpose of implementing the comprehensive plan of Bedford County. The Zoning Ordinances in Bedford County include floodplain regulations. They are designed to achieve the general purposes of promoting the health, safety, and general





# Capabilities

welfare of the public, and of further accomplishing the objectives of Section 15.2-2200 of the Code of Virginia, as amended. To these ends, this ordinance is designed for each of the following purposes:

- Provide for adequate light, air, convenience of access, and safety from fire, flood and other dangers;
- Reduce or prevent congestion in the public streets;
- Facilitate the creation of a convenient, attractive, and harmonious community;
- Facilitate the provision of adequate police, fire protection, disaster evacuation, civil defense, transportation, water, sewer, flood protection, schools, parks, forests, playgrounds, recreational facilities, airports, and other public requirements;
- Protect against destruction of, or encroachment upon, historic buildings or areas;
- Protect against one or more of the following: overcrowding of land, undue density of population in relation to the community facilities existing or available, obstruction of light or air, hazards and congestion in travel and transportation, or loss of life, health, or property from fire, flood, panic, or other hazards;
- Encourage economic development activities that provide desirable employment and enlarge the tax base;
- Provide for the preservation of agricultural and forested lands;
- Protect approach slopes and other safety areas of licensed airports; and
- Protect surface and groundwater resources.

The Town of Bedford goals include protecting and promoting sound development and growth practices that take into consideration environmental factors (i.e. flooding, fire, drought). The Department of Planning and Community Development includes planning, economic development, the building department, and code enforcement. This department reviews site plans and plat surveys, works with businesses looking to relocate or establish themselves in Bedford, works with the community to develop and update the Comprehensive Plan, administers the Land Development Regulations and Zoning and enforces the Town Code as well as the Uniform Statewide Building Code (USBC). The Zoning Ordinances in the Town of Bedford include floodplain regulations.

For planning, the Town of Bedford Land Development Regulations were divided into different types of districts. The intent of Flood Hazard District FH is to preserve and protect lives and property in the flood plains of the City and to satisfy the United States Department of Housing and Urban Development and the State Water Control Board requirements for full entry into the National Flood Insurance Program, upon adoption of the Official Flood Hazard District Map from an engineering study.

Bedford County provided an assessment of their capabilities in Table 5-5.

*Table 5-5 Bedford County Capabilities*

Bedford County Capabilities			Capability Notes
Planning	Comprehensive Plan	Yes	
	Date Updated	2015	
	Time Horizon	2030	
	Land Use Plan	Yes	



# Capabilities

Bedford County Capabilities			Capability Notes
	Emergency Operations Plan	Yes	
	Continuity of Operations Plan	No	
	Disaster Recovery Plan	No	
	Economic Development Plan	Yes	
	Stormwater Management Plan	No	
Legal	Subdivision Ordinance	Yes	
	Zoning Ordinance	Yes	
	Erosion and Sediment Control Ordinance	Yes	
	Floodplain Management Ordinance	Yes	
	Historic Preservation Ordinance	Yes	
Administration	Zoning Staff	Yes	
	Building Inspectors	Yes	
	Public Works Staff	Yes	
	Emergency Planners	Yes	
	GIS Staff	Yes	
	Dedicated Floodplain Management Staff	No	
	Dedicated Grant Writers	No	
Fiscal	Total Annual Budget (2019)	\$110M	
	Public Safety Budget (2019)	\$19.7M	
	Public Works Budget (2019)	\$5.3M	
	Stormwater Utility Fees	No	
	Water/Sewer Fees	Yes	
	Gas/Electric Fees	No	
	Special Purpose Taxes	No	
	Development Impact Fees	No	
	General Obligation Bonds	Yes	
Technical	Certified Floodplain Manager	Yes	



# Capabilities

Bedford County Capabilities			Capability Notes
	CRS Program	No	
	Stormwater Program	Yes	
	Maintain Elevation Certificates	No	
	Storm Ready Certified	No	
	FireWise Certified	Yes, Some	
	CERT Program	No	
	Warning System	No	
	Emergency Notification System	Yes	

The Town of Bedford provided an assessment of their capabilities in Table 5-6.

*Table 5-6 Town of Bedford Capabilities*

Town of Bedford Capabilities			Capability Notes
Planning	Comprehensive Plan	Yes	
	Date Updated	2017	
	Time Horizon	2030	
	Land Use Plan	Yes	
	Emergency Operations Plan	Yes	
	Continuity of Operations Plan	No	
	Disaster Recovery Plan	No	
	Economic Development Plan	Yes	Virginia's Region 2000 Comprehensive Economic Development Strategy (CEDS); EDA approved 2018
	Stormwater Management Plan	No	
Legal	Subdivision Ordinance	Yes	
	Zoning Ordinance	Yes	
	Erosion and Sediment Control Ordinance	Yes	
	Floodplain Management Ordinance	Yes	
	Historic Preservation Ordinance	No	
Administration	Zoning Staff	Yes	
	Building Inspectors	Yes	
	Public Works Staff	Yes	
	Emergency Planners	No	Nondedicated; overseen by Fire Chief
	GIS Staff	Yes	



# Capabilities

Town of Bedford Capabilities			Capability Notes
	Dedicated Floodplain Management Staff	No	No dedicated staff; overseen by Director of Planning & Community Development
	Dedicated Grant Writers	No	No dedicated staff; overseen primarily by Director of Planning & Community Development.
Fiscal	Total Annual Budget (2021)	\$34.2M	
	Public Safety Budget (2021)	\$2.64M	
	Public Works Budget (2021)	\$3.75M	
	Stormwater Utility Fees	No	
	Water/Sewer Fees	Yes	All fees are paid to Bedford Regional Water Authority (BRWA)
	Gas/Electric Fees	Yes	
	Special Purpose Taxes	No	
	Development Impact Fees	No	
	General Obligation Bonds	Yes	
Technical	Certified Floodplain Manager	No	Director of Planning & Community Development has been certified; opportunity to seek recertification
	CRS Program	No	
	Stormwater Program	Yes	Program managed through Bedford County
	Maintain Elevation Certificates		
	Storm Ready Certified	Yes	
	FireWise Certified	No	
	Warning System	No	A nonfunctioning system is located within the Town
	Emergency Notification System	Yes	

## 5.11 Local Capabilities – Campbell County, Town of Altavista, and Brookneal

Campbell County Community Development staff, with the input of the Board of Supervisors, Planning Commission, and citizens are responsible for updating the Comprehensive Plan. The County has adopted and incorporated the State Erosion and Sedimentation Regulations. The Campbell County Code of 1988 includes a chapter on Erosion and Sedimentation Control and Stormwater Management. The Zoning Ordinances in Campbell County include floodplain regulations. The purpose of this zoning ordinance is to promote the general health, safety, and welfare of the public and for the accomplishment of the above stated objectives. To those ends, the ordinance has been designed to give reasonable consideration to each of the following purposes, where applicable:

- To provide for adequate light, air, convenience of access, and safety from fire, flood, crime, and other dangers;





# Capabilities

- To facilitate the provision of adequate police and fire protection, disaster evacuation, civil defense, transportation, water, sewerage, flood protection, schools, parks, forests, playgrounds, recreational facilities, airports, and other public requirements;
- To protect against one or more of the following: overcrowding of land, undue density of population in relation to the community facilities existing or available, obstruction of light and air, danger and congestion in travel and transportation, or loss of life, health or property from fire, flood, panic, and other dangers;
- To encourage economic development activities that provide desirable employment and enlarge the tax base;
- To provide for the preservation of agricultural and forestall lands and other lands of significance for the protection of the natural environment;
- To protect approach slopes and other safety areas of licensed airports, including United States government and military air facilities;
- To promote the creation and preservation of affordable housing suitable for meeting the current and future needs of the County as well as a reasonable proportion of the current and future needs of the planning district within which Campbell County is situated; and
- To make reasonable provisions, not inconsistent with applicable state water quality standards, to protect surface water and ground water as defined in VA. CODE ANN. §62.1-255 (Repl. Vol. 2001).

Campbell County provided an assessment of their capabilities in Table 5-7.

*Table 5-7 Campbell County Capabilities*

Campbell County Capabilities			Capability Notes
Planning	Comprehensive Plan	Yes	
	Date Updated	2019	
	Time Horizon	2034	
	Land Use Plan	Yes	
	Emergency Operations Plan	Yes	
	Continuity of Operations Plan	No	
	Disaster Recovery Plan	No	
	Economic Development Plan	Yes	
	Stormwater Management Plan	No	
Legal	Subdivision Ordinance	Yes	
	Zoning Ordinance	Yes	
	Erosion and Sediment Control Ordinance	Yes	
	Floodplain Management Ordinance	Yes	
	Historic Preservation Ordinance	Yes	
Administration	Zoning Staff	Yes	
	Building Inspectors	Yes	
	Public Works Staff	Yes	
	Emergency Planners	Yes	
	GIS Staff	Yes	



# Capabilities

Campbell County Capabilities			Capability Notes
	Dedicated Floodplain Management Staff	No	
	Dedicated Grant Writers	No	
Fiscal	Total Annual Budget (2019)	\$81M	
	Public Safety Budget (2019)	\$15.0M	
	Public Works Budget (2019)	\$3.8M	
	Stormwater Utility Fees	No	
	Water/Sewer Fees	Yes	
	Gas/Electric Fees	No	
	Special Purpose Taxes	No	
	Development Impact Fees	No	
	General Obligation Bonds	Yes	
Technical	Certified Floodplain Manager	No	
	CRS Program	No	
	Stormwater Program	Yes	
	Maintain Elevation Certificates	No	
	Storm Ready Certified	Yes	
	FireWise Certified	No	
	CERT Program	No	
	Warning System	No	
	Emergency Notification System	Yes	

The Town of Altavista provided an assessment of their capabilities in Table 5-8.

*Table 5-8 Town of Altavista Capabilities*

Town of Altavista Capabilities			Capability Notes
Planning	Comprehensive Plan	Yes	
	Date Updated	2016	
	Time Horizon	2030	
	Land Use Plan	Yes	
	Emergency Operations Plan	Yes	
	Continuity of Operations Plan	No	Use Campbell County's Plan
	Disaster Recovery Plan	No	Use Campbell County's Plan
	Economic Development Plan	Yes	Altavista Economic Development Plan, 2019
	Stormwater Management Plan	No	Stormwater oversight through VDOT
Legal	Subdivision Ordinance	Yes	
	Zoning Ordinance	Yes	
	Erosion and Sediment Control Ordinance	Yes	
	Floodplain Management Ordinance	Yes	



# Capabilities

Town of Altavista Capabilities			Capability Notes
Administration	Historic Preservation Ordinance	No	
	Zoning Staff	Yes	
	Building Inspectors	No	Campbell County
	Public Works Staff	Yes	
	Emergency Planners	No	Campbell County
	GIS Staff	No	Campbell County
	Dedicated Floodplain Management Staff	Yes	Community Development Director
	Dedicated Grant Writers	No	Incorporated into activities under the Authority of the Town Manager.
Fiscal	Total Annual Budget (2020)	\$4.1M	
	Public Safety Budget (2020)	\$1.15M	
	Public Works Budget (2020)	\$1.23M	
	Stormwater Utility Fees	No	
	Water/Sewer Fees	Yes	
	Gas/Electric Fees	No	
	Special Purpose Taxes	No	
	Development Impact Fees	No	
	General Obligation Bonds	Yes	
Technical	Certified Floodplain Manager	No	
	CRS Program	No	
	Stormwater Program	Yes	Use the development and stormwater via DEQ.
	Maintain Elevation Certificates	No	
	Storm Ready Certified	No	
	FireWise Certified	No	
	Warning System	No	
	Emergency Notification System	Yes	Utilize Campbell County system.

The Town of Brookneal provided an assessment of their capabilities in Table 5-9.

*Table 5-9 Town of Brookneal Capabilities*

Town of Brookneal Capabilities			Capability Notes
Planning	Comprehensive Plan	Yes	
	Date Updated	2018	
	Time Horizon	2040	
	Land Use Plan	Yes	
	Emergency Operations Plan	Yes	Primary Campbell County, secondary Town
	Continuity of Operations Plan	No	
	Disaster Recovery Plan	No	



# Capabilities

Town of Brookneal Capabilities			Capability Notes
	Economic Development Plan	Yes	Virginia's Region 2000 Comprehensive Economic Development Strategy (CEDS); EDA approved 2018
	Stormwater Management Plan	No	Stormwater managed by County
Legal	Subdivision Ordinance	Yes	
	Zoning Ordinance	Yes	
	Erosion and Sediment Control Ordinance	Yes	
	Floodplain Management Ordinance	Yes	
	Historic Preservation Ordinance	No	
Administration	Zoning Staff	Yes	
	Building Inspectors	No	Managed through Campbell County
	Public Works Staff	Yes	
	Emergency Planners	No	Police; all other emergency services via Campbell County
	GIS Staff	No	Assistance provide upon request through Campbell County
	Dedicated Floodplain Management Staff	No	
	Dedicated Grant Writers	No	
Fiscal	Total Annual Budget (2021)	\$1.6M	
	Public Safety Budget (2021)	\$0.22M	Police service only
	Public Works Budget (2021)	\$0.48M	
	Stormwater Utility Fees	No	
	Water/Sewer Fees	Yes	
	Gas/Electric Fees	No	
	Special Purpose Taxes	No	
	Development Impact Fees	No	
	General Obligation Bonds	No	
Technical	Certified Floodplain Manager	No	All development via Campbell County
	CRS Program	No	
	Stormwater Program	No	
	Maintain Elevation Certificates	No	
	Storm Ready Certified	No	
	FireWise Certified	No	
	Warning System	Yes	Old audible system, that is not used.
	Emergency Notification System	Yes	





# Capabilities

## 5.12 Local Capabilities – Lynchburg City

The vision of Lynchburg City is to take pride in being a sustainable community; one that protects and manages its limited natural, historical, and cultural resources in such a way that the community environment, which its residents value and which sustains us today will sustain future generations. In order to achieve its Vision for the future, the City of Lynchburg has adopted a number of goals for the city government, citizens, organizations, and businesses to work toward. These goals outline broad policies for future action that address the various elements of the City’s character that its citizens wish to protect, improve, and enhance. In the Comprehensive Plan, they are used to frame more detailed objectives and strategies, the latter outlining the specific actions that the City and its partners can take to achieve the goals and realize its Vision for the future. The Community Planning and Development Department is responsible for updating the Lynchburg City Comprehensive Plan. Many City officials, boards, and commissions are responsible for implementation of the plan. They include the Planning Commission, the project management team, and City Staff. The Zoning Ordinances in Lynchburg City include floodplain regulations.

Lynchburg City provided an assessment of their capabilities in Table 5-10.

*Table 5-10 Lynchburg City Capabilities*

Lynchburg Capabilities			Capability Notes
Planning	Comprehensive Plan	Yes	
	Date Updated	2014	
	Time Horizon	2030	
	Land Use Plan	Yes	
	Emergency Operations Plan	Yes	
	Continuity of Operations Plan	No	Available currently for individual departments. A city-wide plan is pending with completion anticipated in 2021.
	Disaster Recovery Plan	No	
	Economic Development Plan	Yes	
	Stormwater Management Plan	Yes	Stormwater Quality Plans, TMDLs, and Infrastructure Plans.
Legal	Subdivision Ordinance	Yes	
	Zoning Ordinance	Yes	
	Erosion and Sediment Control Ordinance	Yes	Stormwater Management Ordinance
	Floodplain Management Ordinance	Yes	
	Historic Preservation Ordinance	Yes	
Administration	Zoning Staff	Yes	
	Building Inspectors	Yes	
	Public Works Staff	Yes	
	Emergency Planners	Yes	
	GIS Staff	Yes	
	Dedicated Floodplain Management Staff	No	Incorporated within staff duties of Water Resources and Community Development



# Capabilities

Lynchburg Capabilities			Capability Notes
	Dedicated Grant Writers	No	Incorporated within duties of multiple staff roles
Fiscal	Total Annual Budget (2019)	\$179M	
	Public Safety Budget (2019)	\$47.8M	
	Public Works Budget (2019)	\$17.9M	
	Stormwater Utility Fees	Yes	
	Water/Sewer Fees	Yes	
	Gas/Electric Fees	No	
	Special Purpose Taxes	No	
	Development Impact Fees	No	
	General Obligation Bonds	Yes	
Technical	Certified Floodplain Manager	Yes	
	CRS Program	No	Investigation entering program
	Stormwater Program	Yes	
	Maintain Elevation Certificates	Yes	Managed by Community Development
	Storm Ready Certified	Yes	
	FireWise Certified	No	
	Warning System	No	Some local systems owned/managed by local colleges
	Emergency Notification System	Yes	





**MITIGATION**

## **6.0 Mitigation**

### **6.1 2020 Update - Summary of Changes**

The project management team reviewed this section of the plan and determined that the entire section would be rewritten to include more specific mitigation actions at the regional and jurisdictional level.

### **6.2 Introduction**

The Mitigation Strategy provides the jurisdictions within the CVPDC with the goals, objectives, and specific actions which will help the communities become less vulnerable to natural and man-made hazards. The Strategy is meant to be comprehensive with both regional and location-specific actions while at the same time being feasible based on the capabilities of the jurisdictions.

The mitigation planning process involved conducting a HIRA to identify potential impacts and rank the hazards. Although many of the impacts were understood before the process, the HIRA helped identify the magnitude of the issue and associated impacts and can also be used to justify resource expenditures. The process also included working with the Technical Advisory Committee to identify the mitigation goals, objectives, and actions based on the HIRA results and capabilities of the jurisdictions. This process led to the development of the mitigation strategy.

The Mitigation Strategy consists of the following four subsections:

- Mitigation Strategy Types.
- Regional Mitigation Goals, Objectives, and Actions.
- Jurisdiction-Specific Mitigation Actions.
- Mitigation Analysis Techniques.

### **6.3 Mitigation Strategy Types**

Hazard mitigation is most effective when several approaches are used in conjunction with each other to meet a community's goals and objectives. To help categorize the different approaches, six mitigation approaches have been identified.





### 6.3.1 Information and Outreach (I)

Information and Outreach activities are those activities executed to inform and advise residents, business owners, organizations, elected officials, future property owners, and visitors about potential hazards, preparedness, and property assessment practices to mitigate, or limit, impact, inform on preparedness resources, and determine the availability of emergency aid and community resources in the event of a hazard emergency. In many instances, local emergency departments and other organizations are already executing elements of some of the Information and Outreach measures. However, the mitigation strategies provide a mechanism to coordinate messaging on a regional level, expand partnerships, and maximize staff, funding, and hazard protection impact. Information and Outreach measures include:

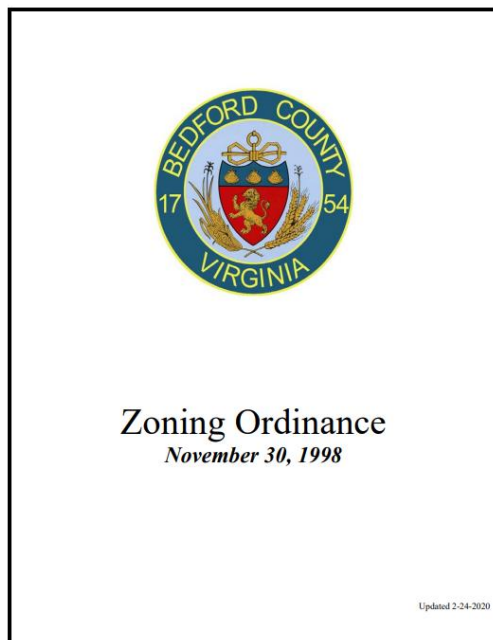
- Training programs;
- Education and outreach campaigns (e.g. social media, websites, and feature stories);
- Insurance program information;
- Emergency facility and flood designation maps; and
- Information materials, workshops, and event materials.



### 6.3.2 Prevention Capacity (C)

Capacity measures are those hazard impact preventative agency-lead policy and program activities, administered through approved activities approved or sanctioned by a local governmental body, organization, or agency policy board. Capacity activities are those voluntary or regulatory actions that inform land use development, building and infrastructure construction, maintenance programs and, often, influence funding through capital improvement plans and other funding structures. Capacity measures are primarily those activities that can be integrated into an existing program, department, or staff initiative. This type of mitigation is often very cost effective with a high benefit to cost ratio and longer lifespan. Once these strategies are incorporated into forward looking plans and ordinances, they become part of the community's day to day operations. Capacity measures include:

- Planning and zoning,
- Development regulations,
- Stormwater Plans, and
- Drainage Maintenance





### 6.3.3 Property Protection (P)

Property Protection defines those mitigation activities used to fortify structures to better withstand hazards or practices that reduce or eliminate impacts through structure or infrastructure relocation, removal, or retrofits. Building or structure fortification can range from simple, low-cost building adjustments to high cost, extensive structural or land grading measures, or acquisition and relocation that can require a corresponding policy (Capacity) programming. Property protection strategies examples include:

- Acquisition programs,
- Dry and wet flood proofing,
- Backup generators, and
- Mobile home tie downs.



Stormwater Interceptor  
Replacement



### 6.3.4 Structure (S)

Structural strategies are those construction measures undertaken to manage hazard impacts that have the capacity to significantly impact populations or property. These strategies include extensive modification of existing structures, land, or infrastructure or construction of new structures. Projects are usually of a size and scale that require design, engineering, permitting, complex funding structure, and long-term management and maintenance requirements by a locality, state and/or federal agency, organization, or business. Examples include:

- Dam stabilization,
- Reservoir or retention pond construction,
- Storm sewer upgrades, and
- Berm construction.



### 6.3.5 Natural System Resiliency (R)

Natural system resiliency initiatives are those that maintain, restore, or preserve natural system function to reduce the impact of natural hazards on life and property. Activities in this category include:

- Streambank and slope stabilization,
- Fire resistant landscape practices,
- Dead or diseased tree removal, and
- Wetland restoration.



## 6.4 Regional Mitigation Goals, Objectives, and Actions

The CVPDC set up working group meetings with the Technical Advisory Committee to identify regional mitigation goals, objectives, and actions. A goal for each type of mitigation strategy was agreed upon and multiple objectives supporting that goal were developed. Specific, regional actions were then identified based on the regional needs and capabilities. Understanding that every jurisdiction in the CVPDC is different, additional jurisdiction-specific mitigation actions were developed and are presented in Jurisdiction-Specific Mitigation Actions Section. The following section provides information on the regional goals, objectives, and actions.



### **6.4.1 Information & Outreach (I) Goal: Increase hazard awareness and preparedness activity participation by area individuals, property owners, and businesses.**

(I) Objective 1: Develop diverse and regionally-consistent hazard preparedness information and actions for public, businesses, and organizations to educate, lessen impact and increase safety during and after natural hazards.

1. Provide information and encourage installation of hazard preparation kit/materials (NWS Storm Ready) at critical facilities (e.g. schools, residential facilities), homes, organizations, and businesses.
2. Provide information to businesses on tools to develop emergency action plans.
3. Develop a preparedness and mitigation action campaign, including social media, radio, written and other outreach formats to be distributed throughout the region. Ensure campaign includes development of materials to serve persons with special needs (e.g. sensory, language barriers).
4. Provide information on and promote safe sheltering in place practices.
5. Support preparedness training and readiness evaluations to organizations that serve special needs. Include coordination with agencies (e.g. Center for Independent Living) to encourage persons with special needs to register with local emergency management and assist in disaster preparedness materials to meet sensory or communication needs.

(I) Objective 2: Provide property evaluation and maintenance best practices to minimize impact from drought, high temperatures, wind, and storms.

1. Develop a property review and maintenance evaluation tool. Include information on septic system maintenance, property clean up strategies and recommended practices, tree trimming and removal recommendations, low/wet area evaluation, flammable material/chemical storage, and where to learn more.
2. In partnership with Virginia Cooperative Extension, Soil & Water Conservation Districts, provide information on water conservation practices, shade tree tips, and draught tolerant and native plants.
3. Provide information, especially to residents and businesses in forested areas, on actions to minimize property loss and vulnerability from forest fires.
4. Provide property evaluation and implementation practices, such as tree removal and trimming recommendations, to lessen property damage during high winds.
5. Make available information on well, springs, and other water resource preservation practices, funding, and technical assistance programs.

(I) Objective 3: Provide information to lessen impact and support timely recovery from flood, dam failure, and stormwater hazard impacts.

1. Utilize existing FEMA, VDEM, National Weather Service (NWS) and National Flood Insurance Program (NFIP) materials to increase awareness of and participation in flood insurance.
2. Partner with area insurance companies, realtors, lenders, and homeowner's associations to share NFIP insurance information to citizens, property owners.
3. Hold property owner workshops to provide stormwater best management practices (e.g. raingardens, French drains, and rain barrels) information.
4. Establish or update local flood and high hazard dam failure studies or maps that provide easily identifiable and understandable property identification for the public to evaluate area vulnerable properties and areas.
5. Establish or update a method for the public to report on areas with recurring stormwater, flooding or standing water problems.
6. Provide regular notices to property owners of structures in floodplain or stormwater impacted areas on insurance and property protection information.
7. Install high water marks, high water crossing roadway signage or messaging campaigns.
8. Expand education on best practices to protect wells from heavy rain (e.g. sediment, turbidity) and information on public testing and assistance programs.

(I) Objective 4: Develop or provide tools to lessen fire hazard impacts.

1. Provide information, through workshops or education campaign, actions (e.g. Fire Wise program) to minimize property loss and vulnerability from forest fires; target forested and isolated residents, organizations, businesses, and public spaces (e.g. campgrounds).
2. Provide information to residents and businesses on best practices to secure flammable materials and chemicals.
3. Provide education to property owners on essential devices (e.g. Smoke detectors) to have in every home and how to properly maintain and use devices.
4. Evaluate or develop evacuation plans, and where necessary provide necessary improvements, to ensure safe evacuation of isolated communities.



**6.4.2 Prevention Capacity (C) Goal: Through governmental operations, business and private sector partnerships, advance planning initiatives, voluntary and regulatory programs (e.g. code enforcement), and maintenance practices to lessen hazard impacts.**

(C) Objective 1: Encourage agency and department coordination and participation in national programs to advance mitigation measure implementation.

1. Introduce existing rating and certification programs (e.g. Community Rating System/CRS) and encourage locality participation.
2. Encourage participation in national rating, insurance (e.g. NFIP), or certification programs (e.g. Community Rating System) by area localities.
3. Establish and maintain mitigation activity review and evaluation schedule with locality and organizational stakeholders. Add additional strategies as necessary and initiate annual workshop on mitigation funding and program practices



4. Provide training for and, where necessary, purchase tools for Building Officials, planning, public works, water resources staff that support mitigation program capacity.

(C) Objective 2: Lessen hazard vulnerability to residents, property, and natural resources through planning, zoning, ordinances, data development, land use regulations, and other programmatic activities.

1. Encourage coordination and incorporation of hazard mitigation practices within local (e.g. Comprehensive Plans) and regional planning documents & initiatives.
2. Utilize existing or expand data capacity to assist in mitigation program analysis and project implementation.
3. Evaluate development standards and encourage practices that minimize stormwater impacts.
4. Encourage water supply and ground water protection through zoning tools to inform development standards.
5. Support practices (e.g. tax incentives, easement program) that preserve land in environmentally sensitive areas.
6. Encourage development of local or regional Resiliency Plans.
7. Continue to update identification and mapping of critical facilities to support response and access services during and after disasters.
8. Develop, where appropriate, Emergency Action Plans, including preparedness and evacuation routes, for sensitive residential facilities (e.g. assisted living facilities), industrial parks, and isolated communities.
9. Evaluate and seek opportunity to execute regional partnerships to facilitate efficient emergency communication and response capabilities between the region's emergency response departments.

(C) Objective 3: Support and execute programs and projects to lessen impact from flood, dam failure, and stormwater hazards.

1. Initiate hydrologic and hydraulic studies, site evaluations, area stormwater management plans to reduce or eliminate flooding and high hazard dam failure problems.
2. Develop routine stormwater system evaluation and maintenance schedule and funding program.
3. Utilize or establish programs (e.g. relocation, buyout, elevation) to minimize the impact of flooding, high hazard dam failure, or habitual standing water.
4. Support, partner, or execute programs that educate or incentivize private property owners to employ stormwater best management practices (e.g. impervious pavement) on their property.
5. Use land use and zoning practices within flood-zone areas to limit development and provide location for public open spaces.
6. Coordinate with public works, transportation, planning, water resources, building departments to review and incorporate practices that minimize stormwater impacts (e.g. improved ditching, install larger culverts, increase drainage piping, and grassed waterways).

(C) Objective 4: Support and execute programs and projects to lessen impact from fire hazards.

1. Encourage planning and implementation projects that evaluate properties and provides fire protection and suppression recommendations.
2. Encourage building codes and zoning that support wildfire mitigation and fire wise practices with woodland and rural areas.

3. Encourage building codes and maintenance regulations that support fire property protection within urban and suburban areas.
4. Encourage preplanning and site visits based on Tier II reporting information.
5. Support initiatives that allow for access to and integration of technology tools in mitigation and emergency response activities.

(C) Objective 5: Support and execute programs and projects to lessen impact from extreme temperatures, and drought hazards.

1. Encourage planning initiatives or implementation projects that improve water source data and identifies or provides increased storage capacity.
2. Establish and execute water conservation practices to protect water resources.

(C) Objective 6: Support and execute programs and projects to lessen impact from severe weather and high wind hazards.

1. Support street tree evaluation, trim, or replacement as integral to public works, street, and infrastructure projects to reduce power outages and access delays.
2. In partnership with public works, VDOT, and emergency services, execute route evaluation, maintenance and clearing practices that support access to critical facilities.
3. Support and encourage projects that provide for underground utilities.
4. Develop and enhance locality debris management plans.



#### **6.4.3 Property Protection Goal: Support property and infrastructure fortification programs and projects to lessen hazard impacts to lives, property, and infrastructure.**

(P) Objective 1: Support fortification measures that increase hazard resiliency of property, public infrastructure, critical facilities, and public spaces.

1. Evaluate or execute retrofit measures necessary to reduce service disruption and facility damage.
2. Evaluate the need for, and where necessary, purchase, backup or secondary generators, or other backup system devices (e.g. Quick Connect) to support continued critical facility use.
3. Execute vulnerability analysis/security plans, and execute protection measures to harden critical facilities, public spaces, essential facility data, and other essential resources to reduce vulnerability from cyber and technological hazards.

(P) Objective 2: Support fortification measures to lessen impact to residents, property, and infrastructure from flooding (riverine, flash floods) and dam failure hazards.

1. Initiate studies or execute elevation, relocation, or acquisition measures, especially in area of repetitive flooding, to reduce or eliminate flooding and high hazard dam failure hazard to lives, property and financial impacts to families and communities.
2. Utilize property retrofitting measures to protect structures from flood damage (e.g. installing sewer backflow valves, berms, wet-proofing, sump pumps, energy system elevation).
3. Support or offer incentives (e.g. tax or program rebates) to property owners that install flood-proofing retrofits, structure elevation or relocation.
4. Install flood elevation markers in recurring flood-prone areas in the region to remind and encourage property and business owners to purchase flood insurance.

5. Conduct routine cleaning and maintenance of stormwater infrastructure.
6. Coordinate with transportation and site improvement projects to incorporate practices that minimize stormwater impacts (e.g. improved ditching, install larger culverts, increase drainage piping).
7. Support the assessment, purchase and use of stormwater performance equipment to guide stormwater/flooding evaluation and implementation activities.
8. Evaluate and implement stormwater control practices (e.g. stabilization, channelization) to divert/control stormwater impacts.

(P) Objective 3: Support fortification measures to lessen impact to residents, property, and infrastructure from high wind hazards.

1. Establish a regular street tree evaluation, trim and replacement schedule along powerlines and primary commuter routes to reduce power outages, reduce access delays, and provide community cooling.
2. Where appropriate, encourage or execute co-location or burial of electrical, phone and cable lines.

(P) Objective 4: Support fortification measures to lessen impact to residents, property and infrastructure from fire, high temperatures, geophysical, and extreme drought hazards.

1. Increase awareness and support utilization of fire-resistant building materials and development practices.
2. Seek funding and technical assistance programs to assist in establishing sustainable property evaluation and protection actions.
3. Encourage collaboration with agency partners for prescribed burning in vegetative and high-risk areas.
4. Evaluate the need for dry hydrant location opportunities; where needed install.
5. Initiate water supply studies, execute water facility improvements (e.g. looping systems), or install source features, especially in areas not served by public utilities.
6. Seek opportunities to install primary or secondary water sources at farms, critical facilities, and other facilities to ensure access during drought, fire, or other emergency situations.
7. Seek opportunities to install primary or secondary cooling devices, water storage, and other readiness measures at critical facilities.
8. Establish a regular street tree evaluation, trim and replacement schedule to support community cooling.

(P) Objective 5: Evaluate and seek opportunities to enhance or install emergency communication systems.

1. Continue to enhance emergency warning systems and encourage residents and businesses to participate in local emergency warning programs.
2. Evaluate opportunities, and where appropriate, install audible warning systems.
3. Seek opportunity to execute regional Public Safety Answering Point (PSAP) equipment/generator(s) to support communication and response capabilities between the region's emergency response departments.



#### **6.4.4 Structural Projects (S) Goal: Execute measures that significantly lessen the impact of natural hazard impact to lives, communities, property, and infrastructure in the region.**

(S) Objective 1: Study, design and execute measures to *preserve and expand existing structures or construct new features that lessen the impact of flooding and dam failure* on lives, property, communities, critical facilities, and infrastructure.

1. Evaluate, maintain, and execute necessary improvements to public dams.
2. Evaluate, maintain, and execute necessary stormwater system, water system, or sanitary sewer system protection or upgrades.
3. Evaluate, design, and execute structural measures that reduce the impact of flooding, high hazard dam failure, and stormwater.
4. Implement flood protection measures, including green infrastructure practices, in coordination with infrastructure upgrade projects.

(S) Objective 2: Advance transportation network connectivity and mode options to support emergency access and evacuation and corridor options to minimize economic impact to communities and businesses.

1. Evaluate, design and repair bridges, culverts, and other roadway features to support safe access and evacuation and reduce flooding and high hazard dam failure impacts to roadway infrastructure.
2. Evaluate, and where appropriate, install transportation facilities or mode improvements to accommodate emergency access or evacuation options.

(S) Objective 3: Study, design and/or construct measures that lessen drought, high temperatures, and fire hazard impacts on residents, property, critical facilities, businesses, working landscapes.

1. Evaluate and execute water distribution, storage, or other system facility improvements.
2. Evaluate the water source storage needs and develop, where needed storage, in isolated woodland and rural areas.
3. Incorporate trees and other land use practices that will support cooling measures within infrastructure improvement projects.
4. Evaluate, and where needed install, dry hydrant locations in the region's woodland and rural areas.
5. Seek opportunities for water shuttle or tender operation resource expansion.



#### **6.4.5 Natural System Resiliency (R) Goal: Preserve the function and resiliency of the region's natural resources and sensitive landscapes.**

(R) Objective 1: Protect the function of area rivers, riverbanks, water resources, and wetlands.

1. Evaluate and implement stream restoration, through green infrastructure, streambank stabilization, or other appropriate practice, to restore or protect a streams natural function and lessen flood impact to utilities, infrastructure, transportation, property, neighborhoods, and sensitive natural resources.
2. Evaluate, support, and establish programs that preserve open space and natural resources.
3. Seek opportunities to coordinate with existing resource protection programs to target studies or implement protection practices in sensitive resource areas.
4. Pursue conservation grants and programs that protect natural areas, especially those in and near flood-prone areas.



(R) Objective 2: Preserve working landscapes, open spaces, and steep slopes to minimize natural hazard impacts.

1. Support programs (e.g. loan, grants) that assist farmers, organizations, localities maintain open spaces and/or working landscapes.
2. Minimize development in large open space tracts, sensitive landscapes, or steep slopes.

(R) Objective 3: Implement measures to preserve area forest lands.

1. Partner with Forest Service, local officials, and other organizations to execute regular evaluation and necessary mitigation actions (e.g. controlled burning, debris removal) to reduce wildfire impacts to forested areas, property, and businesses.
2. Evaluate or execute fire zone practices at public parks or other public spaces.

The CVPDC has created a list of its own action items which will help the jurisdictions reach their own mitigation goals and objectives. These actions are provided in Table 6-1.

## 6.5 Mitigation Analysis Techniques

During the jurisdiction-specific mitigation meetings, each community prioritized the mitigation actions by ability and ease to implement the action, political will, benefits versus the cost, community need, and availability of various funding sources. The STAPLEE method described below was also utilized during prioritization.

The STAPLEE prioritization method considers seven criteria:

Criteria	Description
Social	Based on the idea that community consensus is a necessary precondition for successful implementation of mitigation measures. This also means that measures should not affect adversely a particular segment of the population or a particular neighborhood, or adversely impact local cultural values or resources.
Technical	Address the technical feasibility of the proposed action in terms of effectiveness, secondary impacts, and the technical capabilities of the community to implement and sustain this action.
Administrative	Address the administrative capabilities require to implement each mitigation action. For example, does the jurisdiction have the necessary organization, staff, and funding sources to implement and sustain the mitigation process?
Political	Considers the need for political support for migration actions. This means that all stakeholders in the political process, especially political organizations and institutions both inside and outside the community, should support the measure.
Legal	Used to determine the appropriate legal authority necessary to implement each mitigation action and whether such an authority can be delegated. In addition, the migration action is examined from the standpoint of current statutes, codes, ordinances, and other regulations, as well as the possible legal ramifications of the action's implementation.
Economic	Address the cost-effectiveness of the proposed action and its economic impact on the community. It is only reasonable to expect that the benefits of implementation will exceed the costs incurred. Economic considerations also consider the economic impact of the community's future development.
Environment	Although most mitigation actions are beneficial for the environment, some actions may have adverse impacts, which must be considered and addressed.



## 6.6 Jurisdiction-Specific Mitigation Actions

The CVPDC setup jurisdiction-specific meetings after the HIRA was completed to identify mitigation actions for each City, Town, and County included in the mitigation plan. Each mitigation action is linked to one of the regional mitigation goals and objectives. The tables below provide a description of the mitigation action, the hazard(s) it addresses, the priority level, lead agency or department, supporting agencies or departments, potential funding sources, coordination opportunities, and a time frame for implementation. The priority level was informed by the mitigation analysis described in the next section.



# Mitigation

Table 6-1 CVPDC Mitigation Actions

Agency: Central Virginia Planning District Commission (CVPDC)									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
									Ongoing, 1-3, 2-4, 3-5, 4+
Information & Outreach	I 1.3	Develop hazard preparedness outreach/education best practices, resources, and program activity within the CVPDC website.	All Hazards	High	Communication; Community Development	State, FEMA	VDEM		1-3
Information & Outreach	I 1.3, I 3.1, I 3.4	Expand outreach and education about the National Flood Insurance Program (NFIP), including inclusion within CVPDC website.	Flood, Dam Failure	High	Communication; Community Development	State, FEMA	VDEM		1-3
Information & Outreach, Property Protection	I 1.1, P 5.1	Develop public hazard communication campaign with emphasis on increasing number of residents joining area public information systems.	All Hazards	High	Communication; Community Development	State, FEMA	VDEM	Regional Radio Board	1-3
Information & Outreach	I 1 (All), I 2.2, I 3.8	Establish regular hazard mitigation feature, where best practices for readiness, safe sheltering, public announcements, are incorporated within agency newsletter, social media feeds, and general scheduled agency outreach. Include property maintenance, business best practices - features for preparedness.	All Hazards	High	Communication; Community Development	State, FEMA	VDEM		1-3
Capacity	C 2.1, C 2.4, C 2.5	Ensure the regional Hazard Mitigation Plan and mitigation planning are included as integral components of all regional planning initiatives including transportation, mobility, watershed, community development, emergency, and CEDS agency programs.	All Hazards	High	Community Development, Transportation	VDOT, VDEM, DRPT, DEQ, EDA	CVPDC Program		Ongoing





# Mitigation

Agency: Central Virginia Planning District Commission (CVPDC)									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
									Ongoing, 1-3, 2-4, 3-5, 4+
Capacity	C 1.3	Establish HMP Technical Advisory Committee, include locality, citizen, business, agency representation, that meets at least twice per year to review HMP mitigation strategy progress, evaluate changes, review regional projects.	All hazards	High	Community Development		VDEM		1-3
Capacity	C 1.4	Seek opportunities to host regional mitigation, program skills training for area locality, business, and agency partner staff.	All Hazards	Medium	Community Development		VDEM, USDA, FEMA, DEQ		2-4
Capacity	C 2.6	Seek opportunity to expand regional Comprehensive Economic Development Strategy (CEDS) to incorporate community resiliency or develop regional resiliency plan in coordination with locality partners.	All Hazards	Medium	Community Development		VDEM, FEMA, EDA	CVPDC Watershed Advisory Committee, CEDS	2-4
Capacity	C 2.9	Coordinate an emergency communication and verification protocol with VDOT to ensure emergency critical staff access.	All Hazards	Low	Public Safety	VDOT	VDOT, CVTPO	Regional Transportation Plan	3-5
Capacity, Property Protection	C 2.9, P 5.3	Evaluate and seek opportunity to execute (to include regional participation agreement and equipment purchase) regional Public Safety Answering Point (PSAP) generator(s) to facilitate rapid and efficient emergency communication and response capabilities between the region's emergency response departments.	All Hazards	High	CVPDC	Locality Emergency Management	VDEM, Radio Board	Regional Radio Board	1-3



# Mitigation

Agency: Central Virginia Planning District Commission (CVPDC)									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
									Ongoing, 1-3, 2-4, 3-5, 4+
Capacity	C 2.5, C 2.9	Encourage develop of local or regional Resiliency Plans	All Hazards	High	CVPDC	Member Localities	FEMA, VDEM, EDA, EPA	CEDS	1-3
Capacity, Property Protection	C 3.6, P 2.6, P 2.9	Seek opportunities to evaluate and improve corridors, especially those with recurring stormwater impacts, essential for access to public transit or other multimodal access by vulnerable populations.	Flood	Medium	CVPDC	CVTPO, GLTC	DRPT, VDOT, VDEM, FEMA	Regional Transportation Plan	3-5
Property Protection, Structure	P 2.5, P 2.6, S 2.1-2	Seek opportunities to study condition of or improve drainage along rural roadways to reduce stormwater, flood, and high hazard dam failure impacts that impact roadway movement safety or impact emergency access/movement.	Flood, Dam Failure	Low	VDOT	CVPDC, CVTPO	VDOT	Regional Transportation Plan	ongoing
Information & Outreach, Capacity, Property Protection, Natural System Resiliency	I 3.3, C 3.4, P 2.3, R 1.1	Support initiatives that expand use of green infrastructure in the region through education, workshops, training initiatives to expand expertise and local knowledge for green infrastructure use and implementation in area projects.	Flood	Low	CVPDC		VDEM, FEMA, USDA, DEQ, DHCD, EPA	CVPDC Watershed Advisory Committee	3-5
Property Protection, Structure, Natural System Resiliency	P 2.8, S 1.3, S 1.4, R 1.1	Seek opportunities to evaluate and execute streambank stabilization or other practices, to restore or protect the natural function of area streams to lessen flood impact to essential regional infrastructure (e.g. roadways, rail lines, communication towers).	Flood	Medium			FEMA, VDEM, EDA, DEQ, DCR, EPA, USACE		ongoing



# Mitigation

Table 6-2 Amherst County Mitigation Actions

Community: Amherst County									
NFIP Community #: 510010									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Information & Outreach	I 1.3, I 1.5	Expand public announcements to include special information for shut-ins and other vulnerable populations, how to assist, and emergency preparation.	All Hazards	High	Sheriff's Office	PSA, CVPDC, Red Cross	VDEM, County		Ongoing
Information & Outreach	I 1.1, I 1.3	Expand outreach and education about the National Flood Insurance Program (NFIP), including inclusion within the County's website.	Flood, Dam Failure	Low	Community Development	CVPDC	County	local realtors, local insurance agents	4+
Information & Outreach	I 1.3	Continue public hazard communication outreach to join the County's public information system (Everbridge).	All Hazards	High	Public Safety	CVPDC	VDEM, County		Ongoing
Information & Outreach	I 1.1, I 2.1, I 2.3, I 4.1	Expand hazard preparedness section within the City's website to include property evaluation, firewise practices, hazardous material storage, hurricane straps, anchors for mobile homes, and home storm preparedness kits.	Drought, Fire, Wind, Hazardous Materials	High	Community Development	CVPDC	VDEM, County		1-3
Information & Outreach	I 1.3	Communicate with private facilities, especially those in remote areas on preparedness best practices and remote registration to County warning system. Areas include Lowesville/Woodson area, Oronoco & Otter Creek campgrounds, Monacan Ancestral Museum.	All Hazards	Medium	Public Safety	CVPDC	VDEM, County	local community groups, volunteer dept.	3-5
Information & Outreach	I 1.2, I 4.2	Expand outreach with gas, fuel, small industry to provide information and best practices for hazard material storage and general hazard preparedness.	All Hazards	Medium	Public Safety	CVPDC	VDEM, County, USDA		3-5



# Mitigation

Community: Amherst County									
NFIP Community #: 510010									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Information & Outreach, Capacity	I 1.1, I 3.3, I 3.7, C 3.4	Provide hardening or preparedness best practices to private property owners, especially if in the flood zone, high hazard dam inundation zone, or known for repetitive stormwater impacts, to reduce or eliminate flooding and dam failure impacts; include information on roadway highwater safety. Target communication with historical areas (e.g. Monacan Ancestral Museum), isolated and vulnerable communities.	Flood, Dam Failure	Medium	Community Development	Public Safety, Service Authority, PDC	VDEM, County, USDA, DMV		Ongoing
Capacity	C 5.2	Continue procedural response to prolonged drought or high temperature conditions to ensure ability to respond to strain on water resources and respond to community needs.	Drought, Fire, High Temps	Medium	Public Safety	VDEM, Extension Service	County Pgm, USDA		Ongoing
Capacity, Property Protection	P 1.3	Develop vulnerability analysis, security plans for facilities, equipment and procedures, and where necessary execute improvements to harden public utilities from natural and manmade hazards.	All Hazards	High	ACSA, IT	Public Safety	VDEM, FEMA, USDA, DEQ, VDH		1-3
Capacity, Property Protection	C 2.1, P 1.3	Develop vulnerability analysis, security plans, and where necessary implement, protection measures to harden County critical facilities from natural and manmade hazards.	All Hazards	High	Public Safety, IT	Community Development	VDEM, FEMA, USDA, DEQ, VDH		1-3





# Mitigation

Community: Amherst County									
NFIP Community #: 510010									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Capacity, Property Protection, Natural Resource Resiliency	C 5.1-2, P 4.1-6, R 2.1	Seek evaluation, coordination, and funding opportunities to assist producers respond to drought, high temperatures or other environmental factors impacting crop or livestock production, yield reductions, or harvesting impacts	Drought, High Temps	Low	Extension Service, RELSWCD		USDA, VDEM, DCR, NRCS		4+
Property Protection	P 2.6	Seek opportunities to evaluate and improve drainage along roadways to ensure emergency access to critical facilities, vulnerable, or isolated communities.	Flood	Low	Community Development, VDOT	CVPDC, CVTPO	VDOT	Regional Transportation Plan	4+
Capacity, Property Protection, Structure	C 4.1, P 4.5, S 3.1	Initiate studies or execute measures to provide long-term water resource and sanitary sewer service for the Central Virginia Training Center property. Evaluation should include consideration for ACSA-Lynchburg City water system interconnection.	Flood, Drought, Fire	Low	EDA, Community Development	ACSA	EDA, USDA, DCHD, EPA, DEQ, VDH	Redevelopment Plan	4+
Capacity, Property Protection; Structure	C 3.1, P 2.5, P 2.8, S 1.1, S 1.3	Initiate studies and execute flood & dam structural improvements and maintenance at existing Amherst managed dams to meet all federal and state maximum precipitation rules and high hazard dam regulations. Includes modifications to Graham Creek primary spillway.	Flood, Dam Failure	Low	ACSA	VDEM, DCR	FEMA, VDEM, USDA		Ongoing
Property Protection, Structure	P 1.1, P 2.2, S 1.2, S 3.1	Initiate studies and execute measures for installation of a permanent, tertiary raw water intake on the James River to ensure secondary water source for the	Drought	Low	ACSA		FEMA, VDEM, USDA, VDH, DEQ		4+



# Mitigation

Community: Amherst County									
NFIP Community #: 510010									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
		ACSA primary raw water intake on Harris Creek.							
Property Protection	P 1.1	Undertake a system analysis and execute necessary repairs and/or modifications of the ACSA sanitary sewer pump stations	All Hazards	High	ACSA		VDH, VDEM, DEQ, FEMA		Ongoing
Property Protection, Structure	P 1.1, P 4.5, S 1.2, S 3.1	Continually seek opportunities to evaluate and, where needed, install secondary water source, secondary or looping lines, and service line protection to ensure continued function of the Madison Heights water supply line to Prices Store Tank.	Drought, Fire, All Hazards	Low	ACSA		VDH, DEQ, DHCD, USDA		Ongoing
Property Protection, Natural System Resiliency	P 1.1, S 1.2, R 1.3	Continually evaluate, and where needed, extend sanitary sewage to areas with failing onsite treatment systems to protect streams and groundwater.	Fire, Drought, High Temperatures	Medium	ACSA		DEQ, VDH, VDEM, FEMA, USDA		Ongoing
Property Protection, Structure, Natural System Resiliency	P 1.1, P 2.8, S 1.3, S 1.4, R 1.1	Evaluate and implement streambank stabilization along the James River at Madison Heights to protect ACSA trunk sanitary sewer line and provide sediment reduction and environmental protection to the James River.	Flood, Dam Failure	High	ACSA		VDEM, FEMA, USDA, DEQ, VDH, NFWF, EPA, DCR		2-4



# Mitigation

Community: Amherst County									
NFIP Community #: 510010									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Natural System Resiliency	R 1.2, R 1.3	Seek opportunities to evaluate and implement practices that protect public water resources through coordination with property owners and installation of Best Management Practices to protect sensitive resources.	All Hazards	Low	ACSA	Extension Service, James River Association	DCR, SWCD, NRCS, NFWF, DEQ	TDML Implementation Plans, Watershed Management Plans	Ongoing
Property Protection, Structure, Natural System Resiliency	P 1.1, P 2.8, S 1.3, S 1.4, R 1.1	Evaluate and implement stream restoration, through green infrastructure, streambank stabilization or other appropriate practice(s), to restore the streams natural function and lessen river flooding, high hazard dam failure, and stormwater impacts (Lowesville area, Monacan Park, Peddlar River at Buffalo Spring, Ware's Gap Road near Puppy Creek).	Flood, Dam Failure	Low	RELSWCD	Extension Service, Community Development, James River Association	VDEM, FEMA, DEQ, VDH, NFWF, EPA, DCR,	TDML Implementation Plans, Watershed Management Plans	4+
Structure	S (all)	Mitigation reconstruction.	All Hazards	High	TBD	TBD	VDEM, FEMA		After Event
Property Protection	C 3.3, P 2.1	Initiate program and studies to execute elevation, relocation, or acquisition measures, especially in area of repetitive flooding, to reduce or eliminate flooding and high hazard dam failure impacts to lives, property and financial impacts to families and communities.	Flood, Dam Failure	High	Community Development		VDEM, FEMA		Ongoing



# Mitigation

Table 6-3 Town of Amherst Mitigation Actions

Community: Town of Amherst									
NFIP Community #: 510193									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Information & Outreach	I 1.1, I 1.3	Expand outreach and education about the National Flood Insurance Program (NFIP), including inclusion within the County's website.	Flood, Dam Failure	Low	Community Development	CVPDC	County	local realtors, local insurance agents	4+
Information & Outreach	I 1.3	Continue public hazard communication outreach to join the Town's public information system (Code Red).	All Hazards	High	Public Safety	CVPDC	VDEM, County		Ongoing
Information & Outreach	I 1.1, I 2.1, I 2.3, I 4.1	Expand hazard preparedness section within the City's website to include property evaluation, firewise practices, hazardous material storage, wind straps and anchors for mobile homes, home storm preparedness kit.	Drought, Fire, Wind, Hazardous Materials	High	Community Development	CVPDC	VDEM, County		1-3
Information & Outreach	I 1.2, I 4.2	Expand outreach with gas, fuel, small industry to provide information and best practices for hazard material storage and general hazard preparedness	All Hazards	Medium	Public Safety	CVPDC	VDEM, County, USDA		3-5
Information & Outreach; Capacity	I 1.1, I 3.3, I 3.7, C 3.4	Provide hardening, elevation, or preparedness best practices to private property owners, especially if in the flood zone, high hazard dam inundation zone, or known for repetitive stormwater impacts, to reduce or eliminate flooding impacts; include information on roadway highwater safety.	Flood, Dam Failure	Medium	Community Development	Public Safety, Service Authority, PDC	VDEM, County, USDA, DMV		Ongoing
Capacity	C 5.2	Continue procedural response to prolonged drought or high temperature conditions to ensure ability to respond to	Drought, Fire, High Temps	Medium	Public Safety	VDEM, Extension Service	County Pgm, USDA		Ongoing





# Mitigation

Community: Town of Amherst									
NFIP Community #: 510193									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
		strain on water resources and respond to community needs.							
Capacity, Property Protection	C 2.1, P 1.3	Initiate vulnerability analysis of the Town's essential facilities and equipment and seek funding to make equipment upgrades to ensure safe and continued community service in the event of short or long-term disruption caused by natural disaster, epidemic, or other substantial disruption factor.	All Hazards	High	Public Works, IT	Public Safety	VDEM, FEMA, USDA, DEQ, VDH		1-3
Capacity, Property Protection	P 1.3	Develop vulnerability analysis, security plans, and where necessary implement, protection measures to harden County critical facilities from natural and manmade hazards.	All Hazards	High	Public Safety, IT	Community Development	VDEM, FEMA, USDA, DEQ, VDH		1-3
Property Protection, Structural Projects	P 1.1, P 1.2, S 1.2	Evaluate and execute retrofit measures to reduce service disruption and facility damage to the Town's water and sanitary sewage systems: Rutledge Creek WWTP electrical, property protection measures; protection measures to secure raw water intake including backup or secondary generators or other backup systems (e.g. Quick Connect).	All Hazards	High	Public Works	Eng. Firm	VDEM, FEMA, USDA, DEQ, VDH		1-3
Property Protection	P 2.6	Seek opportunities to evaluate and improve drainage along roadways to ensure emergency access to critical facilities, vulnerable, or isolated communities.	Flood	Low	Community Development, VDOT	CVPDC, CVTPO	VDOT	Regional Transportation Plan	4+



# Mitigation

Community: Town of Amherst									
NFIP Community #: 510193									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Natural System Resiliency	R 1.2, R 1.3	Seek opportunities to evaluate and implement practices that protect public water resources through coordination with property owners and installation of Best Management Practices to protect sensitive resources.	All Hazards	Low	ACSA	Extension Service, James River Association	DCR, SWCD, NRCS, NFWF, DEQ	TDML Implementation Plans, Watershed Management Plans	Ongoing
Property Protection, Structure, Natural System Resiliency	P 1.1, P 2.8, S 1.3, S 1.4, R 1.1	Evaluate and implement stream restoration, through green infrastructure, streambank stabilization or other appropriate practices, to restore or protect the streams natural function and lessen flood and high hazard dam failure impact to Town's water and sanitary sewer system.	Flood, Dam Failure	Low	RELSWCD	Extension Service, Community Development, James River Association	VDEM, FEMA, DEQ, VDH, NFWF, EPA, DCR,	TDML Implementation Plans, Watershed Management Plans	4+
Structure	S (all)	Mitigation reconstruction.	All Hazards	High	TBD	TBD	VDEM, FEMA		After Event
Capacity, Property Protection	C 3.3, P 2.1	Initiate program and studies to execute elevation, relocation, or acquisition measures, especially in area of repetitive flooding, to reduce or eliminate flooding and high hazard dam failure impacts to lives, property and financial impacts to families and communities.	Flood, Dam Failure	High	Community Development		VDEM, FEMA		Ongoing



# Mitigation

Table 6-4 Appomattox County Mitigation Actions

Community: Appomattox County									
NFIP Community #: 510011									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Information & Outreach	I 1.1, I 1.2	Expand outreach and safety education to property owners along the natural gas line.	All Hazards	Medium	Public Safety	Williams/Transco	VDEM		Ongoing
Information & Outreach	I 1.1, I 1.3	Expand outreach and education about the National Flood Insurance Program (NFIP), including inclusion within the County's website.	Flood, Dam Failure	High	Community Development	State, FEMA, CVPDC	VDEM		1-3
Information & Outreach	I 1.3	Expand public hazard communication outreach with emphasis increasing number of residents joining the County's public information system.	All Hazards	High	Public Safety		N/A; County Pgm		1-3
Information & Outreach	I 1.1, I 2.1, I 2.3, I 4.1	Expand hazard preparedness section within the County's website to include property evaluation, firewise practices, hazardous material storage, wind straps and anchors for mobile homes, home storm preparedness kit.	Drought, Fire, Wind, Hazard Materials	Medium	Public Safety	CVPDC, Community Development	VDEM, County Pgm		2-4
Information & Outreach	I 1.2, I 4.2	Establish communication with gas, fuel, small industry to provide information regarding hazard material storage and general hazard communication.	All Hazards	Low	Public Safety	Fire	County Pgm		ongoing
Information & Outreach, Capacity, Property Protection	I 3.7, C 1.4, P 2.6	Continue to identify and coordinate with VDOT to install high water warning or other safety signage along roadways with habitual stormwater impacts.	Flood	High	VDOT	Community Development	VDOT, DMV	Rural Transportation Program	1-3



# Mitigation

Community: Appomattox County									
NFIP Community #: 510011									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Capacity	C 5.2	Initiate locality procedural response to prolonged drought or high temperature conditions to ensure ability to respond to strain on water resources and respond to community needs.	Drought, High Temperatures	Low	County Admin	Public Safety	County Pgm, USDA		4+
Capacity	C 2.7	Initiate building footprint diagram of schools and other older public buildings to ensure best building safety locations.	Earthquake	Low	School Admin	Public Safety	VDEM, USDA,		3-5
Capacity	C 2.9	Coordinate an emergency communication and verification protocol with VDOT to ensure emergency critical staff access.	All Hazards	High	Public Safety	VDEM	County Pgm		ongoing
Capacity, Property Protection	C 2.9, P 5.3	Evaluate and seek opportunity to execute (to include regional participation agreement and equipment purchase) regional Public Safety Answering Point (PSAP) generator(s) to facilitate rapid and efficient emergency communication and response capabilities between the region's emergency response departments.	All Hazards	High	CVPDC	Locality Emergency Management	VDEM, Radio Board	Regional Radio Board	1-3
Capacity	C 2.1	Evaluate capacity and seek to expand availability of breathing machines and oxygen tanks to respond to critical medical needs during emergency situation and power outages.	All Hazards	Medium	Public Safety	EMS			2-4





# Mitigation

Community: Appomattox County									
NFIP Community #: 510011									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Capacity, Property Protection, Natural System Resiliency	C 5.1-2, P 4.1-6, R 2.1	Seek evaluation, coordination, and funding opportunities to assist producers respond to drought, high temperatures or other environmental factors impacting crop or livestock production, yield reductions, or harvesting impacts.	Drought, High Temperatures	Low	Extension	NRCS, RELSWCD	DCR, CREP, USDA, FSA		4+
Capacity	C 2.9	Seek opportunity to execute a property access agreement with property owner to allow secondary emergency access during flood or other hazard event along Blackberry Lane.	All Hazards	Low	Public Safety	Community Development	USDA, VDEM		4+
Property Protection	P 2.5, P 2.6	Seek opportunities to improve drainage along roadways to reduce stormwater and flood impacts (emergency access, dangerous driving conditions) including: Bent Creek at Route 608 and North Creek, Route 611 near Route 666 (Wreck Island Creek), and Blackberry Lane (Wolfcreek).	Flood	High	VDOT	CVPDC	VDOT	Regional Transportation Plan	ongoing
Property Protection, Natural System Resiliency	P 2.8, R 1.1	Evaluate and execute streambank stabilization or channelization to address stormwater flooding.	Flood	Low	Soil Water Conservation District	Extension	DEQ, DCR, VDEM, FEMA	Watershed Plans, TMDL IP	3-5
Property Protection, Structure	P 1.2, S 1.1-2	Fortify the County's communication network to include secondary generator at critical facilities.	All Hazards	High	Public Safety	Fire	VDEM, FEMA, DHS		2-4



# Mitigation

Community: Appomattox County									
NFIP Community #: 510011									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Property Protection	P 1.2	Provide secondary generators at the County's 911 Center, Sheriff's Office and Emergency Service Center.	All Hazards	High	Public Safety	Sheriff	VDEM, FEMA, DHS		2-4
Property Protection, Structure	P 2.6, S 2.1-2	Seek opportunity to coordinate with VDOT to address flooding and at 460/Moore County Store to ensure emergency and critical care access along 460.	Flood	Medium	VDOT	Campbell County, CVPDC	VDOT, FHA	Regional Transportation Plan	3-5
Structure	S (all)	Mitigation reconstruction.	All Hazards	High	TBD	TBD	VDEM, FEMA		After Event
Capacity, Property Protection	C 3.3, P 2.1	Initiate program and studies to execute elevation, relocation, or acquisition measures, especially in area of repetitive flooding, to reduce or eliminate flooding and high hazard dam failure impacts to lives, property and financial impacts to families and communities.	Flood, Dam Failure	High	Community Development		VDEM, FEMA		Ongoing



# Mitigation

Table 6-5 Town of Appomattox Mitigation Actions

Community: Appomattox Town									
NFIP Community #: 510194									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Information & Outreach	I 1.1, I 1.3	Educate public, businesses and organizations on hazard preparedness and National Flood Insurance Program (NFIP) information.	All Hazards	High	Town Manager	VDEM, CVPDC, FEMA	VDEM, FEMA		Ongoing
Information & Outreach	I 1.1, I 1.3	Expand outreach and education about the National Flood Insurance Program (NFIP), including inclusion within the Town's website.	Flood, Dam Failure	High	Town Manager	VDEM, CVPDC, FEMA	VDEM, FEMA		1-3
Information & Outreach	I 1.1, I 1.3	Expand flood insurance coverage and value information, especially those areas known to have regular stormwater impacts and in the high hazard dam inundation zones.	Flood, Dam Failure	Low	Town Manager		VDEM, USDA, CDBG, Town		3-5
Capacity	C 5.2	Initiate locality procedural response to prolonged drought or high temperature conditions to ensure ability to respond to strain on water resources and respond to community needs.	Drought, High Temperatures, Fire	Medium	Town Manager	Public Works	Town Pgm, USDA		3-5
Capacity, Property Protection	C 2.1, P 1.3	Initiate evaluation and execute improvements to harden the Town's critical facilities to reduce vulnerability from natural, cyber, and technological hazards.	All Hazards	High	Public Works		VDEM, DHS, USDA		2-4
Property Protection	P 1.3	Initiate vulnerability analysis, security plans, and where necessary, implement security	All Hazards	Medium	Public Works		VDEM, FEMA, DHS, USDA		2-4



# Mitigation

Community: Appomattox Town									
NFIP Community #: 510194									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
		measures as the Town's public utility facilities.							
Capacity, Property Protection	C 2.7, P 1.3	Initiate vulnerability analysis of the Town's essential department and equipment and seek funding to make equipment upgrades to ensure safe and continued community service in the event of short or long-term disruption caused by natural disaster, epidemic, or other substantial disruption factor.	All Hazards	High	Town Manager	Public Works	VDEM, FEMA, DHS, USDA, EDA COVID, DHCD		1-3
Property Protection	P 2.6	Seek opportunities to improve drainage to reduce stormwater and flood impacts (emergency access, dangerous driving conditions) including: Sunnydale, Hunter Street, Morris Avenue, and Dogwood Drive.	Flood	Low	Public Works	Engineering Firm	VDEM, FEMA, USDA, VDOT, DMV		4+
Property Protection, Structure	P 1.1, P 2.2, S 1.2, S 3.1	Evaluate and execute retrofit measures to reduce service disruption and facility damage to the Town's water and sanitary sewage systems (e.g. generators and secondary pumps).	All Hazards	High	Public Works	Engineering Firm	VDEM, FEMA, USDA, DEQ, VDH		1-3
Property Protection, Structure	P 1.1, P 2.2, S 1.2, S 3.1	Continually evaluate and seek funding for secondary water resource needs.	Drought, Fire, High Temperatures	High	Public Works	Engineering Firm	VDEM, USDA, DEQ, VDH, DHCD		1-3





# Mitigation

Community: Appomattox Town									
NFIP Community #: 510194									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Property Protection, Structure, Natural System Resiliency	P 1.1, P 2.8, S 1.3, S 1.4, R 1.1	Evaluate and implement stream restoration, through green infrastructure, streambank stabilization or other appropriate practice, along the stream in the Sunnydale, South Church Street area to address stormwater impacts.	Flood	Medium	Public Works	Extension, Soil/Water Conservation District	VDEM, DEQ, DCR		3-5
Structure	S (all)	Mitigation reconstruction.	All Hazards	High	TBD	TBD	VDEM, FEMA		After Event
Capacity, Property Protection	C 3.3, P 2.1	Initiate program and studies to execute elevation, relocation, or acquisition measures, especially in area of repetitive flooding, to reduce or eliminate flooding and high hazard dam failure impacts to lives, property and financial impacts to families and communities.	Flood, Dam Failure	High	Community Development		VDEM, FEMA		Ongoing



# Mitigation

Table 6-6 Bedford County Mitigation Actions

Community: Bedford County									
NFIP Community #: 510016									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Information & Outreach	I 1.3, I 1.5	Expand public announcements to include special information for shut-ins, how to assist with shut-in, and emergency preparation.	All Hazards	High	Sheriff's Office	PSA, CVPDC, Red Cross	County, VDEM		Ongoing
Information & Outreach	I 1.1, I 1.3	Expand outreach and education about the National Flood Insurance Program (NFIP), including inclusion within the County's website.	Flood, Dam Failure	Low	Community Development	CVPDC	County	local realtors, local insurance agents	4+
Information & Outreach	I 1.3	Continue public hazard communication outreach to join the County's public information system.	All Hazards	High	Public Safety	CVPDC	VDEM, County		Ongoing
Information & Outreach	I 1.1, I 2.1, I 2.3, I 4.1	Expand hazard preparedness section within the City's website to include property evaluation, firewise practices, hazardous material storage, wind straps and anchors for mobile homes, home storm preparedness kit.	Drought, Fire, Wind, Hazard Materials	High	Community Development	CVPDC	VDEM, County		1-3
Information & Outreach	I 1.2, I 4.2	Expand outreach with gas, fuel, small industry to provide information and best practices for hazard material storage and general hazard preparedness	All Hazards	Medium	Public Safety	CVPDC	VDEM, County, USDA		3-5
Capacity, Property Protection	C 2.9, P 5.3	Evaluate and seek opportunity to execute (to include regional participation agreement and equipment purchase) regional Public Safety Answering Point (PSAP) generator(s) to facilitate rapid and efficient emergency communication and response	All Hazards	Medium	CVPDC	EMA, Public Safety, Regional Emergency Management	VDEM	Regional Radio Board	1-3



# Mitigation

Community: Bedford County									
NFIP Community #: 510016									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
		capabilities between the region's emergency response departments.							
Capacity	C 5.2	Continue procedural response to prolonged drought or high temperature conditions to ensure ability to respond to strain on water resources and respond to community needs.	Drought, Fire, High Temperatures	Medium	Public Safety	VDEM, Extension Service	County Pgm, USDA		Ongoing
Capacity	C 2.1, C 2.9	Expand communication and coordination with AEP to ensure formalization of flood and high hazard dam failure capacity response procedures.	Flood, Dam Failure	Medium	Public Safety	DCR, Utilities	FEMA, VDEM, DCR	AEP	1-3
Capacity	C 2.1, C 2.9	Incorporate emergency strategic planning and response hazard material protocol with local industry (e.g. Georgia Pacific) within locality departmental procedures.	All Hazards	Medium	Public Safety		FEMA, VDEM	Georgia Pacific	1-3
Property Protection	P 1.3	Develop vulnerability analysis, security plans for facilities, equipment and procedures, and where necessary execute improvements to harden public utilities (e.g. Woodfield Pump Station, Montvale Treatment Plant, and electric substations) from natural and manmade hazards.	All Hazards	High	BRWA	Public Safety	VDEM, FEMA, USDA, DEQ, VDH		1-3
Capacity, Property Protection	C 2.1, P 1.3	Develop vulnerability analysis, security plans, and where necessary implement, protection measures to harden County critical facilities from natural and manmade hazards.	All Hazards	High	Public Safety, IT	Community Development	VDEM, FEMA, USDA, DEQ, VDH		1-3



# Mitigation

Community: Bedford County									
NFIP Community #: 510016									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Capacity, Property Protection, Natural Resource Resiliency	C 5.1-2, P 4.1-6, R 2.1	Seek evaluation, coordination, and funding opportunities to assist producers respond to drought, high temperatures or other environmental factors impacting crop or livestock production, yield reductions, or harvesting impacts	Drought, High Temperatures	Low	Extension Service, POSWCD		USDA, VDEM, DCR, NRCS		4+
Property Protection	P 1.1, P 1.3	Evaluate and execute retrofit measures to reduce service disruption and facility damage to the County's water and sanitary sewage systems.	All Hazards	Medium	BRWA		FEMA, VDEM		Ongoing
Capacity, Property Protection	C 2.1, P 1.3	Initiate evaluation and execute improvements to harden the County's critical facilities to reduce vulnerability from natural, cyber, and other technological hazards.	All Hazards	Medium	Emergency Management, Police (Covid, other)	County IT (cyber)	VDEM, DHS, FEMA, USDA		Ongoing
Property Protection	P 2.6	Seek opportunities to evaluate and improve drainage along roadways to ensure emergency access to critical facilities, vulnerable, or isolated communities.	Flood	Low	Community Development, VDOT	CVPDC, CVTPO	VDOT	Regional Transportation Plan	4+
Property Protection, Structure	P 4.2, S 1.1	Initiate studies and execute flood & dam structural improvements at existing Bedford, BRWA managed dams to meet all federal and state maximum precipitation rules and high hazard dam regulations.	Flood, Dam Failure, Drought, Fire	Low	EDA, Community Development	ACSA	EDA, USDA, DCHD, EPA, DEQ, VDH	Redevelopment Plan	4+
Property Protection, Structure	P 1.1, P 4.5, S 1.2, S 3.1	Continually seek opportunities to evaluate and, where needed, install secondary water source, secondary or looping lines, and service line	Drought, Fire, All Hazards	Low	BRWA		VDH, DEQ, DHCD, USDA		Ongoing





# Mitigation

Community: Bedford County									
NFIP Community #: 510016									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
		protection to ensure continued water system function.							
Property Protection, Structure,	P 1.1-3, P 2.2, P 2.6, P 2.7, P 2.8, S 1.3, S 1.4	Initiate evaluation and implement facility improvements to harden County public schools to provide for continuous operation. Evaluation and improvements considerations include: secondary generator needs; secondary/public water source for Montvale; address electrical service capabilities/interruptions at Big Island; stormwater/flood retrofits to Huddleston and Staunton River to protect wells and campus buildings.	All Hazards	Medium	Bedford County School	Public Safety, VDEM	FEMA, VDEM		1-3
Property Protection, Structure,	P 1.1-3, S 1.3, S 1.4	Initiate evaluation and implement facility improvements to harden those County schools used as emergency shelters to ensure continuous/safe operation. Forest, Jefferson Forest, Goodview, Montvale, Staunton River, and Thomas Jefferson.	All Hazards	Medium	Bedford County School	Red Cross	FEMA, VDEM, USDA, DHS		1-3
Property Protection	P 1.1	Execute an evaluation of the mechanical systems and building structure of the community centers. Execute, where needed, fortification actions.	All Hazards	Low	Community Development		FEMA, VDEM, USDA, DHCD, VDH		Ongoing
Capacity, Property Protection	C 4.1, P 4.4	Evaluate need, and where needed install, dry hydrants.	Wildfire	Medium	Fire Dept.	Extension	DOF, USDA, VDEM, FEMA		1-3



# Mitigation

Community: Bedford County									
NFIP Community #: 510016									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Property Protection, Natural System Resiliency	P 1.1, S 1.2, R 1.3	Continually evaluate, and where needed, extend sanitary sewage to areas with failing onsite treatment systems to protect streams and groundwater.	Fire, Drought, High Temperatures	Medium	BRWA		DEQ, VDH, VDEM, FEMA, USDA		Ongoing
Capacity, Property Protection, Natural Resource Resiliency	C 5.1-2, P 4.1-6, R 2.1	Seek evaluation, coordination, and funding opportunities to assist producers respond to drought, high temperatures or other environmental factors impacting crop or livestock production, yield reductions, or harvesting impacts	Drought, High Temperatures	Low	Extension Service	NRCS, POSWCD	USDA, VDEM, DCR, CREP, NRCS	Regional Water Supply Plan	2-4
Natural System Resiliency	R 1.2, R 1.3	Seek opportunities to evaluate and implement practices that protect public water resources through coordination with property owners and installation of Best Management Practices to protect sensitive resources.	All Hazards	Low	BRWA	Extension Service, James River Association	DCR, SWCD, NRCS, NFWF, DEQ	TDML Implementation Plans, Watershed Management Plans	Ongoing
Property Protection, Structure, Natural System Resiliency	P 1.1, P 2.8, S 1.3, S 1.4, R 1.1	Evaluate and implement stream restoration, through green infrastructure, streambank stabilization or other appropriate practice(s), to restore the streams natural function and lessen river and stormwater impacts.	Flood, Dam Failure	Low	Community Development	Extension Service, Bedford Town, James River Association	VDEM, FEMA, DEQ, VDH, NFWF, EPA, DCR,	TDML Implementation Plans, Watershed Management Plans	4+
Structure	S (all)	Mitigation reconstruction.	All Hazards	High	TBD	TBD	VDEM, FEMA		After Event



# Mitigation

Community: Bedford County									
NFIP Community #: 510016									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Capacity, Property Protection	C 3.3, P 2.1	Initiate program and studies to execute elevation, relocation, or acquisition measures, especially in area of repetitive flooding, to reduce or eliminate flooding and high hazard dam failure impacts to lives, property and financial impacts to families and communities.	Flood, Dam Failure	High	Community Development		VDEM, FEMA		Ongoing



# Mitigation

Table 6-7 Town of Bedford Mitigation Actions

Community: Town of Bedford									
NFIP Community #: 510015									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Information & Outreach	I 1.1, I 1.3	Educate public, businesses, and organizations on hazard preparedness including National Flood Insurance Program (NFIP) information.	All Hazards	Medium	Police Chief	CVPDC, Town IT	VDEM		1-3
Information & Outreach	I 1.1, I 1.3	Expand outreach and education about the National Flood Insurance Program (NFIP), high hazard dam inundation zone information within the Town's website.	Flood, Dam Failure	Low-Medium	Planning Director	State, FEMA, CVPDC, Town IT	VDEM, Town	local realtors, local insurance agents	ongoing
Information & Outreach	I 3.6	Expand flood insurance coverage, especially those areas known to have regular flooding or stormwater impacts to renters. Those in the high hazard dam inundation zone will be identified too.	Flood, Dam Failure	Low-Medium	Public Works	CVPDC	DHCD, USDA	local realtors, local insurance agents	ongoing
Information & Outreach	I 1.3	Develop public hazard communication outreach with emphasis on joining the County's public information system.	All Hazards	Medium	Town IT	County EMS	VDEM, Town		ongoing
Property Protection	P 5.1, P 5.2	Evaluate system and execute repairs or install a new emergency warning system in the Town	All Hazards	High	Fire Dept.	Police, Bedford County	VDEM	County Fire and Rescue	1-3
Capacity, Property Protection	C 4.1, P 4.2	Evaluate the Town's fire hydrants and implement system improvements or expansion where needed.	Fire	Medium	Fire Dept.		VDEM, USDA,	Bedford Regional Water Authority	ongoing





# Mitigation

Community: Town of Bedford									
NFIP Community #: 510015									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Capacity, Property Protection	C 2.1, P 1.3	Initiate evaluation and execute improvements to harden the Town's critical facilities to reduce vulnerability from natural, cyber, and other technological hazards.	All Hazards	Medium-High	Emergency Management, Police (Covid, other)	Town IT (cyber)	VDEM, DHS, USDA		ongoing
Capacity, Property Protection	C 5.2	Maintain locality procedural response to high temperature conditions to ensure ability to respond to community needs.	High Temperature	Low	Police		Town Pgm, USDA		4+
Capacity, Property Protection	C 2.1, P 1.3	Develop vulnerability analysis, security plans, and where necessary implement, protection measures at public utilities and other critical Town facilities.	All Hazards	Medium-High	Electric Dept.	Police, Sheriffs Office	VDEM, FEMA, USDA, DEQ, VDH		1-3
Property Protection	P 1.1-3	Seek opportunities to evaluate and execute improvements (e.g. backup generators) to harden essential community resources to ensure safe and continued service during short or long-term disruption caused by natural disaster, epidemic or other disruption factor including Bedford Memorial Hospital.	All Hazards	High	Hospital	Town Electric Dept.	VDEM, FEMA, USDA, VDH		1-3
Property Protection	P 2.6	Seek opportunities to evaluate and improve drainage along roadways to ensure emergency access and safe movement; target areas of Town with recurring flooding: South Bridge St., West Gate/Blue Ridge Ave., Summit & 4th St./Train Trestle.	Flood	Low	Public Works	VDOT, CVPDC	VDEM, FEMA, USDA, VDOT, DMV	Regional Transportation Plan	4+



# Mitigation

Community: Town of Bedford									
NFIP Community #: 510015									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
		Develop high water driving safety education.							
Property Protection, Structure	P 1.1, P 2.1, P 2.2, S 1.3	Evaluate and execute necessary improvements to harden, retrofit, elevate, or move the Town's electric substations from flood and high hazard dam failure impacts.	Flood, Dam Failure	Low	Electric		FEMA, VDM, DEQ, USDA		4+
Property Protection, Structure, Natural System Resiliency	P 1.1, P 2.8, S 1.3, S 1.4, R 1.1	Evaluate and implement streambank restoration, through green infrastructure, streambank stabilization or other appropriate practices, to lessen stormwater impact to BRWA Woodfield Pump Station, other water and sanitary facilities. (Natural resources/watershed plan).	Flood	Low	Planning Dept.	Water Authority, CVPDC	VDEM, FEMA, DEQ, VDH, NFWF, EPA, DCR,		3-5
Structure	S (all)	Mitigation reconstruction.	All Hazards	High	TBD	TBD	VDEM, FEMA		After Event
Capacity, Property Protection	C 3.3, P 2.1	Initiate program and studies to execute elevation, relocation, or acquisition measures, especially in area of repetitive flooding, to reduce or eliminate flooding and high hazard dam failure impacts to lives, property and financial impacts to families and communities.	Flood, Dam Failure	High	Community Development		VDEM, FEMA		Ongoing



# Mitigation

Table 6-8 Campbell County Mitigation Actions

Community: Campbell County									
NFIP Community #: 510010									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Information & Outreach	I 1.3, I 1.5	Expand public announcements to include special information for shut-ins and other vulnerable populations, how to assist with shut-in, and emergency preparation.	All Hazards	High	Sheriff's Office	PSA, CVPDC, Red Cross	County, VDEM		Ongoing
Information & Outreach	I 1.1, I 1.3	Expand outreach and education about the National Flood Insurance Program (NFIP), including inclusion within the County's website.	Flood, Dam Failure	Low	Community Development	CVPDC	County	local realtors, local insurance agents	4+
Information & Outreach	I 1.3	Continue public hazard communication outreach to join the County's public information system.	All Hazards	High	Public Safety	CVPDC	VDEM, County		Ongoing
Information & Outreach	I 1.1, I 2.1, I 2.3, I 4.1	Expand hazard preparedness section within the City's website to include property evaluation, firewise practices, hazardous material storage, wind straps and anchors for mobile homes, home storm preparedness kit.	Drought, Fire, Wind, Hazard Materials	High	Community Development	CVPDC	VDEM, County		1-3
Information & Outreach	I 1.3	Communicate with private and medical facilities, especially those that provide a public service or house hazardous materials (e.g. YMCA, UVA Medical Center, Framatome) about hazard mitigation.	All Hazards	Medium	Public Safety	CVPDC	VDEM, County	local community groups, volunteer dept.	3-5



# Mitigation

Community: Campbell County									
NFIP Community #: 510010									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Information & Outreach, Capacity	I 1.1, I 3.3, I 3.7, C 3.4	Provide hardening or preparedness best practices to private property owners, especially if in the flood zone, high hazard dam inundation zone, or known for repetitive stormwater impacts, to reduce or eliminate flooding impacts; include information on roadway highwater safety.	Flood, Dam Failure	Medium	Community Development	Public Safety, Service Authority, PDC	VDEM, County, USDA, DMV		Ongoing
Capacity	C 5.2	Continue procedural response to prolonged drought or high temperature conditions to ensure ability to respond to strain on water resources and respond to community needs.	Drought, Fire, High Temperatures	Medium	Public Safety	VDEM, Extension Service	County Pgm, USDA		Ongoing
Capacity, Property Protection	C 2.9, P 5.3	Evaluate and seek opportunity to execute (to include regional participation agreement and equipment purchase) regional Public Safety Answering Point (PSAP) generator(s) to facilitate rapid and efficient emergency communication and response capabilities between the region's emergency response departments.	All Hazards	Medium	CVPDC	EMA, Public Safety, Regional Emergency Management	VDEM, Radio Board	Regional Radio Board	1-3
Capacity	C 2.1	Expand communication & coordination between agencies (e.g. VDOT) and emergency personnel to expedite emergency response, access, evacuation procedures.	All Hazards	Medium	EMA, Public Safety	VDOT	VDEM, County		1-3





# Mitigation

Community: Campbell County									
NFIP Community #: 510010									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Capacity	C 2.1	Expand communication and coordination with the railroad to obtain inspection cycles and information on any fortification or evaluation programs (3 tunnels Taber, 501 and Altavista).	Earthquake	Medium		Norfolk Southern, CVPDC, CVTPO	County	Regional Transportation Planning	1-3
Capacity, Property Protection	C 2.1, P 1.3	Develop vulnerability analysis, security plans, and where necessary implement, protection measures to harden County critical facilities from natural, technological, and manmade hazards.	All Hazards	High	Public Safety, IT	Community Development	VDEM, FEMA, USDA, DEQ, VDH		1-3
Capacity, Property Protection	C 2.1, P 1.1	Seek opportunities to evaluate and where needed secure roadways and access routes to critical facilities and sensitive industries.	All Hazards	Low	Public Works, Public Safety, VDOT	Planning, CVPDC	VDOT, VDEM, FEMA	Regional Transportation Planning	1-3
Capacity, Property Protection	C 4.1, P 4.4	Evaluate need, and where needed install, dry hydrants.	Wildfire	Medium	Fire Dept.	Extension	DOF, USDA, VDEM, FEMA		4+
Property Protection, Structure	P 1.1, S 1.2	Seek opportunities to increase water flow capacity along Route 29 near Flat Creek Pump Station	Flood, Dam Failure, Fire	High	CCUSA				1-3
Property Protection	P 2.6	Seek opportunities to evaluate and improve drainage along roadways to reduce stormwater and flood impacts (emergency access, dangerous driving conditions) including: Timberlake, Brookville High School, Rainbow Forest, Cresthaven/460 areas.	Flood	Medium	Public Works, VDOT	Campbell County Public Schools, Planning, CVPDC, CVTPO	VDOT, VDEM, FEMA	Regional Transportation Planning	Ongoing



# Mitigation

Community: Campbell County									
NFIP Community #: 510010									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Property Protection, Structure, Natural System Resiliency	P 2.8, S 1.3, S 1.4, R 1.1	Evaluate and implement streambank restoration, through green infrastructure, streambank stabilization or other appropriate practice, along the Staunton River and tributaries to lessen stormwater impact to County infrastructure, critical facilities, and public spaces.	Flood	Low	RELSWCD	Extension Service, Community Development, James River Association	VDEM, FEMA, DEQ, VDH, NFWF, EPA, DCR,	TDML Implementation Plans, Watershed Management Plans	4+
Property Protection, Structure	P 2.1, P 2.6, S 1.3	Instigate elevation and flood mitigation evaluation studies at County critical facilities within the flood and high hazard dam inundation zones and implement the mitigation.	Flood, Dam Failure	High	Community Development, CCUSA		FEMA, VDEM, DEQ, VDH, USDA		Ongoing
Property Protection	P 4.3	Coordinate with the Forest Service to evaluate, and when needed execute, controlled burns to lessen wildfire impacts.	Wildfire	Low	Forestry	Extension	DOF, USDA, VDEM		4+
Property Protection, Structure	P 1.1, P 2.2, S 1.2	Support resiliency evaluation and installation of fortification measures to lessen flood impact (e.g. pump station, etc.) to water and wastewater system infrastructure.	All Hazards	High	Community Development, CCUSA				1-3
Property Protection	P 5.1, P 5.3	Secure existing or expand communication network to accommodate service communication during an emergency or recovery period.	All Hazards	Medium	Public Safety	Regional Radio Board			1-3
Property Protection	P 3.2	Continually seek opportunities to underground utility lines to essential infrastructure and critical facilities.	All Hazards	Medium	Public Works and Utilities	VDOT, AEP	FEMA, DHDC, USDA		Ongoing



# Mitigation

Community: Campbell County									
NFIP Community #: 510010									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Property Protection, Structure	P 1.1, P 4.5, S 1.2, S 3.1	Continually seek opportunities to evaluate and, where needed, install secondary water source, secondary or looping lines, and service line protection to the County's water system.	Drought, Fire, All Hazards	Medium	CCUSA	Community Development	VDH, DEQ, DHCD, USDA		Ongoing
Capacity, Property Protection, Natural Resource Resiliency	C 5.1-2, P 4.1-6, R 2.1	Seek evaluation, coordination, and funding opportunities to assist producers respond to drought, high temperatures or other environmental factors impacting crop or livestock production, yield reductions, or harvesting impacts	Drought, High Temperatures	Medium	Extension Service, RELSWCD		USDA, VDEM, DCR, CREP, NRCS	Regional Water Supply Plan	4+
Property Protection, Structure, Natural System Resiliency	P 1.1, S 1.2, R 1.3	Continually evaluate, and where needed, extend sanitary sewage to areas with failing onsite treatment systems to protect streams and groundwater.	Fire, Drought, High Temperatures	High	CCUSA	VDH- Lynchburg District, Community Development	DEQ, VDH, VDEM, FEMA, USDA		Ongoing
Structure	S (all)	Mitigation reconstruction.	All Hazards	High	TBD	TBD	VDEM, FEMA		After Event
Capacity, Property Protection	C 3.3, P 2.1	Initiate program and studies to execute elevation, relocation, or acquisition measures, especially in area of repetitive flooding, to reduce or eliminate flooding and high hazard dam failure impacts to lives,	Flood, Dam Failure	High	Community Development		VDEM, FEMA		Ongoing



# Mitigation

Community: Campbell County

NFIP Community #: 510010

Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
		property and financial impacts to families and communities.							





# Mitigation

Table 6-9 Town of Altavista Mitigation Actions

Community: Town of Altavista									
NFIP Community #: 510029									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Information & Outreach	I 1.1, I 1.3	Educate public, businesses, and organizations on hazard preparedness including National Flood Insurance Program (NFIP) information.	All Hazards	Medium	Community Development	CVPDC	VDEM, FEMA, Town Pgm	local realtors, local insurance agents	1-3
Information & Outreach	I 1.1, I 1.3	Expand outreach and education about the National Flood Insurance Program (NFIP), including inclusion within the Town's website.	Flood, Dam Failure	Medium	Community Development	CVPDC	Town Pgm	local realtors, local insurance agents	1-3
Information & Outreach	I 3.6	Expand flood insurance coverage, especially those areas known to have regular flooding or stormwater impacts to renters. Those in the high hazard dam inundation zone will be identified too.	Flood, Dam Failure	Low	Community Development	CVPDC	DHCD, USDA	local realtors, local insurance agents	3-5
Information & Outreach	I 1.3	Develop public hazard communication outreach with emphasis on joining the County's public information system.	All Hazards	Medium	Administration	Campbell County Emergency Services (Code Red)	VDEM, Town Pgm		2-4
Capacity	C 2.1, C 2.9	Expand communication and coordination with AEP, thereby creating standard operating procedures, regarding dam release and river turbidity to protect Town water and wastewater infrastructure.	Flood, Dam Failure, Drought	High	Utilities	Public Works, Community Development, Altavista Police	Town Pgm, VDEM	AEP, Campbell County EMS	1-3



# Mitigation

Community: Town of Altavista									
NFIP Community #: 510029									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Capacity, Natural System Resiliency	C 2.1, R 1.3	Initiate a Staunton River and Watershed Protection coordination with Hurt, Pittsylvania County, Campbell County and other surrounding jurisdictions.	Flood, Dam Failure	Low	Community Development	Utilities	NFWF, EPA, VDH, DCR, DEQ,	Pitts, Hurt, CC, RELSWCD, DEQ, VDH	3-5
Capacity, Property Protection	C 3.6, P 1.1	Evaluate and execute retrofit measures to reduce service disruption and facility damage to the Town's water and sanitary sewage systems.	All Hazards	Medium	Utilities	Public Works, Administration	DEQ, USDA, DHCD	USDA, VDHODW	Ongoing
Property Protection	P 1.3	Initiate evaluation and execute improvements to harden the Town's critical facilities to reduce vulnerability from natural, cyber, and technological hazards.	All Hazards	Medium	Utilities	Public Works, Administration	VDEM, FEMA, DHS, USDA, EDA, COVID, DHCD,	EPA, VRWA	Ongoing
Capacity	C 5.2	Maintain locality procedural response to prolonged drought or high temperature conditions to ensure ability to respond to strain on water resources and respond to community needs.	Drought, High Temperatures	Medium	Utilities	Administration	Town Pgm, USDA	EPA	Ongoing
Capacity, Property Protection	C 2.1, P 1.3	Develop vulnerability analysis, security plans, and where necessary implement, protection measures at public utilities and other critical Town facilities.	All Hazards	High	Utilities	Administration	VDEM, FEMA, USDA, DEQ, VDH		Ongoing



# Mitigation

Community: Town of Altavista									
NFIP Community #: 510029									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Property Protection, Structure	P 2.2, P 2.8, S 1.3, S 1.4	Evaluate and execute berm or other necessary mitigation features to protect the Town's water and wastewater facilities from flooding and high hazard dam failure impacts.	Flood, Dam Failure	High	Utilities	Public Works, Administration	FEMA, VDM, DEQ, USDA		3-5
Property Protection, Structure, Natural System Resiliency	P 2.8, S 1.3, S 1.4, R 1.1	Evaluate and implement streambank restoration, through green infrastructure, streambank stabilization or other appropriate practice, along the Staunton River and tributaries to lessen stormwater impact to Town's water & sanitary sewer system, public park, and public spaces. (Natural resources/watershed plan).	Flood	High	Public Works	Community Development, Utilities	VDEM, FEMA, DEQ, VDH, NFWF, EPA, DCR,	Recreation Committee, Dept of Forestry, RELSWCD, Corps of Engineer, VDH	1-3
Structure	S (all)	Mitigation reconstruction.	All Hazards	High	TBD	TBD	VDEM, FEMA		After Event
Capacity, Property Protection	C 3.3, P 2.1	Initiate program and studies to execute elevation, relocation, or acquisition measures, especially in area of repetitive flooding, to reduce or eliminate flooding and high hazard dam failure impacts to lives, property and financial impacts to families and communities.	Flood, Dam Failure	High	Community Development		VDEM, FEMA		Ongoing



# Mitigation

Table 6-10 Brookneal Mitigation Actions

Community: Brookneal Town									
NFIP Community #: 510030									
Regional Strategy Identification	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Information & Outreach	I 1.1, I 1.3	Educate public, businesses and organizations on hazard preparedness and National Flood Insurance Program (NFIP) information	All Hazards	Medium	Public Works Dept.	Governing Body, CVPDC	VDEM, FEMA, Town Pgm	local realtors, local insurance agents	Ongoing
Information & Outreach	I 1.1, I 1.3	Expand outreach and education about the National Flood Insurance Program (NFIP), including inclusion within the Town's website.	Flood, Dam Failure	Medium	Public Works Dept.	Governing Body, CVPDC	Town Pgm	local realtors, local insurance agents	Ongoing
Information & Outreach	I 3.6	Expand renter's insurance and flood insurance coverage and value information, especially those areas known to have regular stormwater impact. Those in the high hazard dam inundation zone will be identified too.	Flood, Dam Failure	Medium	Public Works Dept.	Governing Body, CVPDC	DHCD, USDA	local realtors, local insurance agents	Ongoing
Information & Outreach	I 1.3	Develop public hazard communication outreach with emphasis on joining the County's public information system	All Hazards	Medium	Public Works Dept.	Governing Body, Campbell County Emergency Services (Code Red)	VDEM, Town Pgm	Campbell County EMS	Ongoing
Capacity, Property Protection	C 3.6, P 1.1	Evaluate and execute retrofit measures to reduce service disruption and facility damage to the Town's water and sanitary sewage systems	Flood, All Hazards	Medium	Public Works Dept.	Governing Body	DEQ, USDA, DHCD	USDA, VDHODW	Ongoing
Property Protection	P 1.3	Initiate evaluation and execute improvements to harden the Town's critical facilities to reduce vulnerability	All Hazards	Low	Public Works Dept.	Governing Body	VDEM, FEMA, DHS,	EPA, VRWA	3-5





# Mitigation

Community: Brookneal Town									
NFIP Community #: 510030									
Regional Strategy Identification	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
		from natural, cyber, and other technological hazards.					USDA, EDA, COVID, DHCD		
Capacity, Property Protection	C 3.6, P 1.2	Initiate evaluation and install backup generators at the Town's utility facilities (e.g. lagoons) to harden the critical facilities to reduce vulnerability from flooding or other hazard disruptions.	Flood, Wind	High	Public Works Dept.	Governing Body	VDEM, FEMA, DHS, USDA, DHCD		2-4
Capacity	C 5.2	Initiate locality procedural response to prolonged drought or high temperature conditions to ensure ability to respond to strain on water resources and respond to community needs.	Drought, High Temps	Medium	Public Works Dept.	Governing Body	Town Pgm, USDA	EPA	2-4
Capacity, Property Protection	C 2.1, P 1.3	Develop vulnerability analysis, security plans, and where necessary implement, protection measures at public utilities and other critical Town facilities.	All Hazards	Medium	Public Works Dept.	Campbell County Public Safety	VDEM, FEMA, USDA, DEQ, VDH		Ongoing
Property Protection, Structure, Natural System Resiliency	P 2.8, S 1.3, S 1.4, R 1.1	Evaluate and implement streambank stabilization or channelization along the Staunton River and tributaries to lessen stormwater, flooding, and high hazard dam failure impacts to Town's water and sanitary sewer system.	Flood, Dam Failure	Medium	Public Works Dept.	Governing Body	VDEM, FEMA, DEQ, VDH, NFWF, EPA, DCR	Recreation Committee, Dept of Forestry, RELSWCD, Corps of Engineer, VDH	Ongoing
Capacity	C 2.1, C 2.9	Expand communication and coordination with AEP regarding dam release and river turbidity to protect Town water and wastewater infrastructure	Flood, Dam Failure, Drought	Medium	Public Works Dept.	Governing Body, AEP, Altavista	Town Pgm, VDEM	AEP, Campbell County EMS	Ongoing



# Mitigation

Community: Brookneal Town									
NFIP Community #: 510030									
Regional Strategy Identification	Regional Strategy	Action Item Description	Hazard(s)	Priority (High, Medium, or Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Capacity, Property Protection	C 3.6, P 1.1, P 1.3	Initiate vulnerability analysis of the Town's essential departments and equipment and seek funding to make equipment upgrades to ensure safe and continued community service in the event of short or long-term disruption caused by natural disaster, epidemic, or other substantial disruption factor.	All Hazards	High	Town Manager	Public Works Dept.	VDEM, DHS, FEMA, USDA, EDA, COVID, DHCD		1-3
Structure	S (all)	Mitigation reconstruction.	All Hazards	High	TBD	TBD	VDEM, FEMA		After Event
Capacity, Property Protection	C 3.3, P 2.1	Initiate program and studies to execute elevation, relocation, or acquisition measures, especially in area of repetitive flooding, to reduce or eliminate flooding and high hazard dam failure impacts to lives, property and financial impacts to families and communities.	Flood, Dam Failure	High	Community Development		VDEM, FEMA		Ongoing



# Mitigation

Table 6-11 Lynchburg City Mitigation Actions

Community: Lynchburg City									
NFIP Community #: 510093									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Information & Outreach	I 1.1, I 1.3	Educate public, businesses, and organizations on hazard preparedness including National Flood Insurance Program (NFIP) information	All Hazards	High	Emergency Services, Water Resources, Community Development	CVPDC	VDEM, FEMA, City	Local realtors, local insurance agents	1-3
Information & Outreach	I 1.1, I 1.3	Expand outreach and education about the National Flood Insurance Program (NFIP), including inclusion within the City's website.	Flood, Dam Failure	High	Emergency Services, Water Resources, Community Development	Communications - Marketing Dept., CVPDC	City		1-3
Information & Outreach	I 3.6	Expand flood insurance coverage, especially those areas known to have regular flooding or stormwater impact. Those in the high hazard dam inundation zone will be identified too.	Flood, Dam Failure	Medium - Low	Emergency Services, Water Resources, Community Development	Fire Department	VDEM, City CDBG, Private Lenders		3-5
Information & Outreach	I 3.1-3	Enhance and maintain an education campaign for the floodplain management program to educate homeowners or business owners on floodplain requirements and flood and dam breach preparedness including highwater roadway safety information.	Flood, Dam Failure	High	Emergency Services, Water Resources, Community Development	Fire Department, CVPDC	VDEM, FEMA, NFWF, DMV		1-3



# Mitigation

Community: Lynchburg City									
NFIP Community #: 510093									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Information & Outreach	I 1.1, I 2.1, I 2.3, I 4.1	Expand hazard preparedness section within the City's website to include property evaluation, firewise practices, hazardous material storage, wind straps and anchors for mobile homes, home storm preparedness kit.	All Hazards	High	Emergency Services, Water Resources, Community Development	Fire Department, Communications/ Public Engagement	VDEM, City		1-3
Information & Outreach	I 3.3	Provide information to property owners in the floodplain to assist in identifying and implementing wet and dry floodproofing projects.	Flood	Medium	Community Development, Water Resources	Communication/ Public Engagement	FEMA		3-5
Information & Outreach	I 1.3	Develop a public communications plan/strategy for floods and high hazard dam failure.	Flood, Dam Failure	High	Water Resources, Emergency Services	Communications/ Public Engagement	FEMA		
Information & Outreach, Capacity	I 1.2, I 4.2, C 4.4	Maintain communication with gas, fuel, and small industry to provide information regarding hazard material storage and general hazard communication. Include utilities and private sector in exercises including next year's functional contamination exercise. Visit Tier 2 hazmat locations.	All Hazards	Medium	Emergency Services, Fire Department	Community Development	VDEM, City		Ongoing
Information & Outreach, Capacity	I 1.2, C 2.1, C 2.9	Identify points of contact and integrate private utilities and other, privately-owned critical	All Hazards	Medium	Emergency Services, Fire Department	GIS, Community Development	VDEM, City		Ongoing





# Mitigation

Community: Lynchburg City									
NFIP Community #: 510093									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
		infrastructure into hazard mitigation planning.							
Information & Outreach, Capacity	I 1.2, C 2.1, C 2.9	Provide guidance on conducting vulnerability assessments and continuity of operations planning for private utilities and other, privately-owned critical infrastructure.	All Hazards	Medium	Emergency Services, Fire Department	GIS, Community Development	VDEM, City		Ongoing
Capacity, Natural System Resiliency	C 2.5, C 3.5, R 1.2, R 2.1-2	Study land use/land cover in the sensitive areas (i.e., floodplain, high hazard dam inundation zones, streams, and steep slopes) to identify areas for conservation/open space.	Flooding, Dam Failure	Medium	Water Resources, Community Development, Public Works (Forestry)	GIS	VDEM, FEMA, DCR, DEQ, NFWF	CVPDC Watershed Program	1-3
Capacity	C 3.3-6	Promote sustainable and resilient development of the City's riverfront.	All Hazards	High	Water Resources, Community Development, Economic Development	CVPDC	City, Private Investors, FEMA, VDEM	City Downtown Master Plan, Regional Comprehensive Economic Development Strategy	Ongoing
Capacity	C 2.1, C 2.8	Adopt new floodplains restudied by FEMA.	Flood	High	All City Dept.	FEMA, DCR, VDEM	FEMA		1-3
Capacity	C 2.1, C 2.8	Update floodplain ordinance and other plans based on new floodplain.	Flood	High	Water Resources, Community Development	PDC, Public Works, Lynchburg City Schools	VDEM, FEMA		3-5



# Mitigation

Community: Lynchburg City									
NFIP Community #: 510093									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Capacity	C 6.4	Develop debris management plan	Wind, Tornado	Low	Public Works, Water Resources, Fire Department	Parks & Recreation	VDEM, City	CVPDC	
Information & Outreach, Capacity	I 3.6, C 2.1	Implement elevation certificates collection protocol/program.	Flood	Low	Community Development	Water Resources	City		Ongoing
Capacity	C 2.1	Identify unreinforced masonry schools and other public buildings and educate occupants on safer locations in the structure. Coordinate locations with hazards	Earthquake, Tornado, High Wind Hazards	Low	Fire, Emergency Services, Community Development	PDC, Public Works, Lynchburg City Schools	VDEM, City	CVPDC	2-4
Capacity	C 1.4	Encourage and participate in CFM Training.	Flood	Low	Water Resources, Community Development	Fire Department, Emergency Services, Public Works, Parks & Recreation, DCR	VDEM, City		2-4
Capacity	C 2.1, C 2.8	Develop and publicize heat response plan which includes the use of cooling centers	Extreme Temperatures	Low	Emergency Services	Parks & Recreation, Lynchburg City Schools, Fire Department	FEMA, VDEM, City		2-4
Capacity	C 1.1	Consider starting a Community Emergency Response Team (CERT).	All Hazards	Medium	Emergency Services or Fire Dept.	Emergency Services	FEMA, City		1-3



# Mitigation

Community: Lynchburg City									
NFIP Community #: 510093									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Capacity	C 1.1, C 1.2	Pursue entrance into the Community Rating System (CRS) Program.	Flood	High		DCR	City		1-3
Capacity, Property Protection	C 2.1, C 2.8, P 2.6	Evaluate resources needed and initiate procedure to manage emergency road closure events.	All Hazards	Low	Emergency Services, GIS, Public Works	Police, Fire, Water Resources			Ongoing
Property Protection	P 1.3	Develop vulnerability analysis, security plans, and where necessary implement, protection measures at public utilities and other critical facilities.	All Hazards	Medium	All City Dept.	VDEM	VDEM, FEMA, DEQ, VDH, DHS		ongoing
Property Protection	P 1.3	Initiate evaluation and execute improvements to harden the City's critical facilities to reduce vulnerability from cyber and other technological hazards.	All Hazards	High	Information Technology	City Security Task Force	VDEM, FEMA, DHS, EDA, COVID, DHCD	City Security Task Force	ongoing
Capacity, Information & Outreach	C 3.1, I 3.4	Seek high hazard dam breach evaluation and studies to determine worst case inundation area of multiple high hazard dams breaching at once.	Dam Failure	Medium	Water Resources, Emergency Services	CVPDC, DCR	FEMA, DCR, VDEM	Amherst and Campbell Counties	1-3
Property Protection	P 2.5, P 2.6, P 2.8	Implement stormwater retrofits to reduce flooding, reduce contributing runoff from impervious surfaces	Flood	Medium	Water Resources, Public Works		VDEM, FEMA, DEQ, DCR		4+



# Mitigation

Community: Lynchburg City									
NFIP Community #: 510093									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Property Protection	P 1.1, P 1.2	Evaluation of back-up power/generator/network for DWR facilities and other City facilities, emergency/neighborhood shelters, and other City facilities.	All Hazards	High	Water Resources, Public Works, Lynchburg City Schools	IT	City, VDEM, DHS		1-3
Property Protection	P 1.1, P 1.2	Implementation of back-up power/generator/network for DWR facilities, emergency/neighborhood shelters, and City facilities	All Hazards	High	Water Resources, Public Works, Lynchburg City Schools	IT	FEMA, VDEM	Adjacent counties and towns	3-5
Property Protection, Structure, Natural System Resiliency	P 2.8, S 1.3, S 1.4, R 1.1	Evaluate stream corridors for stream bank stability issues to protect public assets (sewer, trails, transportation) and identify/prioritize projects for implementation of stream restoration projects.	Flood, Dam Failure	Medium	Water Resources, Public Works	CVPDC	VDEM, FEMA, DEQ, VDH, NFWF, EPA, DCR	RELSWCD, TMDL Implementation Plans, CVPDC Watershed Program, James River Association	3-5
Property Protection, Structure	P 1.1, P 2.5, P 2.8, S 1.3	Retrofit of stormwater infrastructure to manage stormwater runoff	Flood	Medium	Water Resources, Public Works		VDEM, FEMA, DEQ, EPA		Ongoing
Property Protection, Capacity	P 3.1, C 6.1	Initiate tree canopy analysis or condition study; selectively remove dead or diseased trees that have the potential to impact structures or block ROW during weather events	Wind, Flood, High Temperatures	Medium	Public Works, Parks & Recreation	Water Resources	VDEM, FEMA, DOF, City		Ongoing





# Mitigation

Community: Lynchburg City									
NFIP Community #: 510093									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
Property Protection, Capacity	P 5.1, C 2.8	Develop a flood and high hazard dam failure communication plan for City-owned dams.	Flood, Dam Failure	High	Water Resources, Emergency Services	Communication/ Public Engagement, GIS	VDEM, FEMA		Ongoing
Capacity, Property Protection	C 3.1, P 2.1	Initiate hydrologic evaluations and stormwater impact analysis to identify potential properties, open spaces, or businesses appropriate for acquisition to reduce repetitive loss or provide green infrastructure stormwater storage.	Flood, Dam Failure	Medium	Water Resources, Community Development	Public Works, Parks & Recreation	VDEM, FEMA		4+
Capacity, Property Protection	C 3.3, C 3.5, C 3.6, P 2.1, P 2.3	Develop strategy to address Repetitive Loss properties and areas.	Flood	High	CRS Coordinator	Water Resources, Emergency Services, DCR	VDEM, FEMA, DCR		1-3
Information & Outreach	I 3.2 I 3.6	Seek opportunities to execute property flood audits for properties in floodplains.	Flood	Medium	Community Development, Water Resources	Fire Department	VDEM, FEMA	Local realtors, local insurance agents	3-5
Structure	S (all)	Mitigation reconstruction.	All Hazards	High	TBD	TBD	VDEM, FEMA		After Event
Capacity, Property Protection	C 3.3, P 2.1	Initiate program and studies to execute elevation, relocation, or acquisition measures, especially in area of repetitive flooding, to reduce or eliminate flooding and high hazard	Flood, Dam Failure	High	Community Development		VDEM, FEMA		Ongoing



# Mitigation

Community: Lynchburg City									
NFIP Community #: 510093									
Strategy Category	Regional Strategy	Action Item Description	Hazard(s)	Priority (High Medium Low)	Lead Agency or Department	Support Agency or Department	Potential Funding Sources	Coordination Opportunity(s)	Time Frame (years)
		dam failure impacts to lives, property and financial impacts to families and communities.							





# IMPLEMENTATION AND MAINTENANCE





# Implementation and Maintenance

## 7.0 Implementation and Maintenance

The success and value of the CVPDC HMP as a tool and resource to mitigate and positively impact reductions in natural hazard impact on property and individuals relies on plan integration, monitoring, evaluation and, when necessary, updating. This section of the plan outlines the process for plan approval, executive oversight, integrating hazard mitigation into locality and regional planning efforts, and capturing and reflecting changes during the five-year life of this essential regional initiative.

### 7.1 Plan Adoption

Adoption of the CVPDC HMP by each of the region's member jurisdictions is anticipated to be completed in fall 2020. All adoption resolutions, as well as approval confirmation by FEMA and VDEM, will be included within Appendix A: Adoption Resolutions.

Confirmation of public comment opportunity during the planning process and during the formal review and adoption process, including all necessary public hearings, will be guided, and assisted by CVPDC staff in accordance with FEMA requirements.

### 7.2 Plan Integration and Implementation

The CVPDC HMP articulates a menu of activities and recommendations that can be integrated into community plans, department protocols, locality capital improvement plans, and agency systems to implement pre-disaster mitigation goals and objectives for the region. Plan adoption is essential, however, fundamental to implementation success is the structural integration of the HMP within foundational community and regional plans, regulatory systems, departmental procedures, and funding structure.

The capability assessment serves as a summary of the existing plans and programs that provide the foundation for plan incorporation into plan updates and integration within departmental programs and system protocols. The planners, emergency managers, and other appropriate staff will ensure appropriate mitigation plan incorporation and activity integration is executed at the locality level.

The primary tool for implementing land use goals is within each locality's zoning ordinance. The regional mitigation plan goals, objectives, and strategies should be evaluated and considered within review and zoning regulation updates, especially site improvements within flood zones.

Emergency managers should capitalize on local and regional disaster operations and recovery plans to execute elements of the Plan mitigation strategies, especially those directly applicable to emergency response operations and efficiency, including training, equipment, and facility improvement needs.

Many of the mitigation strategies, especially those property protection, structural, or natural system resiliency projects, will require considerable planning and large financial investment. Execution will require continuously seeking funding opportunities including federal and state grant programs,





# Implementation and Maintenance

incorporation and dual benefits across departments and agencies to capitalize on funding efficiency, integration within capital improvement plans.

Ensuring the fundamental recognition, understanding and value in the integration of “hazard mitigation”, “community resiliency”, “stormwater protection”, and “disaster preparedness” planning by residents, businesses, and policy makers will be essential in the implementation of the pre-disaster activities to serve and benefit the region’s localities and residents.

## 7.3 Evaluating and Updating

The CVPDC will be responsible for convening the CVPDC Mitigation Plan Advisory Committee (MPAC), similarly comprised of locality and agency stakeholder representatives. The CVPDC staff lead will be responsible for organizing two meetings per year that will be dedicated to monitoring progress on strategy execution and evaluating programs (e.g. grants) and coordination opportunities to execute strategies, and determining if any updates or changes within the regional pre-disaster plan are warranted.

At the twice-yearly meetings, the MPAC members will review and report mitigation strategies implementation activities, including regional, locality-specific, and stakeholder summaries. The meetings will also be used to coordinate regional projects, with focus on information and outreach strategies, and incorporate a staff educational component such as information on state, federal or non-profit funding information, overview of success program execution by local partner, discussion of challenges, recording of anticipated future changes or Plan integration, and outline agenda and actions for future meetings. In addition to the scheduled MPAC meetings, CVPDC staff will also conduct individual locality meetings, as necessary, to support or reflect projects relevant to Plan implementation.

Included as an integral component CVPDC staff activity and the Plan maintenance program, will be the yearly submittal of a Virginia Hazard Mitigation Plan Annual Report Form to VDEM. It is anticipated that the yearly Plan annual report will be submitted to VDEM in January of each year, however, the submittal schedule will be per VDEM’s requirement. The CVPDC Hazard Mitigation Annual Report, as well as regular program features throughout the year, will be made available for public comment and housed on the CVPDC Mitigation Plan website.

A CVPDC HMP update process will be initiated by the CVPDC, at a minimum, four years after the year of plan adoption. The CVPDC will ensure that the regional hazard plan does not exceed the FEMA five-year program approval and mitigation program eligibility by beginning to seek FEMA funding and plan development preparation three years from the FEMA adoption.

## 7.4 Public Involvement

This regional pre-disaster planning document will be used by the CVPDC, member jurisdictions and area stakeholders as an active tool to inform projects, programs, or policies to minimize hazard impacts. The CVPDC HMP, along with any changes and the yearly annual reports, will remain publicly available on the CVPDC website. Included within the mitigation plan website is a continuous feature that allows for public comment on the document, any element of mitigation plan execution, or to contact CVPDC staff at any



# Implementation and Maintenance

time. In addition to commenting on the Plan, to ensure continued public participation opportunities in Plan monitoring and maintenance, the following activities may be utilized:

- MPAC meetings advertised in local newspapers, newsletters, bulletin boards, locality office buildings and/or websites;
- Incorporating hazard mitigation plan activities as components of other CVPDC committee or partner agency agendas; and
- Using media outlets, locality, or area stakeholder websites/newsletters to feature mitigation strategy updates or activity execution.



# Appendix A: Adoption Resolutions

## Appendix A: Adoption Resolutions

Placeholder for Adoption Resolutions



# Appendix B: FEMA Crosswalk

## Appendix B: FEMA Crosswalk

REGULATION CHECKLIST	CROSSWALK REFERENCE #
<b>ELEMENT A. PLANNING PROCESS</b>	
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Section 3: Planning Process
A2. Does the Plan document an opportunity for neighboring communities local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Section 3.6: Coordination with other Agencies, Entities, and Plans
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Section 3.7: Public Involvement
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information (Requirement §201.6(b)(3))	5.3: Planning Capabilities, 6.0: Mitigation, 7.2: Plan Integration and Implementation
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process (Requirement §201.6(c)(4)(iii))	7.4: Public Involvement
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement 201.6(c)(4)(i))	7.3: Evaluating and Updating
<b>ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT</b>	
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	4.0: Hazard Identification and Risk Assessment
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	4.0: Hazard Identification and Risk Assessment
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	4.0: Hazard Identification and Risk Assessment
<b>ELEMENT C. MITIGATION STRATEGY</b>	
C1. Does the Plan document each jurisdiction's existing authorities, policies, programs, and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	5.0: Capabilities
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(ii))	5.3.11: Floodplain Management





# Appendix B: FEMA Crosswalk

REGULATION CHECKLIST	CROSSWALK REFERENCE #
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	6.4: Mitigation Goals, Objectives, and Actions
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	6.5: Jurisdiction-Specific Mitigation Actions, 6.6 Mitigation Analysis Techniques
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement 201.6(c)(3)(iv)); (Requirement 201.6(c)(3)(iii))	6.5: Jurisdiction-Specific Mitigation Actions, 6.6 Mitigation Analysis Techniques
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement 201.6(c)(4)(ii))	7.2: Plan Integration and Implementation
<b>ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION</b>	
D1. Was the Plan revised to reflect changes in development? (Requirement §201.6(d)(3))	2.6.4: Development Trends
D2. Was the Plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	6.0: Mitigation
D3. Was the Plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	6.0: Mitigation
<b>ELEMENT D - CHANGES FROM THE CROSSWALK</b>	
<b>ELEMENT E. PLAN ADOPTION</b>	
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	Appendix A
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	Appendix A



# Appendix C: Acronyms

## Appendix C: Acronyms

AAL – Average Annual Loss

AEL – Annualized Earthquake Loss

AM&O – Atlantic, Mississippi, and Ohio Railroad

ASCE – American Society of Civil Engineers

ASDSO – Association of State Dam Safety Officials

BFE – Base Flood Elevation

BRIC – Building Resilient Infrastructure and Communities Program

CDBG – Community Development Block Grant Program

CDC – Centers for Disease Control

CERT – Community Emergency Response Team

CFM – Certified Floodplain Manager

CGIT – Center for Geospatial Information Technology

CIP – Capital Improvement Plan

CME – Coronal Mass Ejections

COG – Continuity of Government Plan

COOP – Continuity of Operations Plan

CRS – Community Rating System

CVPDC – Central Virginia Planning District Commission

CVSZ – Central Virginia Seismic Zone

CWA – Clean Water Act Section 319 Grants

CWSRF – Clean Water Revolving Fund

DBIZ – Dam Break Inundation Zone

DCR – Virginia Department of Conservation and Recreation

DEQ – Virginia Department of Environmental Quality

DEM – Digital Elevation Model

DGMR – Division of Geology and Mineral Resources (Virginia DMME)

DHCD – Virginia Department of Housing & Community Development

DHS – U.S. Department of Homeland Security

DMA 2000 or DMA2K – Disaster Mitigation Act of 2000

CVPDC Hazard Mitigation Plan 2020 Update



# Appendix C: Acronyms

DMME – Virginia Department of Mines, Minerals & Energy  
DMTF - Virginia Drought Monitoring Task Force  
DPW – Department of Public Works  
DSCI – Drought Severity and Coverage Index  
DSCOVR – Deep Space Climate Observatory  
DSIS – Virginia Dam Safety Inventory System  
DWSRF – Drinking Water State Revolving Fund  
EAP – Emergency Action Plan  
EDA – Economic Development Administration  
EF – Enhanced Fujita (Tornado Scale)  
EHS – Extremely Hazardous Substances  
EOC – Emergency Operations Center  
EOP – Emergency Operations Plan  
EPA – U.S. Environmental Protection Agency  
EPCRA - Emergency Planning and Community Right to Know Act  
EPP – Emergency Preparedness Plan  
ER – Emergency Relief  
ETO – Emergency Transportation Operations  
ETSZ – Eastern Tennessee Seismic Zone  
EUV – Extreme Ultraviolet  
EVA – Extra-Vehicular Activity  
EWP – Emergency Watershed Protection  
FEMA – Federal Emergency Management Agency  
FFH – First Floor Height  
FHWA – Federal Highway Administration  
FIRM – Flood Insurance Rate Map  
FMA – Flood Mitigation Assistance Program  
GCSZ – Giles County Seismic Zone  
GFDL – Geophysical Fluid Dynamics Laboratory  
GIC – Geo-magnetically Induced Currents  
GIS – Geographical Information System



# Appendix C: Acronyms

GNSS – Global Navigation Satellite Systems  
GPS – Global Positioning System  
Hazmat – Hazardous Material  
HF – High Frequency  
HFLC – Hurricane-Flood-Landslide Continuum  
HIFLD – Homeland Infrastructure Foundation-Level Data  
HIRA – Hazard Identification Risk Assessment  
HMGP – Hazard Mitigation Grant Program  
HMP – Hazard Mitigation Plan  
HUD – U.S. Department of Housing and Urban Development  
ICS – Industrial Control System  
IED – Improvised Explosive Device  
IMF – Interplanetary Magnetic Field  
KBDI – Keetch-Byram Drought Index  
LWCF – Land and Water Conservation Fund Grants  
MH – Manufactured Housing  
MMI – Modified Mercalli Intensity  
MPO – Metropolitan Planning Organization  
MRLC – Multi-Resolution Land Characteristics  
MSA – Metropolitan Statistical Area  
NAS – National Academy of Sciences  
NESIS – Northeast Snowfall Impact Scale  
NCDC – National Climatic Data Center  
NCEI – National Centers for Environmental Information  
NESIS – Northeast Snowfall Impact Scale  
NF – Nuisance Flooding  
NFHL – National Flood Hazard Layer  
NFIP – National Flood Insurance Program  
NFIRS – National Fire Incident Reporting System  
NFPA – National Fire Protection Association  
NLCD – National Land Cover Database





# Appendix C: Acronyms

NLDAS – North America Land Data Assimilation System

NOAA – National Oceanic Atmospheric Administration

NTAS – National Terrorism Advisory System

NWS – National Weather Service

ORNL – Oak Ridge National Laboratory

PCB – Polychlorinated Biphenyl

PDC – Planning District Commission

PDM – Pre-Disaster Mitigation Program

PDSI – Palmer Drought Severity Index

PGA – Peak Ground Acceleration

PMF – Probable Maximum Flood

PRD-UDI - Preliminary Regulatory Determination/Unknown Dam Initiative

QCEW – Quarterly Census of Employment and Wages

Risk MAP – FEMA Risk Mapping, Assessment, and Planning

RL – Repetitive [flood] Loss

RMA – Resource Management Area

RPA – Resource Protection Area

RFC – Repetitive Flood Claims Program

SARA - Superfund Amendments and Reauthorization Act

SBA – Small Business Administration

SCADA – Supervisory Control and Data Acquisition

SFCP – Small Flood Control Projects

SFHA – Special Flood Hazard Area

SRL – Severe Repetitive [flood] Loss

STAPLEE – Social, Technical, Administrative, Political, Legal, Economic, and Environmental

SWPC – Space Weather Prediction Center

TAC – Technical Advisory Committee

TAZ – Traffic Analysis Zones

TRI – Toxic Release Inventory

UC – Urban Cluster

USACE – U.S. Army Corps of Engineers



## Appendix C: Acronyms

USBC - Virginia Uniform Statewide Building Code

USDA – United States Department of Agriculture

USDM – United States Drought Monitor

USDOT – United States Department of Transportation

USGS – United States Geological Survey

VDEM – Virginia Department of Emergency Management

VDEQ – Virginia Department of Environmental Quality

VDH – Virginia Department of Health

VDOF – Virginia Department of Forestry

VDOT – Virginia Department of Transportation

VFSR – Virginia Fire Safety Regulations

VGIN – Virginia Geographic Information Network

WHC – Woodland Home Communities

WHO – World Health Organization

WHP – Wildfire Hazard Potential

WMO – World Meteorological Organization

WONDER – Wide-ranging Online Data for Epidemiologic Research

WSAG – Water Supply Assistance Grant

WUI – Wildland-Urban Interface



# Appendix D: Meeting Documentation

## Appendix D: Meeting Documentation

The regional pre-hazard mitigation plan development included steering committee meetings, individual locality stakeholder meetings, community meetings. Plan development also included public input through public meetings, through an administered public survey, and information through policy board meeting. Throughout the planning process there were also individual conversations with extension agents, economic development, and locality staff regarding specific need evaluation for mitigation strategy development.

### PROJECT DEVELOPMENT MEETINGS

#### Steering Committee Meetings

June 14, 2018 | [Meeting Summary](#); [Sign in Sheet](#)

January 22, 2019 | [Meeting Summary](#); [Sign in Sheet](#)

October 17, 2019 | [Meeting Summary](#); [Sign in Sheet](#)

November 21, 2019 | [Agenda](#)

April 16, 2020 | [Meeting Summary](#); [Attendees](#)

May 28, 2020 | [Meeting Summary](#); [Attendees](#)

August 19, 2020 | [Meeting Summary](#); [Attendees](#)

#### Locality & Stakeholder Meetings

Local Emergency Planning Committee (LEPC) Meeting | January 15, 2020; [Minutes](#); [Sign in Sheet](#)

Locality Vulnerability Meeting: Amherst | January 19, 2020; [Minutes](#); [Attendees](#)

Locality Vulnerability Meeting: Campbell | February 18, 2020; [Minutes](#); [Attendees](#)

Locality Vulnerability Meeting: Appomattox | February 18, 2020; [Minutes](#); [Attendees](#)

Locality Vulnerability Meeting: Lynchburg | February 19, 2020; [Minutes](#); [Attendees](#)

Locality Vulnerability Meeting: Bedford | March 9, 2020; [Minutes](#); [Attendees](#)

### PUBLIC INPUT & PARTICIPATION

#### Public Meeting

December 4, 2019 | 5:30 pm – 7:00 pm

The Miller Center

301 Grove Street, Lynchburg

[Presentation Link](#)

[Attendees](#)

#### Public Meeting (webinar format)

June 25, 2020 | 5:30 pm

[Presentation Link](#)

#### Public Survey

The regional pre-disaster public survey was open and electronically available from November 20 – December 13, 2019. Information about and a direct link to the survey was made available on all the locality websites, the CVPDC website, via the CVPDC newsletter, social media, and through information provided to all of the local news outlets including regional newspapers and radio. In addition, information



## Appendix D: Meeting Documentation

regarding the December 4, 2019 public meeting and pre-disaster survey was provided as an informational item at each locality November policy board meeting.

[CVPDC Pre-Disaster Mitigation Plan Public Survey](#)

[CVPDC Pre-Disaster Mitigation Plan Public Survey Results](#)





# Appendix D: Meeting Documentation

## **Region 2000 Hazard Mitigation Plan Update**

### **Project Kickoff Meeting**

Region 2000 Local Government Council Office

828 Main Street; 12<sup>th</sup> Floor, Lynchburg

Thursday, June 14, 2018

9:30 – 11:30 am

### **Meeting Agenda**

1. Welcome Kelly Hitchcock
2. Introductions
3. Hazard Mitigation Planning – Role & Value Christopher Bruce, VDEM
4. 2013 Region 2000 Hazard Mitigation Plan – History/Status Peter Sforza, VT CGIT
5. Hazard Planning – Coordination with Economic Development Peter Sforza
6. Hazards Review & Discussion
7. Hazard Mitigation Plan Update Process Peter Sforza, VT CGIT
8. Hazard Mitigation Plan Proposed Schedule CGIT Team
9. Next Steps

## **Region 2000 Hazard Mitigation Plan Update**

### **Kickoff Meeting, June 14, 2018**

#### **Minutes of Meeting**

#### **Kelly Hitchcock, Region 2000 Local Government Council**

- Introductions (CGIT) and other attendees

#### **Peter Sforza, CGIT VT**

- Team Introductions

#### **Christopher Bruce, VDEM**

- What is the current applicability of the previous mitigation projects? New projects to be considered
  - Involvement of the localities in the meetings and in the process
  - Types of Hazard Mitigation Grants
    - **HMGP - After disasters**
      - These grants are provided to states and local governments to implement long term mitigation measures after major disaster declarations
      - The applicability of this grant is statewide
      - Hence, when Hurricane Matthew (FEMA) received federal declaration 2 years ago, all communities were eligible to apply for the grant
        - It was not just for Hampton Roads, the approval was statewide
        - Everyone has to apply for same amount of money it's not just the affected localities
        - e.g. Central Shenandoah PDC - planning grant after Hurricane Matthew
    - **Flood Mitigation Assistance Grant**
      - Same places are flooded repetitively
      - Hard to implement mitigation measures for tornado as compared to flooding (NFIP) and stormwater
    - **Types of Pre disaster mitigation grants**
      - 2017-2018 funding for the statewide and nationwide explained



## Appendix D: Meeting Documentation

- Types of mitigation strategies:
  - Flood diversion
  - Floodplain and stream restoration - to channel flood flow, Albemarle County has a couple of projects done recently
  - Water and Sewer protection
  - Infrastructure and Utility protection - Roadways, Critical Infrastructure
  - Soil stabilization – Erosion
  - Green Infrastructure purchasing houses and turning into green spaces
  - Acquire Management - mostly for drought management
  - Wildfire - education services, *Central Shenandoah* has a *wildfire mitigation plan* separate from their HMP
  - Flood Proofing - structures in Stanton to keep water out
  - Elevations - above 100 yr flood plains (Hampton Roads)
  - Acquisitions (FEMA grants) to move people out of the hazards way. Deed restricted and converted to open spaces
  - Structure Relocation - Moving the complete structure to a new place. At Least 50% of the property has to have suffered severe loss (Repetitive flood Loss)
  - Safe Rooms - for protection from tornadoes, storms
  - Purchase of generators
  - Retrofitting properties to withstand hurricane wind loads
- **Previous HMP grants in Virginia**
  - Elevations, Acquisitions, Plan Updates appear to be the most commonly used grants
  - It is easier to approve grants when a hazard mitigation plan has a number of them and they are well explained

### Peter Sforza

- **Center for Geospatial Information Technology, Virginia Tech – Introduction**
  - Past and ongoing projects
  - Services provided
- **Hazard Mitigation Planning stages**
  - Step one will be to identify risks in the region - this will be done through quantitative and qualitative assessments of hazards and vulnerabilities (*CGIT*)
  - Step two will be deciding strategies to mitigate hazards
  - Approvals by VDEM, FEMA, Localities
  - Application by the localities
- **New Innovative Ideas in the plan update**
  - Open to suggestions
  - Plan to involve a research element focusing on the economic development/growth of the region
  - To attract new businesses (*e.g. Northern Virginia HMP*)
  - Work in collaboration with Kelly for the economic growth aspect
- **Related Studies/documents**
  - Previous Region 2000 HMP
  - Statewide Hazard Mitigation Plan
  - Central Shenandoah Wildfire Management Plan



# Appendix D: Meeting Documentation

- *Flood Hazard Study for Lynchburg (Link to the plan to be provided by the Lynchburg representative)*
  - HMPs for colleges and universities in region 2000
- **Case Studies**
  - List of hazards affecting Region 2000 between 2012 to present, is prepared by CGIT
  - Feedback from the localities to ensure the comprehensiveness of the list
- **Timeline**
  - Webinars and in person meetings to discuss the progress
  - 2019
    - Complete HIRA by April
    - Big projects? - New mitigation strategies
    - Assessment and rankings
    - Public engagement (Newspapers, public hearings, websites – online surveys) - e.g. *Hampton Roads Mitigation Plan*
  - Completion in 2020
    - VDEM, FEMA Reviews
    - Dec - adaptation of the plan
- **Integration of GIS**
  - Inventory analysis
  - Probability of occurrence, quantitative analysis
  - Classification of hazards as low medium or high risk (Drought vs hurricane)
  - This will be based on inputs from stakeholders, public and geospatial analysis
  - Identify other databases to be used
    - Insurance claims data (e.g. *Virginia Tech HMP*)
    - Karst, sinkholes dataset
  - Modeling damage to buildings situated in the floodplains using HAZUS level 2 i.e. building level data
- **Technical Advisory Groups – Expectations**
  - *Worksheet circulated*
  - Technical advisory committees consisting of representatives from the localities and agencies to be formed
  - Their expertise related to a particular hazard will be used in the plan update process
  - In later stages of the plan - help with goals and strategies
  - Involvement of universities, colleges, CENTRA health etc.
  - *Suggestions for any other institutions to be involved ??*
  - Help in writing grants
  - Technical feedback
- **HAZUS**
  - Will be used for quantitative hazard risk analysis
  - Level 2 - detailed building inventory
  - Integration of State Level Property assessments database, state properties
  - Need to acquire local r2k data
- **HIRA**
  - Coordination with Kelly and VDEM throughout the process
  - Inputs from localities and other stakeholders involved in the process
  - Identify hazards across the region
  - Assess the vulnerability



## Appendix D: Meeting Documentation

- **New hazards to be considered for possible inclusion**
  - Communicable diseases (Human, animal, plants) - Virginia Tech research group
  - Flu analysis
  - Thunderstorm, lightning
  - Energy grid knockouts because of solar flares
  - Nanotoxicity (*VT hazard mitigation plan*)
  - HazMat
  - Social Vulnerability
  - Transmission pipelines data intersected with landslides
- **Overview of the Hazards and analysis methods**
- **New Elements Planned**
  - Use of Property Assessments Data
  - Transmission pipeline data
  - Web portal to engage stakeholders, post the results of HIRA and get feedbacks, web based surveys
- **Hazard Risk Prioritization**
  - Semi-quantitative ranking system to prioritize hazards
  - Technical Advisory Committee meetings dates will be decided later

### Kelly

- Integration of web portal will ensure continued and efficient inputs
- Each locality in region 2000 might have unique needs. Through this process we'll try to pull it all together
- Christopher and Jonathan from VDEM will be involved throughout the process

### Suggestions

- Grants/ Funding for backup generators (Could be a mitigation project)
- Current situation - 1 backup generator, 15-20 yrs old at most of the places

### Christopher

- FEMA requires the locality involvement/information to be documented properly even if the small towns are represented by their counties
- Final Project Timeline Revision pending





# Appendix D: Meeting Documentation

Hazard Mitigation Plan Update  
Kickoff Meeting - June 14, 2018  
Attendance Sheet

Name	Title	Locality and/or Organization
Sony Orbay	Local Health <sup>Coordinator</sup> Emergency	CVHD / VDEM
JEFF MARTIN	Assistant Director	LYN. WATER RESOURCES
Chad Nease	Planner/GIS	SPDC
Jack Jones Jr	Chief of Dept H&A	Bedford County
Anne Witt	Geohazards Geologist	VA DIME
J. MIKE CREWS	Director of Public Works	TOWN OF BROOKNEAL
PHIL HYSEL	WARNING COORDINATION <del>DETERMINATION</del>	NWS BRACKENBURG
MIRA SIMPSON	Deputy Director of Public Safety	CAMPBELL CO.
JONATHAN EVANS	Comm. Tech	CAMPBELL CO.
Piper VanDePerre	Emergency Programs Specialist	Lynchburg Emergency Services
Chris Bruce	PLANNER -	VOEM
Johnnie Reark	Director of Community Development	Appomattox County
Melissa Foster	Director of Emergency Services	City of Lynchburg
BETH LOHMAN	LAND PROTECTION PROGRAM MGR	DEQ-BRNO
Dan Witt	Asst. Town Mayor	Town of Albemarle
Bobby Wierlick	Public Safety Director	Appomattox Co.
Jennifer Maul	Deputy Director	Lynchburg Emergency Services
Jonathan T. Simmons	Regional Planner	VOEM Region 6
Peter Sforza	Director, CGIT Virginia Tech	Virginia Tech CGIT
Aishwarya B Borake	Grad student, Virginia Tech Intern, CGIT	Virginia Tech



# Appendix D: Meeting Documentation

## **Meeting Name:**

**Region 2000 Hazard Mitigation Plan Update Meeting**

## **Location and Date:**

GLTC Transfer Center Community Room,  
800 Kemper Street, Lynchburg, VA  
Tuesday, January 22, 2019 10:00 am – 1:00 pm

## **Agenda**

1. Hazard Mitigation Planning Process
2. Region 2000 Community Profile
  - Methods and Data Source
  - Updates Summary
  - Community Profiles
  - Land Cover
  - Watershed
  - Demographics
  - Higher Education
  - Population Projection
  - Zoning and Land uses
3. Hazard Identification and Risk Assessment (HIRA)
  - Proposed methods and data source
  - Proposed updates
4. Capability Assessment
5. Hazard Prioritization

## **Region 2000 Hazard Mitigation Plan Update Kickoff Meeting, January 22, 2019 Minutes of Meeting**

- Introductions
- Regional Mitigation Plan Development Overview
  - Timeline
  - CRS Program Coordination
- VDEM News
- Overview & Discussion Draft Community Profile
- Hazard Identification and Risk Analysis
  - Review data and methods
  - Consensus on Hazard Types
- Individual Hazard Meetings Kelly Hitchcock
  - Meeting Schedules
  - Stakeholder
- Summary of Next Steps



# Appendix D: Meeting Documentation

Hazard Mitigation Plan Update

January 22, 2019

Attendance Sheet

Name	Title	Locality and/or Organization
Brittany Powell	VDH/LHEC	VDH
Anno Witt	<del>VA DHE</del> Geologist	VA DHE
Johanne Roark	Director Comm. Dev.	Appomattox County
Bobby Wingfield	Public Safety Director	Appomattox County
Jonathan T. Simmons	Regional Planner	VDEM RG
Lauren Pillow	Hazardous Waste Inspector	VADEQ
J. MICHAEL CREWS	PUBLIC WORKS DIRECTOR	TOWN OF BROOKNEAL
Tracy Fairchild	Public Safety Director	Campbell Co.
Myra Simpson	Deputy Director	Campbell County Public Safety
Alan Belcher	Director, Ambassador Services	Centra Health, Inc.
Byron Byrd	Lieutenant	Bedford Co. Dept. Fire & Rescue
Jackie L. Jones, Jr.	Chief of Dept / Eng. Capt	Bedford County Va - Dept of Fire & Rescue
Clay Ross	Natural Resources Specialist	Bedford County
Chris Bruce	VDEM PLANNING	VDEM
Jennifer Maul	Deputy Director	City of Lynchburg
Philipp Garbathuber	Senior Planner	Pg Region 2000/CVPDC
<del>Jeff Martin</del>		
JEFF MARTIN	ASSISTANT DIRECTOR, WATER RESOURCES	Lynchburg Water Resources
Erin Hawkins	Water Quality Manager	City of Lynchburg, Water Resources
GARY SIMMONS	TOWNSHIP MANAGER	APPOMATTOX



## Appendix D: Meeting Documentation

Hazard Mitigation Plan Update  
January 22, 2019  
Attendance Sheet

Name	Title	Locality and/or Organization
Kelly Hitchcock	Planning & Research Director Region 2000 (PDC #11)	→
Peter Sforza	Director	Virginia Tech CGIT
Haitao Wang	Research Associate	Virginia Tech CGIT
Aishwarya Borocho	Hazard Mitigation Analyst	Virginia Tech CGIT





# Appendix D: Meeting Documentation

## **Meeting Name:**

**CVPDC Hazard Mitigation Plan Update Meeting**

## **Location and Date:**

GLTC Transfer Center Community Room,  
800 Kemper Street, Lynchburg, VA  
Thursday, October 17, 2019 3:00 am – 4:30 pm

## **Agenda**

1. Draft HIRA Chapter – Comments
2. Review Technological Hazard Data
3. Mitigation Project Identification
4. Public Outreach
  - Public Meeting
  - Citizen Survey
  - Website
5. Confirmation Next Steps

## **Mitigation Strategies**

### **Education/Outreach:**

- Awareness of hazards & encourage safe actions to mitigate impacts.
- Educate for disaster preparedness (public, agencies, staff); include high water crossing, river use, response protocol, preparedness kits
- Support development of emergency plans for large employers/industries

### **Response/Access:**

- Access to sensitive communities (access, identification, transport, uniform messaging)
- Readiness/needs of shelters

### **Capacity (Programs):**

- Zoning, area stormwater plans/studies, targeted demolition
- Coordination among departments/programs
- Identification of additional staff, programs

### **Information & Data Development:**

- Critical facility disaster plans (develop, maintain)
- Security and backup for communication network
- Identification, capacity to address gaps

### **Impact Protection**

- Minimize economic loss/risks of drought (public system access, vulnerability studies, capacity, restrictions, agriculture/SWCDs/NRCS)
- Reduce impacts increasing 90-degree days/periods



# Appendix D: Meeting Documentation

- Wildfire mitigation (Firewise, defensive space, hazardous materials, fireresistant building materials)
- Protect Natural systems – streambank stabilization,

## **Infrastructure (buildings):**

Repetitive loss structures/zones

- Identification of elevate, relocate, acquire, demolish opportunities - storage zones
- Retrofit needs – green infrastructure, coordination with roadway/infrastructure upgrades

Critical Facilities

- Shelter needs – supplies, access, retrofit needs
- Emergency plans
- Water/wastewater facilities – at site, lines/distribution, backup/pumps, plans
- Water Towers – protection (fencing, stormwater retrofits)
- Powerlines – street tree clearance,

Community/Transportation

- Access – routing (flood zones),
- Green Infrastructure – stormwater retrofits
- Movement – connectivity, clearance (street trees)
- Drainage improvements
- Flooding warning signs, establish alternative routes, highwater mark marking



# Appendix D: Meeting Documentation

CVPDC Hazard Mitigation Plan Update  
October 17, 2019

## Attendance Sheet – Please Print

Name	Title	Locality or Organization	Email
Bob Hopkins	Director of Public Utilities	Amherst County Service Authority	rhopkins@acsava.com 434-221-8757
Piper VanDePerre	Emergency Programs Specialist	City of Lynchburg	piper.vandeperre@lynchburgva.gov 455-3886
Erin Hawkins	Water Quality Mgr.	City of Lynchburg	434-455-3809 erin.hawkins@lynchburgva.gov 455-4258
JEFF MARTIN	ASSISTANT DIRECTOR	LYN. WATER RESOURCES	JEFFREY.MARTIN@LYNCHBURGVA.GOV
Anne Witt	Hazardous Geologist	VA DMME	anne.witt@dmme.virginia.gov
Sara Carter	Town Manager	Town of Amherst	Sara.carter@amherstva.gov
Chris Bruce	PLANNER	VDEM	chris.bruce@vdm.virginia.gov
Myra Simpson	Deputy Director	Campbell County PS	mmsimpson@co.campbell.va.us
JONATHAN EVANS	COMM TECH	CAMPBELL COUNTY PS	JMEVANS@CO.CAMPBELL.VA.US
Jack W. Jones, Jr.	Chief of Dept	Bedford Co F&E	John@bedfordcountyva.gov
Lauren Pillow	Hazardous Waste Inspector	VADEQ	lauren.pillow@deg.virginia.gov

CVPDC Hazard Mitigation Plan Update  
October 17, 2019

## Attendance Sheet – Please Print

Name	Title	Locality or Organization	Email
J. MICHAEL CREWS	Public Works Director	TOWN OF BROCKNEAL	publicworks@townofbrockneal.com
Thomas W. Fore	Utilities Director	Town of Altavista	twfore@altavistava.gov
Bryan Byrd	Lieutenant/EM	Bedford Co. Fire Rescue	bbyrd@bedfordcountyva.gov
JEFF HURTAK	SERGEANT/POLICE	LIBERTY UNIV. POLICE	LUPDCRIMEPREVENTION@LIBERTY.EDU
Greg Bennett	Director	LU Env. Health & Safety/Emerg. Mgmt.	gebennett1@liberty.edu
Kelly Hotchkiss	Planner	CVPDC	KHotchkiss



# Appendix D: Meeting Documentation

## **CVPDC Hazard Mitigation Plan Update**

### **Project Meeting**

GLTC Transfer Center

800 Kemper Street

Thursday, November 21 2019

3:00 – 4:30 pm

### **Meeting Agenda**

1. Review & Discuss Draft Primary Regional Goals
2. Group breakout (by interest/expert area) – Goal Strategies
3. Public Outreach
  - Survey Distribution
  - Public Meeting # 1
    - Approach
    - Presentation
  - Public Meeting(s) #2
    - Approach
    - Timeline/Requirements for individual localities
4. Confirmation Next Activities
5. Next meeting – Thursday, December 19th





# Appendix D: Meeting Documentation

## **CVPDC Hazard Mitigation Plan Update**

### **Project Meeting**

April 16, 2020

Web/Go-To-Meeting

3:00 pm – 4:15pm

### **Agenda**

1. Introduction
2. Flood Hazard Chapter Review/Discussion
3. HMP Interactive Mapping Review
4. Dam Hazard Chapter Review/Discussion
5. Review/Confirmation of Follow Up Action Items
6. CVPDC HMP Completion Schedule
7. Next Meeting

### **Minutes**

#### **Introduction**

Hitchcock welcomed participants; introductions were made. Bill Bohn, Sobis Inc. and Haitao Wang, VT-CGIT were introduced as the CVPDC HMP developers and would be leading the meeting.

#### **Flood Hazard Chapter Review/Discussion**

Bohn provided a summary of the general organization of the Flood Chapter and pointed out, along with Flood/Dam Chapter information review, that a task for the meeting was to receive consensus on the HMP Chapter format as the same format will be used on all of the hazard chapters.

The following reflects key discussion points from the Flood Hazard Chapter review.

- Table 2 - Erin Hawkins suggested a use of consistent dollar amounts, in terms of thousands of dollars or actual dollar amounts, used throughout the document.
- Kristin Owen noted that she will provide updated insurance coverage. Owen noted she does have the capability to differentiate coverage information such that structure and content coverage is available for each locality. Owen will provide the information; team will discuss the best format to present the coverage data within the HMP.
- Bohn provided an overview of the methodology for the flood risk data, the HAZUS level 2 analysis which combines the local parcel data and the building structure footprint data.
- Bohn provided an overview of the noted flood areas, which included FEMA identified and other stormwater areas. Bohn requested that each locality review these maps and provide information on any areas known to have flooding so they could be included in the map.



# Appendix D: Meeting Documentation

**ACTION:** Localities review flood map, provide feedback on any areas missing from the map.

- Bob Hopkins noted that in Table 13 the potable water # was the same for both Appomattox & Amherst counties; suggested to check these #'s.
- Bohn pointed out that Wang had created individual locality dashboard data. Pointed out this is the type of information that the public will most likely pay attention to and will be included within the website and public outreach. Requested review of information, comments.
- Bohn provided an overview of the elements from the Amherst Town/County section and noted that each locality is organized in similar fashion. Proceeded to highlight elements within each of the locality sections.
- Bob Hopkins noted elements from the County are not included within the infrastructure critical facility list. Hopkins noted he has added the comments to a hard copy that will be provided to Hitchcock.
- Sobis reiterated team is requesting Flood/Dam chapter comments by Friday, May 1<sup>st</sup>.
- Flood-prone roads and bridge summary is provided
- Bohn noted that for each locality a locality-wide vulnerable structures in the floodplain is provided. Also provided are closeup maps in zones with concentrated structures. Bohn reminded participants that more detail from all the maps is available via the interactive maps (details later in the meeting).
- Erin Hawkins suggested for HMP readability that there be more clear section distinction, via font/physical appearance differences, to more easily find sections within chapters that follow the chapter index.
- Kristen Owen questioned the vulnerable structure data sets and reiterated that there be wording to distinguish between vulnerable structures and repetitive loss structures. Ensure the privacy elements for repetitive loss and that there is not confusion in sharing privacy. Recommended making clear statement points are not repetitive loss data.
- Erin questioned the City vulnerable maps and noted structures listed outside flood zone. Bohn confirmed these maps would be updated and currently included the dam inundation areas.

## HMP Interactive Mapping Review

Bohn provided an overview of the HMP interactive maps including navigating the GIS layers and individual locality details.

- Hawkins suggested that the orientation of the maps, with readability to be shown in landscape, might be looked into. The map should be positioned in a landscape format so that it is readable on the website.
- Bohn identified the web map tools to add/remove layers, show the legend, identify objects, and change the base map.

## Dam Hazard Chapter Review/Discussion

The following reflects key discussion points from the Dam Chapter review.

- Erin Hawkins suggested that a time range be added to the Dam previous occurrence.
- Hopkins suggested rewording the 1<sup>st</sup> sentence of Previous Occurrences paragraph.
- Jonaanon Evans noted Campbell County was missing from Timberlake Dam. Bohn noted he and Haitao were working on a format to more clearly show dam/inundation areas that impact multiple localities.



## Appendix D: Meeting Documentation

- Erin Hawkins noted that the HMP looks at individual dam inundation zones. Questioned if there was analysis associated with a worst case, cumulative failure scenario. It was agreed that HMP should include a regional dam study/analysis within the regional strategies.

**ACTION:** Develop wording/include dam study analysis within regional mitigation strategies.

- Hawkins noted there is some graphic laying on top of maps around page 72/73.
- Kristen Owen noted that she had some comments regarding the maps and some other specific comments from the Chapter. Owen will speak with Wang/Bohn individually regarding comments.

### Review/Confirmation of Follow Up Action Items

Hitchcock reiterated the request for localities to review the HMP Flood and Dam Chapters and provide comments by Friday, May 1<sup>st</sup>. She also noted, unless there were specific concerns noted by the end of the week, Bohn/Wang will continue with the other hazard chapters with the same format.

### CVPDC HMP Completion Schedule

Hitchcock noted she had communicated with VDEM/FEMA regarding public meetings. It has been confirmed that electronic format is permitted. It is anticipated that the draft strategies and access to the draft plan will be held in June. Hitchcock noted she will communicate with each locality and the full TAC on the outreach strategy. Chris Bruce confirmed that currently there is no word on a change in the FEMA mitigation grant cycle and thus, is expected to be announced in June with applications in November. Hitchcock noted the CVPDC HMP will meet this cycle.

### Next Meeting

Date to Be Determined.

Hitchcock noted that there will be a similar electronic meeting in May to review the final hazard chapters and continued coordination with localities on individual strategies. Hitchcock noted that, according to standard dates, the May meeting would be the 3<sup>rd</sup> Thursday, May 21<sup>st</sup>. However, that date will not work so a new date will be established and provided so the TAC can hold the date.

### Virtual Attendees

Jonaaron Evans, Campbell County  
Janice Crawford, Framatome  
Anthony Davis,  
Erin Hawkins, City of Lynchburg  
Piper VanDePerre, City of Lynchburg  
Greg Bennett, Liberty University  
Clay Ross, Bedford County  
Sam Bryant, Amherst County  
Jim Calvert, BWXT  
Bill Bohn, Sobis Inc.  
Kelly Hitchcock, CVPDC

Edward Chambers, Liberty University  
Mallory Cook, CVPDC  
Kristin Owen, DCR  
Jeff Martin, City of Lynchburg  
Ralph Lawson, Red Cross  
Chris Bruce, VDEM  
Bob Hopkins, ACSA/Amherst County  
Mike Crews, Town of Brookneal  
Todd Davis, Georgia Pacific  
Haitao Wang, VT-CGIT



# Appendix D: Meeting Documentation

## **CVPDC Hazard Mitigation Plan Update**

### **Project Meeting**

May 28, 2020

Web/Go-To-Meeting

3:00 pm – 4:30pm

### **Agenda**

1. Introduction
2. Draft Hazard Chapter(s) Review/Discussion
3. Mitigation Strategies

Region-wide, Locality-specific

4. CVHMP Website – Review/Discussion
5. CVHMP Public Meeting – Format, Public Outreach
6. Review/Confirmation of Follow Up Action Items

### **Minutes**

#### **1. Introduction**

Hitchcock welcomed participants. Bill Bohn provided an overview of the Agenda and meeting intent.

#### **2. Draft Hazard Chapter(s) Review/Discussion**

Bohn reminded the group that additional Draft Hazard Chapters had been provided and that a response by June 8<sup>th</sup> was requested. Bohn noted that unlike the Flood and Dam Chapters, these hazard chapters were generally not long, with some being quite short. Bohn noted the importance of each locality reviewing those sections related to their area.

Bohn also noted that four (4) additional hazard chapters, with a focus more on human-caused hazards would be sent and a review would be requested. Additional review time for these will be provided. Bohn asked for comments regarding the draft chapters or the review process in general. There were no specific questions or comments regarding the draft chapter content during the meeting. It was noted that some comments had been provided and that all reviews - edits or general comments – can be made directly on the document and will be seen.

Draft Chapter Comments:

Erin Hawkins requested additional time to review the additional chapters.

- Hitchcock confirmed additional comment period for additional chapters and, that if time was need for current chapters to contact her or Bill. Bohn noted the need to finalize these chapters as they inform mitigation activities.





# Appendix D: Meeting Documentation

## Draft Hazard Chapter Review Follow Up Actions

- Stakeholders review and provide comments to the Draft Hazard Chapters.
- Hitchcock will send out the final 4 draft hazard chapters.

### 3. Mitigation Strategies

Bohn noted that with the general completion of the Hazard Chapters, focus would be directed towards Mitigation Strategies. Bohn noted that the draft regional mitigation strategies had been developed (showed document on screen) and will serve as the foundation for the individual locality strategies. Bohn noted that instead of having a full group meeting, each locality would be contacted, and the primary locality contacts will have individual meetings focused on mitigation strategies. Bohn noted that some preliminary projects had been identified for each locality. However, he wants to guide discussion to review the list and consider any additional projects.

Bohn and Hitchcock noted that individual locality web meetings would be held the 9<sup>th</sup> and 10<sup>th</sup> of June. Hitchcock will contact each locality to request a few 1-hour meeting options to hold the mitigation strategy meetings.

## Mitigation Strategy Follow Up Actions

- Hitchcock send out mitigation strategy meeting emails to locality contacts
- Locality contacts respond with June 9<sup>th</sup> or 10<sup>th</sup> availability options
- Hitchcock send draft mitigation strategy list to locality contacts

### 4. CVHMP Website – Review/Discussion

Bohn provided an overview of the Draft CVPDC Hazard Mitigation Plan website developed by CGIT. Bohn, in review of the Community Tab noted that currently only the larger localities are noted. Bohn asked if the Town's needed their own community profile section or if they could be noted within the County description. No specific response was noted. It was agreed that Hitchcock will reach out to the Towns regarding this element of the website.

Bohn provided an overview of the maps and mapping section capabilities. It was noted that a simple Mapping Tool How to document would be added.

It was noted that the website was a draft and that there were features still under development. Bohn noted that a key element missing is local images. Stakeholders were asked to please send any local images, that might also include historical hazard images, that could be used on the site and would not need special citing. Hitchcock noted, she would include the image appeal in the pending email.

## Website Comments:

- Hawkins sought confirmation that the site would stay active and a tool to monitor HMP success over time. Hitchcock confirmed that the site will remain active.
- Susannah Smith questioned if there will be a continuous monitoring component to the HMP and what those aspects will be. Hitchcock noted there will be a maintenance component and that is a required HMP element. She noted that she will draft the overview element, which is intended to include at least yearly meeting of a project team and will include review and metric of mitigation strategy execution. Hitchcock noted that the lack of HMP oversight, maintenance, and review of mitigation strategy activity was one of the cited negative FEMA comments from the past HMP.



# Appendix D: Meeting Documentation

## HMP Website Follow Up Actions

- Send Hitchcock any locality images – represent the locality and any historical hazard images – that can be used on the HMP website.
- Send locality images to Kelly
- Hitchcock develop written elements for planning and about section of the site.
- CGIT, Sobis, CVPDC staff team finalize draft elements to send for review prior to community meeting.

## 5. HMP Public Meeting

It was confirmed that the 2<sup>nd</sup> HMP public meeting will be Thursday, June 25<sup>th</sup> and will be via a webex format. It was confirmed that the ability to have a webex meeting is according to VDEM/FEMA approval. Hitchcock noted that the meeting is intended to be via a ZOOM format but that the CVPDC also has Go-To-Meeting format capability. Hitchcock questioned if anyone had a format preference. It was agreed ZOOM format would be used.

Hitchcock confirmed that she will provide each locality information for their board packages, their locality website and will also share format information to share on any social media format – Facebook, Instagram, etc.

It was also confirmed that Bill Bohn will lead the meeting through a presentation format, that all users will be muted until an end question session, and that participants will be asked to enter their names in the chat format. It was also confirmed that the meeting will be recorded and that information on how to provide comment and future HMP review information will be provided. Lastly, Bohn confirmed that he will provide a draft presentation for review by June 18<sup>th</sup>.

## Public Meeting Comments:

- Zoom format agreed.

## Public Meeting Follow Up Actions

- Hitchcock provide meeting announcement information, to include multiple social media format content, to localities.
- Bohn provide draft public meeting presentation by June 18<sup>th</sup> for review.

## 6. Review/Confirmation of Follow Up Action Items

1. Hitchcock send out mitigation strategy meeting emails to locality contacts
2. Locality contacts respond with June 9<sup>th</sup> or 10<sup>th</sup> availability options
3. Hitchcock send draft mitigation strategy list to locality contacts
4. Hitchcock send out mitigation strategy meeting emails to locality contacts
5. Locality contacts respond with June 9<sup>th</sup> or 10<sup>th</sup> availability options
6. Hitchcock send draft mitigation strategy list to locality contacts
7. Send Hitchcock any locality images – represent the locality and any historical hazard images – that can be used on the HMP website.
8. Send locality images to Kelly
9. Hitchcock develop written elements for planning and about section of the site.
10. Hitchcock provide meeting announcement information, to include multiple social media format content, to localities.



## Appendix D: Meeting Documentation

11. Bohn provide draft public meeting presentation by June 18<sup>th</sup> for review.

### 7. Meeting adjourned

#### Virtual Attendees

Anne Witt, DMME  
Jonaaron Evans, Campbell County  
Erin Hawkins, Lynchburg City  
Piper VandePerre, Lynchburg City  
Lauren Pillow, DEQ  
Sharon Williams, Altavista  
William Perry, VDOF  
Susannah Smith, Lynchburg City  
Mike Crews, Town of Brookneal  
Bill Bohn, Sobis, Inc  
Haitao Wang, VT CGIT  
Kelly Hitchcock, CVPDC



# Appendix D: Meeting Documentation

## **CVPDC Hazard Mitigation Plan Update**

### **Project Meeting**

August 19, 2020

Virtual Meeting

<https://global.gotomeeting.com/join/730398909>; Access Code: 730-398-909

3:00 pm – 4:30pm

### **Agenda**

1. Confirmation of Draft Plan review & submittal to VDEM & FEMA
2. Draft Plan Review – highlight key section for feedback
  - a. Jurisdiction descriptions,
  - b. Planning process,
  - c. HIRA intro and conclusion,
  - d. Capabilities,
  - e. Mitigation, and
  - f. Implementation and maintenance.
3. Confirmation of FEMA expectations; HMP Crosswalk review
4. FEMA Pre-Mitigation Program – Grant schedule
5. Preparation for Locality HMP Presentation and Adoption

### **Minutes**

1. Confirmation of Draft Plan review & submittal to VDEM & FEMA Kelly Hitchcock and Bill Bohn noted that through the TAC and stakeholder contribution the draft plan was nearing completion. Bohn noted that the TAC, locality stakeholders were asked to review the draft document and provide comment to Kelly by Monday, August 31st. Hitchcock noted that it is understood there may be some specific locality strategies or editorial components that will continue to be added, the key is that the primary elements of the Draft HMP Plan can be sent to Chris Bruce/VDEM for preliminary review and evaluation of necessary HMP components for FEMA submittal. The Draft CVPDC HMP will be submitted to FEMA in September.

2. Draft Plan Review – Section Highlights Bohn provided an overview of the draft document. Bohn highlighted those elements of the draft that would be valuable for the TAC to take special review and provide comments/edits/additions. It was asked that the TAC have their edits, suggestions, questions back to Kelly by Monday, August 31st. Hitchcock reiterated that the full draft will be made available for public review and 30 day comment, etc. in the fall.

#### Sections included:

- Jurisdiction descriptions – Bohn noted that there might be some need to expand some Town descriptions and welcomed additional information; Planning Process – set to highlight the outreach, team, stakeholder input. Bohn noted copies will be included in Appendix. Bohn also



## Appendix D: Meeting Documentation

noted that what will also be added to the Appendix, as will be required by FEMA, will be the individual locality adoption documentation.

- HIRA intro and conclusion – Bohn noted that the Draft does not include the detailed HIRA chapters as those have been reviewed/edited prior and would make the file very large. Bohn highlighted that within the introduction were overview of critical facilities (a full list of critical facilities will be available in the appendix).
- Capabilities – Highlights the locality communication with Hitchcock/Bohn. Bohn noted that some of the charts were place holders and would be updated to reflect the Capabilities Chart that reflects the communication with Kelly. Section also includes detail of implementation/funding agencies and programs.
- Mitigation – Chapter captures the regional strategies and the individual locality strategies. Bohn encouraged localities to review. Hitchcock noted that they are still finalizing some strategies with localities. She also noted that while the Draft HMP document is being reviewed by VDEM – who will be looking for content according to requirements – adjustments to these lists can/will continue.
  - Chris Bruce, VDEM confirmed that elements of the Draft can be adjusted during his review. However, when the HMP is submitted to FEMA it does need to be in the final format. He noted changes can be addressed through the maintenance and amendment process.
  - Chief Jones questioned if the mitigation strategy for an Emergency Manager could be included within the HMP. Bohn noted that this could. Hitchcock noted that Sam Bryant, Amherst, had noted the same need. Hitchcock agreed she will communicate with each to add within the local/regional strategies.
- Implementation and Maintenance – Bohn noted this is a totally new section and noted this was a section that was not developed and the HMP was not maintained in the last plan. Hitchcock noted the section outlines a process where the CVPDC and the localities continue to meet and seek opportunities to execute and monitor progress.

3. Confirmation of FEMA expectations; HMP Crosswalk review Bohn summarized the FEMA HMP Crosswalk and highlighted this document served as the foundation for the HMP activities and the VDEM/FEMA review. Tom Fore pointed out that Altavista has been awarded a mitigation grant by FEMA and appreciated the plan development process and the benefit in the grant approval process.

4. FEMA Pre-Mitigation Program – Grant Schedule Bohn confirmed that FEMA has announced and opened the next pre mitigation grant round. Bohn highlighted the grants are due to VDEM in November and that there are a number of how-to-apply workshops. A summary of the FEMA grant information and application workshop information will be provided. Hitchcock noted the information sheet will be sent out along with the Draft Plan link.

5. Preparation for Locality HMP Presentation and Adoption An overview of the final review and locality adoption process was discussed. Hitchcock noted that the Draft Plan will be submitted to Chris Bruce, VDEM the first week in September. Bruce confirmed that the review typically is two to three weeks, however any emergency can impact that review time. Bruce reiterated that what is submitted to FEMA must be the complete draft document – thus all mitigation strategies within this version. Bruce noted that amendments to the document can be made for later strategies. Bruce also noted that FEMA review process is typically two months, and that a major emergency could impact that review. Chris suggested that presentations to the localities, that will incorporate FEMA recommendations, would more likely be





# Appendix D: Meeting Documentation

in the December timeframe. Chris noted that all the localities will be able to submit grant applications however, HMP adoption must have taken place by awards. Hitchcock confirmed that she and Bohn will communicate with Chris to confirm the VDEM review, FEMA submittal, FEMA review and locality presentation, adoption request schedule and provide to the TAC.

## Virtual Attendees

Mary Zirkle, Town of Bedford  
Chief Jack Jones, Bedford County  
Jonaaron Evans, Campbell County  
Tom Fore, Town of Altavista  
Amy McDaniel, Lynchburg City  
Myra Simpson, Campbell County  
Piper VanDePerre, Lynchburg City  
Sharon Williams, Town of Altavista

Chris Bruce, VDEM  
Melissa Foster, Lynchburg City  
Gary Williams, Town of Amherst  
Susanna Smith, Lynchburg City  
Haitao Wang, CGIT  
Bill Bohn, SOBIS Inc.  
Kelly Hitchcock, CVPDC

## Local Emergency Planning Committee (LEPC) Meeting City of Lynchburg LEPC January 15, 2020 Minutes

Chair Jeff Martin called the meeting to order:

1. Welcome and Introductions
2. Hazmat Update: Todd Davis gave a brief summary of hazmat activities for the calendar year 2019.
  - a. 66 responses for natural gas leaks on the Rescue, 73 total for the department
  - b. 22 flammable spill responses
  - c. 8-10 catch basins deployed
  - d. Personnel sent to trainings for hazmat technician, Chempack, Framatome, bioterrorism drill at LU, tank truck and propane, several conferences
  - e. New Iso Identifier Pager purchased
  - f. 1 new hire to the hazmat team, 1 member left
3. Upcoming training opportunities:
  - a. NSPA will be hosting a pediatric disaster response course in July. The course is 2 days long and free of charge. It will be held at the Vinton War Memorial. For more information, please reach out to [mmccullough@vaems.org](mailto:mmccullough@vaems.org).
  - b. NSPA also offers mental health classes. These can be requested by fire departments as well as other agencies and will fulfill the requirement to offer this type of class to first responders.
4. The group discussed proposed legislation Virginia House Bill 1192 which would potentially require organizations with "aboveground storage tanks" of hazardous materials with total storage capacity of 1320 gallons or more to register their tanks, providing similar information to that which is required on a Tier II report, and forward this report to the Director of Environmental Quality and their local director of emergency management.
5. Emergency Services reported that their department is working on the capability to receive text-to-911 messages by the deadline of July 1, 2020. They have also completed the update process for the Lynchburg Emergency Operations Plan (EOP) which will go to Council for readoption on January 28, 2020.



# Appendix D: Meeting Documentation

6. Kelly Hitchcock with the Central Virginia Planning District Commission gave an update on the progress of the region's efforts to complete/update its hazard mitigation plan. The group will be having two more meetings in January and February and there will be multiple opportunities for public input. This plan is important because it outlines the types of hazards that our region is vulnerable to as well as provides specific mitigation strategies that could reduce these vulnerabilities. The inclusion of these strategies in the plan is particularly significant because having them in the plan opens up the possibility of using grant money to fund future projects if accepted by FEMA. The plan is expected to be completed in Spring of 2020.
7. After the meeting a tour of the Water Treatment Plant was provided to attendees that were interested.
8. Next meeting to be held April 15th, 2020 at 2 pm, location TBD.

## Sign In Sheet

LYNCHBURG LEPC SIGN-IN SHEET 01/15/2020 MEETING			
NAME	AGENCY/BUSINESS	EMAIL ADDRESS	PHONE NUMBER
Piper VanDerPore	Emergency Services	Piper.vanderpore@lynchburgva.gov	434-401-2418
Zachary Perkins	Emergency Services	zachary.perkins@lynchburgva.gov	434-546-0082
Kelly Hitchcock	CVPDC	kelly.hitchcock@cvpdc.org	434-845-3491

LYNCHBURG LEPC SIGN-IN SHEET 1/15/2020 MEETING			
NAME	AGENCY/BUSINESS	EMAIL ADDRESS	PHONE NUMBER
Ellen Davidson-Martin	City IT Dept.	ellen.davidson-martin@lynchburgva.gov	(434) 455-6037
Todd Davis	Lynchburg Fire Dept	anthony.davis@lynchburgva.gov	(434) 942-3473

LYNCHBURG LEPC SIGN-IN SHEET 1/15/2020 MEETING			
NAME	AGENCY/BUSINESS	EMAIL ADDRESS	PHONE NUMBER
Jeff Sydenstricker	CVCC	sydenstrickerj@centralvirginia.edu	434-832-7756
Christina Ferrell	Horizon	christina-ferrell@horizon.org	434-946-2210
Joe Dawdy	Horizon	Joseph.Dawdy@horizon.org	434-221-3412
ROGER PENNY	RED CROSS	roger.penny@redcross.org	434-841-4483
Ralph LANSOR	RED CROSS	Ralph.Lansor@redcross.org	434-709-0199



## Appendix D: Meeting Documentation

**LYNCHBURG LEPC SIGN-IN SHEET  
1/15/2020 MEETING**

NAME	AGENCY/BUSINESS	EMAIL ADDRESS	PHONE NUMBER
Greg Bennett	LLC	gobennett@liberty.edu	407-488-933
Kate Edwards	LUPD	kwinney4@liberty.edu	434-907-9935
Jennifer Martin	LACL	jmartin@laci.org	434-528-4971 x1007
Brittany Powell	VDH	brittany.powell@vdh.virginia.gov	434-941-3087
Monica McGillogh	NSPA	mcmcgillogh@vaems.org	540-529-9649

**LYNCHBURG LEPC SIGN-IN SHEET  
1/15/2020 MEETING**

NAME	AGENCY/BUSINESS	EMAIL ADDRESS	PHONE NUMBER
Mike Reeves	FIRE	MIKE.REEVES@LYNCHBURGVA.GOV	434-660-0823
Erin Hawkins	COL	erin.hawkins@lynchburgva.gov	455-3869
Craig Homay	COL	CRAIG.HOMAY@LYNCHBURGVA.GOV	455-4085
Diane Reed	Centra	diane.reed@centrahealth.com	434 316 3736



# Appendix D: Meeting Documentation

**CVPDC Hazard Mitigation Plan Update**  
**Locality Vulnerability Meetings**  
**Amherst County, Town of Amherst Town**  
CVPDC Office  
828 Main St., 12<sup>th</sup> Floor  
Wednesday, February 19, 2020  
8:30 am – 11:00 am

## Attending

Sara Carter, Town of Amherst  
Gary Williams, Director of Plants  
Bob Hopkins, Amherst County Service Authority  
Sam Bryant, Amherst County  
Bill Bohn, Sobis, Inc (consultant partner with VT-CGIT)  
Kelly Hitchcock, CVPDC

## Minutes

### 1. INTRODUCTION

Hitchcock welcomed and provided brief background and summary of earlier meeting and HMP plan activity.

### 2. LOCALITY HAZARD VULNERABILITY REVIEW

Bill Bohn, Sobis, Inc., facilitated the vulnerability meeting and presented locality-specific data and vulnerability for primary hazards. The following reflects key discussion points from the data review and discussion within each of the hazards.

## Flood

Bohn provided flood data, that included review of critical facilities.

- Rutledge Creek WWTP in the floodplain.
  - Gary noted headworks not in high elevation area.
  - It was noted plans area in place for high water, sand bagging is used and available.
  - Standby, secondary power is up the hill
  - Sara Carter noted that property protection for the system should be included in the HMP.
- Town of Amherst Raw Water Intake in flood zone. The need to harden the facility is known and the Town is working though a VDH grant to implement a complete water system evaluation and upgrade than includes plant, pump stations and other core facilities. Bohn will contact Town for upgrade details.
- Pedlar Volunteer Fire & Rescue
  - It was noted this has flooded before; volunteers maintain the building and have elevated materials. The facility take about 3% of local emergency calls. It was noted the radio tower is in the area as well.
  - Coordinating and incorporating hardening information/practices.
- Monacan Ancestral Museum
  - Sam Bryant Confirmed folks area aware the facility – which includes a number of resources – is in the floodplain. It was noted that the office is now located in the Town. Additionally, key artifacts have been elevated. Bohn noted communicating and recommending action plan for flooding an valuable activity.
- Two campgrounds are in the flood zone. Oronoco Campground and Otter Creek. Bohn said having information for campers is a mitigation activity to incorporate.
- Bohn looked at churches and more remote residential areas. Louisville area/Woodson area of the County.
- Bohn noted that portion of the Natural Gas line area within the flood zone. Communication and coordination with the company is a mitigation activity.



## Appendix D: Meeting Documentation

- Bob Hopkins noted that a trunk line from the County's sewer, collects about 50% of waste, is on the north bank of James River. A major Corp of Engineer project underway to armor a portion of the line. Hopkins noted that he has established a detailed HMP project list for the ACSA system.
- Susan Carter noted that portions of the Town's system follow stream and suggest that the HMP include general wording for water/sewer line protection, to include streambank stabilization.
- Bohn provided information on residential and outbuildings/sheds located in flood plain. Pointed out that often homes are not in flood zone, but residents locate sheds. Opportunity to provide education on location, practices for elevating materials. Bohn also noted some localities include ordinances requiring permits for new out building structures.
- Sara Carter reiterated the importance of including HMP mitigation vulnerability text noting the Town's sewer lines flow adjacent to streams and pointed to the need for streambank stabilization as a infrastructure protection action.
- Carter also noted the need to highlight Town's pump stations in the floodplain and importance of road access to the pump stations in hazard event.

### *Amherst Flood Mitigation Strategies*

- Initiate facility hardening/protection measures for the Town's water/sewer infrastructure (summary from Town).
- James River streambank stabilization for ACSA sewer line/system protection (summary from ACSA).
- Harden Amherst Town raw water intake facility.
- Initiate facility system hardening/protection for the Pedlar Volunteer Fire & Rescue facility.
- In partnership with Monacan Nation, establish flood mitigation plan for the Monacan Ancestral Museum.
- Establish a public information process for safety measures/practices/information at area campgrounds.
- Expand and establish regular communication with Colonial Natural Gas company to ensure quick and established hazard response.
- Develop information/outreach to public regarding location of outbuildings in flood zone and general property evaluation and mitigation best practices.
- Include information on flood zone, or link to DCR information, on locality website. Include opportunity for residents to look up their address.

### *Amherst Flood Follow up Actions*

- Follow up with Town for detailed system upgrades (via the existing VDH grant) and detailed summary of additional action for HMP strategies.
- Communicate with Hopkins to insure full ACSA infrastructure system HMP actions.

### **Dams**

Bohn noted High Hazard Dam (HHD) information was obtained from DCR and there are five (5) HHD noted in Amherst County.

- Pedlar River Dam – no critical facilities in the inundation area.
- Graham Creek Reservoir – treatment plan in the inundation area
- Stonehouse Lake Dam
- Thrashers Creek Dam
- Reusens Dam

Bohn noted that a public information strategy is to post information about the flood inundation areas on local websites. Provide ability for residents to see if property in the area and provide information about flood insurance. Hopkins noted that the ACSA plant is in the flood inundation zone; need to be added to the list 3





# Appendix D: Meeting Documentation

## *Amherst Dam Mitigation Strategies*

- Include information about dams, dam inundation zones or link to DCR website on locality websites.

## *Amherst Dam Follow up Actions*

- Include ACSA plant within dam inundation zone.

## **Wildfire**

Bohn noted for Amherst wildfire is a hazard with considerable likelihood and impact for Amherst.

- Sam Bryant noted the wildfire where 30,000 acres was impacted and the importance of the Dept of Forestry and local volunteer fire departments. Bryant noted that capacity – the numbers within the local volunteer fire departments is a real concern.
- Bryant noted there are two important strategies – dry hydrants and land (access routes) and water sources. Bryant noted the County has fire truck with 4,000 gallon water capacity that can be filled in approximately 4 minutes. The key is access to the water (routes).
- It was noted that County has its 911 system serving Everbridge area but, need to expand subscriptions to the system. Bryant will provide the current number.
- There are two swift water teams – Monetelson Fire & Amherst Fire. Ensuring these departments are fully stocked and have necessary equipment should be within the HMP.
- Bryant noted the County contacts the City of Lynchburg in the event of a Hazmat event and in a larger event would rely on VDEM.
- Bryant noted he has begun looking into the equipment/supply needs/training task to respond to technical rescues. Bryant will follow up with Hitchcock to outline activity for HMP.

## *Amherst Wildfire Mitigation Strategies*

- Expand number of dry hydrants located in the County, especially in vulnerable, isolated community areas.
- Establish public outreach for participation in the 911 system.
- Expand swift water rescue capabilities (details to come).
- Evaluate necessary actions to expand technical rescues/hazard response capabilities.
- Increase communication with Forest Service, and private property owners to expand emergency access to water sources.

## *Amherst Wildfire Follow up Actions*

- Communicate with Bryant on swift water and technical rescue needs/existing status.
- Follow with Bryant on number of existing 911 system registrants.

## **Wind/Power Outage/Heat**

Bohn shared data of known mobile home parks.

- The use of Hurricane straps for buildings, tie-down strategies for mobile home.
- Bohn noted a mitigation strategy is to share with developers, homeowners the ease/value (often reduction in home insurance) in installing hurricane strips to roof trusses.
- Do not have specific cooling stations, local churches provide services
- It was noted that there is not back up generators to run cooling at the Town Office or Police Station; should be included in the HMP.
- It was suggested an evaluation of all the essential facilities (Library) for secondary system should be included in the HMP.
- Bohn questioned if there were any other Hazmat situations that could be impacted during hazard event. It was noted that train runs near a 30,000 gallon propane tank in the Town. It was noted the County has a good partnership with the City, but the program is reactive, not proactive. Establishing a preventative program should be included in the HMP.
- Grieff Brothers/train and impacts to natural hazard. Value in establishing proactive communication with these industries.



## Appendix D: Meeting Documentation

- It was also noted that the County has a good relationship with Sweet Briar College and Centra Health in responding to needs.

### *Amherst Wind/Power/Heat Mitigation Strategies*

- Outreach to insurance, building officials, builders, families for installation of wind/HERK straps for new builds; especially target mobile home wind safety strategies/practices/safe location.
- Evaluate secondary/emergency need evaluations at public community spaces (e.g. library, locality offices).
- Provide back up generators at Town critical facilities (confirm locations).
- Develop hazmat/emergency response plans in partnership with industry, facilities along the rail line. Establish emergency response reviews with locations that house large number of residents (e.g. Sweet Briar College).

### *Amherst Wind/Power/Heat Follow up Actions*

- Follow up with Town on facilities to include secondary generator/power back up.

### **Earthquakes**

Bohn noted earthquakes not much concern in our area. Bohn noted susceptibility of these older structures to earthquake damage. Suggested education to school administration/staff to know location of older school areas and where to locate kids/staff in event of emergency. No other specific discussion items or strategy recommendations were noted.

### **3. Draft HMP Completion Steps**

Hitchcock confirmed that the summary of the meeting would be provided to all of the participants and noted a summary of Draft Mitigation Activities and the Draft Amherst Capacity and Vulnerability Chapter would be provided.

The CVPDC HMP Public Meetings – that would present general information and draft strategies would be held in April. Each locality will be able to determine if they want individual public meetings.

The full Draft CVPDC HMP would be submitted to VDEM and FEMA in May.



# Appendix D: Meeting Documentation

## **CVPDC Hazard Mitigation Plan Update**

### **Locality Vulnerability Meetings**

#### **Campbell Hazard Vulnerability Review**

CVPDC Office

828 Main Street, 12th Floor

Tuesday, February 18, 2020

11:00 am – 1:30 pm

#### **Attending**

Paul Harvey, Director Community Development, Campbell County

Brian Stokes, Environmental Manager, Campbell County

Tim Hoden, Director of Operations, Campbell County

Todd Scott, Agriculture Agent Campbell County

David Garrett, Public Works Director, Town of Altavista

Cliff Tweedy, Deputy County Administrator, Campbell County

Sharon Williams, Director Community Development, Town of Altavista

Marvin Tweedy, VDOT Facilities Manager, VDOT-Salem

Russell Thurston, Town Manager, Town of Brookneal

Michael Crews, Public Works Director, Town of Brookneal

Myra Simpson, Deputy Director, Campbell County Public Safety

Tracy Fairchild, Public Safety Director, Campbell County Public Safety

Jonaaron Evans, Communication Tech, Campbell County Public Safety

Austin Mitchell, Zoning & Subdivision Administrator, Campbell County Community Development

David Kerr, GIS Analyst, Campbell County Community Development

Tom Fore, Director Public Utilities, Town of Altavista

Bill Bohn, Sobis, Inc.

Kelly Hitchcock, CVPDC

#### **Minutes**

##### **1. Introduction**

Hitchcock welcomed participants, provided brief HMP background summary. Introductions were made.

Bill Bohn welcomed, provided overview of meeting purpose.

##### **2. Locality Hazard Vulnerability Review**

Bill Bohn, Sobis, Inc., facilitated the vulnerability meeting and presented locality-specific data and vulnerability for primary hazards. The following reflects key discussion points from the data review and discussion within each of the hazards.

##### **Flood**

Bohn presented vulnerability flood map. Bohn noted information does not include stormwater impacted areas (local input needed). Also noted the data does not currently include FEMA repetitive loss data as there are some data/software updates that have resulted in FEMA delay in providing information to DCR. Data is anticipated in the coming months.

- Data showed Campbell County unique in that a fairly high percentage of 65-year old and up (at about 25%) are located in the floodplain.
- Bohn presented and discussion of critical facilities in the floodplain.



# Appendix D: Meeting Documentation

## Brookneal Treatment plant

- Ditching in plan development. Noted last time river known over the bank in 1996. Tom Fore will provide summary of planned activities.

## Otter River 2

- Intake, pumps for plant up the hill. Reservoir can provide 10/15 days capacity with pump adjustment. Opportunity for higher, elongated elevation.

## Flat Creek Pump Station

- Mounted above ground , wet well.
- Brian Stokes questioned flood map., noted not aware of high water issues in this area and indicated he tried to get remapping of the area about two miles down. Stokes noted an undersized culvert under Route 29 that results in impacts.

## Hydropower

- Bohn asked if anyone knew the design level. No one was sure.
- It was noted hazardous material in this area at BGF Industries. Stokes noted that BGF replaced culvert a number of years ago; hazardous holding pond.
- Fore noted problem puts Altavista wastewater facility under water.
- Strategy – installation of berm/facility protection structure.
- Bohn asked is there anything done currently with business from information standpoint?
- It was noted that UVA Medical Center - dialysis and cancer treatment. How are patients informed. It was suggested a local strategy can be to establish communication with businesses to ensure system to inform patients in case of flooding (where to go and when not to come to facility). Communication for backup services.

## Communication Tower

- IT was noted this is not being used. Should this be removed?

## Wastewater Treatment

- Tom Fore will provide detailed summary of improvement plans/mitigation request for system.

## Seneca Park Pump Station

## Framatome

- Treatment and access road in floodplain.
- Bohn noted importance and strategy to communicate with businesses. Ask what hazard in-place plans are. Very private, work to expand communication.

## Other

Bohn asked if there were any other critical facilities with issues.

- It was noted that AEP is expanding Joshua Falls substation. Should not be in floodplain.
- It was noted that Campbell County has a number of tunnels, railroad that are subject to flooding. Pennsylvania Avenue, flooding on this bridge and this is roadway to water plant.
- Bohn asked if County looked at ordinances to reduce development. Bohn noted no adverse impact regulations can be put in place and other actions that support reduction in insurance.



## Appendix D: Meeting Documentation

- Bohn asked floodplain can be filled in and built. Brian Stokes noted the county discourages building and developer must contact FEMA first. Noted there is restrictive language. Do not allow in theory, make difficult, but developer can go to FEMA. Infrastructure is required above baseline elevation. Not a no but, make restrictive.
- Bohn noted another strategy and element to look at is out buildings in the floodplain. Suggested locality look at consideration for wording and, at a minimum include information to public on education/outreach for outbuilding/material education.
- David Garrett, Altavista noted that Altavista YMCA has an area in the flood area. Noted outreach and education to this facility on readiness, needs to be an included strategy.
- Tom Fore indicated the Hurt Water Treatment Plant flooded in the 80's and impacted the area. Communication and impact for the areas downstream should be included in the plan and understanding of their mitigation activities.

### *Campbell Flood Mitigation Strategies*

- Install ditching, berm or other flood protection device to protect Brookneal Treatment plant.
- Instigate elevation and flood mitigation evaluation study at local facilities.
- Evaluate and, if needed, upsize culvert on Route 29 (get detailed location from Stokes).
- Initiate hazard communication and mitigation outreach to area businesses that manage or hold hazardous materials.
- Develop public hazard communication outreach, include importance of joining County's public information system.
- Communicate with facilities, especially those that provide public services (eg UVA medical/dialysis program).

### *Campbell Flood Follow up Actions*

- Obtain detailed Altavista system mitigation improvements from Fore
- Provide map details to Campbell for review

### **Dam Breach**

- Bohn noted DCR indicated 3 High Hazard (HH Dam) Dams in the County – Timberlake/Leesville, Otter River, Camp Hideaway – which is not yet built.
- It was noted that Rustburg is not a HH Dam but does have safety exercises. It was noted that Emergency Action Plans (EAPs) are in place for each HH Dam.
- There was some discussion regarding Otter River Dam; it was determined this was referring to the reservoir.
- Bohn noted that some mitigation activities can be posting general information regarding flood inundation zones and general flood information on websites. Confirmed that Timberlake has dam emergency exercises yearly.

### **Wildfire**

- Bohn provided general data overview. Noted the wooded/higher residential interface areas. Also questioned water capacity in forested areas.
- Seneca Park Pump Station – does not impact residential, just a few businesses

### *Campbell Wildfire Mitigation Strategies*

- Explore controlled burns with forest service to reduce impacts.





## Appendix D: Meeting Documentation

- Explore installation of dry hydrant or execute a study to evaluate dry hydrant needs in the community.

### **Tornado and other winds**

- Bohn noted that looked at date to reveal areas without basements and pocket manufactured home areas.
- The use of HERK straps for buildings, tie-down strategies for mobile home; and undergrounding of powerlines to key infrastructure was another noted strategy.
- Warning systems – It was noted that so many people no longer rely on local news, information and have subscription services. The need to ensure information to these folks.
- It was noted about ¼ of County currently signed up for the County's alert system.
- It was noted that often in emergency local personnel can not get through road closures set up by VDOT. There is a need for coordination in communication and verification of critical staff, emergency access protocol.

### *Campbell Wind/Power Outage Mitigation Strategies*

- Outreach to insurance, building officials, builders, families for installation of wind/HERK straps for new builds; especially target mobile home wind safety strategies/practices/safe location.
- Undergrounding of utility lines to key infrastructure/critical facilities.
- Establish format to ensure emergency outreach, promote participation in County information system.
- Establish communication/coordination between agencies/emergency personnel to allow property access, evacuations, response emergency response and road access.

### **Extreme Temperatures - heat/cold**

Bohn shared temp data.

- County and Towns do not have designated cooling stations. However, ability to open community centers if the need arises is available.
- Myra Simpson will send emergency shelter location information.
- Bohn asked about crop insurance. Todd Scott noted that farmers have insurance, however there is about a 6-month delay to see impact on hay production or other impacts.
- Todd Scott noted drought impact on cattle and the need for CREP funds for secondary water sources.
- Cliff Tweedy noted there has been the use of container water stations.
- The County does have the capacity to instigate water restrictions; threshold based on request from water authority.
- Tom Fore noted the need for a water study to evaluate long term water capacity needs.
- It was noted that the mechanical needs of community centers – air condition needs, mechanical work condition, etc. is not known. There should be evaluation of these facilities.

### *Campbell Heat/Cold Mitigation Strategies*

- Continue to investigate secondary water sources
- Secondary generators at critical facilities
- Education/information outreach
- Consider drought/prolonged high temperature process for public support



## Appendix D: Meeting Documentation

- Study, evaluation of community center mechanical systems and overall cooling, emergency use needs.
- Include water sources or coordination with other agricultural agencies for water access

### *Campbell Heat/Cold Follow up Actions*

- Hitchcock follow up with Simpson for emergency shelter location information

### **Storms – winter/thunder/hail**

- Date and general concern discussion related to electrical outage and road closures. The impact of tunnels on access was noted as potential impact for Campbell. There was question regarding the inspection cycle and communication regarding the tunnel.
- Other than public information and outreach, related to readiness and best practices, as with other hazards, there were no specific concerns or strategies noted for storms.

### **Earthquake**

- Bohn noted fault line in Campbell County. Bohn noted susceptibility of these older structures to earthquake damage. Suggested education to school administration/staff to know location of older school areas and where to locate kids/staff in event of emergency. No other specific discussion items or strategy recommendations were noted.
- The potentially sustainability of railroad tunnels on the community was noted. The need for coordination with railroad to obtain inspection cycles or communication was noted.

### **3. Confirmation Next Draft Plan Completion Steps**

Hitchcock noted that meeting summaries would be provided. HMP Public Meetings will be held during April, Hitchcock will communicate with each locality to determine schedule and if they want a public meeting. Draft HMP is anticipated for VDEM/FEMA submittal in May and will be brought back to localities during the summer for approval/adoption.



# Appendix D: Meeting Documentation

## **CVPDC Hazard Mitigation Plan Update**

### **Locality Vulnerability Meetings**

#### **Appomattox County, Appomattox Town**

Appomattox County Public Safety Office

339 Court Street, Appomattox

Tuesday, February 18, 2020

2:00 – 4:30 pm

### **Attending**

Jeff Elder, Facilities Director, Town of Appomattox

Gary Shanaberger, Manger, Town of Appomattox

Susan Walton, Captain, Appomattox County Rescue Squad

John Spencer, Interim Planner, Appomattox County

John Vannoy, 911 Supervisor, Appomattox County

Bobby Wingfield, Public Safety Director, Appomattox County

Bill Bohn, Sobis, Inc (consultant partner with VT-CGIT)

Kelly Hitchcock, CVPDC

### **Meeting Summary**

#### **1. INTRODUCTION**

Bobby Wingfield welcomed and provided brief background and summary of earlier meeting and HMP plan activity.

Elder and Wingfield stressed the importance of presenting vulnerability and strategies that realistically present options, programs for small communities, with small budgets like Appomattox. Bohn confirmed that Appomattox does, generally have some lower risk as some of the other localities – as a function of population density, population proximity to high hazard potential. Bohn and Wingfield reiterated to the group the importance and value of the plan in reflecting both large and smaller, more likely, mitigation practices that can have considerable value and impact in the community.

#### **2. LOCALITY HAZARD VULNERABILITY REVIEW**

Bill Bohn, Sobis, Inc., facilitated the vulnerability meeting and presented locality-specific data and vulnerability for primary hazards. The following reflects key discussion points from the data review and discussion within each of the hazards.

### **Flood**

Bohn provided flood data, that included review of critical facilities.

- 148 pump street – close to flood zone but noted this is not used anymore, includes electrical for the park only.
- Natural gas line – Bohn noted value in including the mitigation activity for standard communication with company. Wingfield noted that property owners along the line should be educated on location of line. Wingfield also noted that Williams and Colonial come to LPAC meeting and complete Title III reporting.
- Areas impacted by heavy rain flooding
- Sunnysdale/Church area regular stormwater impacts



## Appendix D: Meeting Documentation

- Bent Creek at James River/Route 608/North Creek – need updated box culvert to address this area
- Hunter Street/Morris Ave/Dogwood Drive in Town – rain event flooding along the creek area.
- Route 611 at/near Route 666 (Wreck Island Creek)
- Blackberry lane flooding situation results in emergency vehicles can't access homes in this area (Wolfcreek).
- Ford Crossing at Washout Gap at 631 required frequent highwater rescues. It was noted that Robert Brown, VDOT, as result of earlier meeting was going to install highwater alert signage.
- Bohn noted he did not see evidence of hazardous materials in floodplain. Elder noted that Tiger Fuel had some tanks (area of Park to Lee Grant)
- Elder provided overview of system within the Town's water/sewer system. A summary of the improvements will be sent to Bohn/CGIT.
- Bohn questioned any known, specific agricultural flooding impacts. Elder noted there are low-lying areas, stream/pasture areas impacted by storm flooding but, most folks know these areas and part of general farming businesses. Did not have areas or conditions where there was unusual or high impact areas.

### Appomattox Flood Mitigation Strategies

- Streambank stabilization/channelization project to address stormwater flooding in Sunnydale, South Church area.
- Look for opportunity to work with property owner (Hackett) to seek emergency access agreement to ensure access to mitigate flooding/access impact along Blackberry Lane.
- High water does not cross signage at Bent Creek, Route 666 (Wreck Island Creek), and Ford Crossing.
- Work with VDOT and Campbell County to address flooding, bridge, culvert flooding at 460/Moores County Store to ensure emergency access to hospital, etc.
- Establish communication with gas and small companies for education/outreach in hazard material storage and general hazard communication.
- Flood insurance education, to include information for renters for education on what renter's insurance pays for and opportunity for lower-rate flash flood rates.

### Flood Follow up Actions

- Jeff Elder will provide summary of Town's water/sewer upgrade plan and pending improvements.

### Dam Failure

Bohn provided information from DCR high hazard dam; questioned any additional non-high hazard dam concerns. Elder noted that Calwell had flooded.

### Wildfire

Bohn presented Critical facilities and fire hazard data.

- Pineview Estate (shown as elderly center) is closed.
- County does have scattered residential throughout in light pine forested areas. Agreed general recommendations for information/education purposes on Fire Wise practices, set backs, and general practices to protect structures.



# Appendix D: Meeting Documentation

## *Appomattox Wildfire Mitigation Strategies*

- Fire Wise information/education make public
- Include HMP section, to include wildfire data on County website; reiterate to folks value in looking at property, cleaning, etc.

## **Tornado and other winds**

Bohn presented wind vulnerable – manufactured home lots or older structure, density area – data.

- County does have an emergency alert system, does promote to residents, as of February 18, 2020 system included 3,902 contacts signed up for system alerts
- Wingfield noted that via IPAWS the area hooked into Cell carrier notices.
- Bohn noted that our region impact from hurricanes in our area more flash flooding, along with some wind. Suggested public information on flood insurance – lower rate when not in floodplain.

## *Appomattox Wind/Power Outage Mitigation Strategies*

- Public outreach/education campaign for emergency system registration (can track changes in registrations).
- Outreach to insurance, building officials, builders for installation of wind stapes for new builds; especially target mobile home wind safety strategies/practices/safe location.
- Communication with essential employers/companies - BWXT
- Critical radio communication; generator at industrial park

## **Extreme Temperatures - heat/cold**

Bohn shared temp data.

- Town/County do not have designated cooling centers. Generally, library/Walmart or other public locations serve the role.
- List of facilities with known generators included – Fire/rescue operation facility, school/community center.
- Wingfield noted a second generator at the 911 center, sheriff's office and emergency service for PSAPs would be valuation.
- Bohn questioned what the locality water use restriction capacity is in drought conditions. Town has 2 to 3 days capacity in storage tanks. Instigates restrictions based on state call.
- Town can, if need be, bring back old wells with 250,000 capacity.
- The Town/County did look at secondary water line routing at approximately \$5-6 million.

## *Appomattox Heat/Cold Mitigation Strategies*

- Continue to investigate secondary water sources
- Secondary generators at critical facilities
- Education/information outreach
- Consider drought/prolonged high temperature confirmed public process

## **Storms – winter/thunder/hail**

Date and general concern discussion related to electrical outage and road closures. Appomattox County does not have CERT team and has not seen the need for this in the county.

- General outreach and education related to readiness in the mitigation activity.





# Appendix D: Meeting Documentation

## Other Hazards

### Earthquake

Bohn noted fault line in Campbell County. No high rise buildings in Appomattox but there are older masonry buildings – area schools. Bohn noted susceptibility of these older structures to earthquake damage. Suggested education to school administration/staff to know location of older school areas and where to locate kids/staff in event of emergency.

## General Emergency Concerns/Observations

- Wingfield noted the increase in emergency situations/power outages for calls regarding breathing machines and need for oxygen. Walton confirmed a small number of spares available but request need exceeding capacity.
- Wingfield also noted the importance/value in seeking collaboration between local and regional agencies for emergency response.

## 3. Draft HMP Completion Steps

Hitchcock confirmed that the summary of the meeting would be provided to all of the participants and noted a summary of Draft Mitigation Activities and the Draft Appomattox Capacity and Vulnerability Chapter would be provided to folks in late March.

The CVPDC HMP Public Meetings – that would present general information and draft strategies would be held in April. Each locality will be able to determine if they want individual public meetings.



# Appendix D: Meeting Documentation

## **CVPDC Hazard Mitigation Plan Update**

### **Locality Vulnerability Meetings**

#### **Lynchburg City**

Water Resources Office

525 Taylor Street

Wednesday, February 19, 2020

1:00 – 3:30 pm

#### **Attending**

Erin Hawkins, Water Quality Manager, Water Resources

Clay Simmons, Deputy Director, Public Works

Tom Martin, City Planner, Community Development

Jeff Martin, Assistant Director, Water Resources

Greg Poff, Deputy Director, Water Resources

Jonathan Wright, Deputy Chief, Fire Department

Todd Davis, Fire Captain, Fire Department

Ellen Davidson-Martin, IT Administrative Manager, IT

Allison Johnson, GIS Manager, IT

Susannah Smith, Construction Coordinator, Parks & Recreation

Tim Mitchell, Director, Water Resources

Piper VanDePerre, Emergency Programs Specialist, Emergency Services

Amy McDaniel, Deputy Director Emergency Services, Emergency Services

Dan Floyd, Assistant Director Facilities, Lynchburg Public Schools

Melissa Foster, Director, Emergency Services

Bill Bohn, Sobis Inc.

Kelly Hitchcock, CVPDC

#### **Meeting Minutes**

##### **1. Introduction**

Hitchcock welcomed participants, provided a brief background and introduced Bill Bohn.

##### **2. Locality Hazard Vulnerability Review**

Bill Bohn, Sobis, Inc., provided a brief overview of his background in mitigation planning and led attendee introductions. Bohn facilitated the vulnerability meeting and presented locality-specific data and vulnerability for primary hazards. The following reflects key discussion points from the data review and hazard discussions.

##### **Flood**

Bohn presented flood vulnerability data; including key critical facilities in the flood zone for review/discussion.

- Wastewater Treatment Plant: Gregg Poff noted designed to be out of the 110yr. Processors elevated above the 100yr; impacted by 500 yr. Poff noted the City is process of approximate \$50million upgrade – will provide a summary of key elements and consideration for HMP. Bohn noted that mitigation program can potentially provide funding; important to include elements of upgrades within HMP.



## Appendix D: Meeting Documentation

- AEP facility. Bohn questioned City/AEP communication. While not specific mitigation funding can be provided to private company; understanding of impact zone and what activities can be undertaken to minimize impact. Opportunity for communication/impact at critical facilities with power outage.
- Amazement Square – importance of communication and assurance of evacuation procedures in public facilities.
- Bohn noted some localities execute buyout programs in key sensitive area. Studying or developing can be included. The City does not currently have a buyout program.
- The importance of protection from chemicals located in flood zone was discussed. It was noted that Griffin Pipe, Foundry, Westrock all submit Tier II reports. A potential focus would be prioritization of Buncher Rail Car.
- The importance of the rail line protection and the old tunnel/channel was noted.
- Bohn presented data that showed about 22% of city rental population is located in the flood zone (100, 500 & some dam inundation zone). While property owners know the information, rental residents may not. He noted sharing information regarding flood insurance, and the lower rate for flood insurance when in a dam zone vs floodplain education/outreach a good strategy.
- Bohn noted data indicated that there are 149 out structures (eg sheds) located in the flood zone. Bohn noted two strategies can be 1) general education/outreach for placement and elevating of chemicals in existing structures and 2) some localities implement new permit/location requirements for new structures <250 sq ft.
- Bohn asked development in the City can take place in floodplain filled areas. Tom Martin noted the City has the “no net rise” provision and does require confirmed map provisions from DCR. Martin noted that the City does discourage and noted recent development council decision based on flood changes.
- Erin Hawkins noted that the Water Resources Dept is looking at stormwater design standards, focus efforts on known stormwater impacted areas to target mitigation practices.
- Bohn noted that he has worked with communities that have executed rainwater harvesting and other green infrastructure practices. Asked if there are any specific plans for these types of activities.
- Tim Mitchell noted that in the CSO Long Term Control Plan did an extensive evaluation of green infrastructure practices and the modeling showed, generally, not cost effective to meet the TDML reductions. Bohn noted that HMP funding can be used to coordinate between programs and that FEMA mitigation funds can be used to potentially fund the difference. Hitchcock noted that in the HMP general wording, executing green infrastructure and coordinating with infrastructure improvements is noted.

### *Lynchburg Flood Mitigation Strategies*

- Provide targeted flood insurance, dam inundation information to lower basin businesses, residents.
- Coordinate communication with AEP to establish impact zones in the City from power outages, especially in lower basin.
- Communicate with managers/owners public spaces (eg Amazement Square) importance of emergency evacuation and communication process.
- Develop targeted communication with business/industry in flood zone with chemical/potential hazardous material storage information.



## Appendix D: Meeting Documentation

- Establish property evaluation, flood zone information to residents to discourage outbuildings in flood zone; include information on chemical storage in existing structure.
- Post information on City website of flood zone; include out building information.
- Consider future ordinance requiring permit for new outbuildings.
- Implement stormwater design standards; target mitigation practices in areas with recurring stormwater impacts.
- Include streambank stabilization to protect city infrastructure, trails, park/public spaces – public investment.

### *Lynchburg Flood - Follow Up Actions*

- Hitchcock/Bohn obtain more detailed information regarding the City's water/wastewater system improvement plan.
- Hawkins will provide summary of water resources activities.

### **Dams**

Bohn presented information on the High Hazard Dams (HHD) in Lynchburg. He noted data provided by DCR and the City has three (3) HHD.

- Bohn noted that included with each HHD map is the sunny day and the worst case Probable Maximum Flood (PMF) breach inundation zones.
- Wyndhurst is currently updating its Emergency Action Plan (EAP).
- It was noted that DCR is looking at starting EAP will all dam/inundation areas; also, they will have all the dams accessible via through their website.
- Melissa Foster noted her department participates in the dam exercises; noted that outreach to residents would be a valuable HMP/department activity.
- Tim Mitchell noted that the City is undertaking evaluations and that DCR is responsible for providing the dam safety evaluations.
- It was recognized that a data gap evaluation of all the resources, critical facilities, and warning communication for the dam inundation zones should be included in the HMP.

### *Lynchburg Dam Mitigation Strategies*

- Establish flood inundation zone public information.
- Develop flood inundation zone study to evaluate/gather data that will include communication/facility details for critical facilities.
- Ensure coordination between departments regarding EAP and emergency exercises for HHD inundation zones.

### **Urban Fire**

Bohn presented map/data presenting dense city areas with older buildings.

- Bohn questioned if there were specific neighborhoods to study/identify regarding sensitive, fire potential or know to have higher percentage of fire incidences.
- It was not there are not specific are fire plans.
- Bohn asked if there are areas with large construction projects. He noted building are vulnerable during construction for fire events.
- It was noted that during construction permits for large structures the Fire Marshall reviews/approve plan. Providing fire safety best practices to developer and department coordination during this time represents a mitigation strategy opportunity.



## Appendix D: Meeting Documentation

- It was noted the City maintains its property maintenance violations/property owner communication. Targeted fire prevention and compliance activities represent mitigation activities.
- The City is working on developing building rating layers to let emergency know what to expect in responding to emergencies. Melissa Foster stressed the value of this data and expanding departmental/agency aid relationships.

### Lynchburg Urban Fire Mitigation Strategies

- Establish fire safety best practices information to be distributed to developers during the permit/approval process .
- Target fire property protection and property violation notices to property owners in older/dense areas and owners of vacant/derelict properties.
- Develop a coordinated GIS property rating data layer; establish coordinated communication protocol to City departments.

### Wind

Bohn provided high and rotational wind data. Noted the area does not have high incidence but recognized derecho and tornado events over the last few years.

- Bohn noted hurricane strips are inexpensive and effective mitigation practice that can be easily installed during construction; having these devices can reduce insurance rate.
- Providing information to the public regarding property evaluation (eg trees, outside furniture) and wind best practices.
- It was noted that the city does not have a designated CERT program but does have an Emergency Operations Plan that include volunteer coordination, donation process, public coordination program that incorporates many of the CERT program activities.

### Lynchburg Wind Mitigation Strategies

- Develop wind building mitigation best practices document; provide to developers, property owners.
- Establish property wind property evaluation public education/outreach.

### Storms/Extreme Heat

- Bohn asked about the city shelters, critical facility emergency backup capabilities.
- There are backup generators at pump stations, water/septic facilities.
- It was noted that the schools have backup generators but more for systems (refrigeration, servers). Sandusky has a portable generator.
- Melissa Foster noted there was low cooling center use the last time. Residents did utilize buses, libraries and private businesses for cooling during day light hours.
- Bohn provided a map of cooling centers (Miller Center; Salvation Army) and pointed out the location relative to LMI neighborhoods. Opportunity to utilize community centers; what resources might be needed.
- Dan Floyd noted that the LCS has good communication with Lynchburg to address route adjustments due to weather or general construction. Opportunity for development of designated alternative routes.

### Lynchburg Storm/Extreme Heat Mitigation Strategies





## Appendix D: Meeting Documentation

- Develop wind building mitigation best practices document; provide to developers, property owners.
- Establish public outreach/education for wind property evaluation best practices.
- Evaluate potential storm/heat readiness/needs for area community centers (eg. generators).
- Evaluate designated LDC bus alternative routes.
- Provide backup generators at schools and community centers.

### Earthquakes

- Bohn noted earthquakes not a high probability hazard in our region.
- Bohn noted that older, masonry buildings are more negatively impacted by earthquakes; provided a list of older buildings. Noted many older buildings been renovated/added but, original structure there. Identifying original masonry areas and ensuring not used as a holding location is a earthquake mitigation activity.

### Lynchburg Storm/Extreme Heat Mitigation Strategies

- Develop wind building mitigation best practices document; provide to developers, property owners.
- Establish public outreach/education for wind property evaluation best practices.
- Evaluate potential storm/heat readiness/needs for area community centers (eg. generators).
- Evaluate designated LDC bus alternative routes.
- Provide backup generators at schools and community centers.

### Other

Bohn asked if there were any other general hazard discussion.

- Erin Hawkins noted that community resiliency is becoming a standard evaluation element within water resources and noted that pending wording regarding resiliency services within engineering RFPs being explored.
- How invasive species were going to impact City trees, provided emerald ash bore, and the need for evaluation and replacement over time.

### 3. Confirmation Next Draft Plan Completion Steps

Hitchcock noted that meeting summaries would be provided. HMP Public Meetings will be held during April, Hitchcock will communicate with each locality to determine schedule and if they want a public meeting. Draft HMP is anticipated for VDEM/FEMA submittal in May and will be brought back to localities during the summer for approval/adoption.

Hawkins thanked participants. She and noted that she and Piper will be communicating with folks to review mitigation strategies and urged folks to contact her or Kelly for any suggestions.

The full Draft CVPDC HMP would be submitted to VDEM and FEMA in May.



# Appendix D: Meeting Documentation

## **CVPDC Hazard Mitigation Plan Update**

### **Locality Vulnerability Meetings**

#### **Bedford County, Bedford Town**

Bedford County Dept. of Fire & Rescue Headquarters

1185 Turning Point Road, Bedford

Monday, March 9, 2020

1:00 – 3:00 pm

### **Attending**

Wyatt Woody, Director Parks & Recreation, Bedford County

Mac Duis, Chief Operations Officer, Bedford County Public Schools

J.P. Morris, Assistant Resident Engineer, VDOT – Bedford Residency

Ralph Lawson, Disaster Program Manager, American Red Cross

Pam Bailey, Marketing & Business Development Coordinator, Bedford County EDA

Mary Zirkle, Economic Development Coordinator, Town of Bedford

John Moore, Battalion Chief, Bedford County Fire & Rescue

Nathan Carroll, Assistance Executive Director, Bedford Regional Water Authority

Michael Bailey, 1st Sergeant, Virginia State Police

Jeff Johnson, E-911 Manager, Bedford County

Shannon Walker, Lieutenant, Bedford Police Department

Jack Jones Jr., Chief of Department, Bedford County Fire & Rescue

Andy Crawford, Director, Bedford Dept. of Social Services

Bill Bohn, Sobis Inc (consultant partner with VT-CGIT)

Kelly Hitchcock, Central VA Planning District Commission

### **Meeting Minutes**

#### **1. Introduction**

Hitchcock welcomed participants, provided a brief background and introduced Bill Bohn.

#### **2. Locality Hazard Vulnerability Review**

Bill Bohn, Sobis, Inc., provided a brief overview of his background in mitigation planning and led attendee introductions. Bohn facilitated the vulnerability meeting and presented locality-specific data and vulnerability for primary hazards. The following reflects key discussion points from the data review and hazard discussions.

### **Flood**

Bohn presented flood vulnerability data for Bedford.

- Three pump stations were noted to be in the floodplain. Nathan Carroll noted that Woodfield pump station did have some history of flood impacts. Further, it was noted there is a need for streambank clearing and potential stabilization at the Orange Street (#3 pump).
- Carroll noted that he had a system summary and will provide the summary to Hitchcock/Bohn.
- Carroll indicated that he is aware of only 1 facility – in the Forest area – that may be updated soon. The Montvale Treatment Plan, Bohn noted is in the floodplain, is not known to have had flood impacts. Carroll is not aware of any hardening plans currently in place.



## Appendix D: Meeting Documentation

- Two of the Town's electric substations are in the floodplain. Mary Zirkle indicated the team should contact John Wagner, Director of the Electric Dept., to ask about any known problems or plans.
- Bohn noted, as would be expected, the AEP hydroelectric plant, is in the floodplain. Bohn noted formalizing communication and confirmation of flood capacity and plans should be included in the hazard mitigation review process.
- Georgia Pacific plant is in the floodplain. It was confirmed that GP does submit Hazardous Material summaries to the community. John Moore, Bedford County Fire & Rescue, noted that plans were currently underway in Bedford that included working with Georgia Pacific regarding emergency strategic planning and response to any hazardous that would enter the James in a flood event.
- Bohn noted that data was pulled for structures in the 100 & 500 yr flood events. It was noted not too many homes in the floodplain, however there are a number of sheds & secondary building in the floodplain; structures which often include chemicals. Community education and outreach for elevation of structures.
- Bohn noted residential structures in the dam inundation zone. An action that can be taken is to include education and outreach to families, including renters, that regular insurance will not cover flood and that folks can get lower flood insurance when obtained in the dam zone.
- Location of campgrounds was reviewed as it relates to providing safety information. Bohn noted there were not public campgrounds in the flood zones but there are some private ones. Opportunity to reach out and provide general safety and awareness information as a mitigation activity.
- It was noted Bedford does not have schools or other essential community facilities in the floodplain.
- Bohn noted the growth areas designated for the Bedford community and asked if there were any other growth areas not included in the identified areas.
- Bohn asked about any areas, especially within the Town or county density areas, that experience stormwater flooding. South Bridge Street, West Gate/500 block of Blue Ridge Avenue, Summit & 4th Street/Train Trestle areas all experienced regular stormwater/drainage problems. Stormwater around the train trestle has resulted in washed out areas. Address stormwater in these areas should be included in the HMP.
- Mac Duis noted that some of the schools have generators, but the use is primary for backup for essential systems. Most are not equipped with generators for building shelter capacity. Duis noted that Big Island is quite isolated, and lack of power requires, on accusation, for students to be sent home.
- Montvale school water is provided though a private provider. It was noted this area of the County has limited backup water capacity – for the school, fire capacity and economic development.
- Bohn questioned the general practice for expansion of services by the water authority. Carroll noted there were a range of practices that included seeking to purchase from an existing provider and also a private provider requesting to be acquired by the authority. It was agreed that throughout areas of the County there is a need for water capacity redundancy and this should be included in the HMP.
- Water capacity to respond to fire needs was discussed. Hydrant review and capacity, from installation in known areas to an evaluation study should be included in the HMP.



# Appendix D: Meeting Documentation

## *Bedford Flood Mitigation Strategies*

- BCWA system protection/hardening strategies – developed through communication with BCWA – to protect key system facilities and essential infrastructure.
- Communicate with VDOT and railroad to instigate stormwater retrofits around the 4th Street trestle area and replacement of undersized culverts in South Bridge Street, Blue Ridge Avenue, and Summit within the Town.
- Establish emergency response plans and agency coordination with companies within floodplain areas of the County/Town (eg Georgia Pacific).
- Initiate public outreach campaign on information regarding flood insurance.
- Initiate water supply redundancy studies and, where appropriate, implementation at essential facilities.
- Obtain generators for community critical facilities, including schools and government buildings.

## *Bedford Flood - Follow Up Actions*

- Hitchcock follow up with Nathan Carroll, BRWA, for facility summary information and discussion of BRWA mitigation plan initiatives.
- Hitchcock/Bohn follow up with Zirkle, Lieutenant Walker for confirmation of stormwater areas in the Town.
- Hitchcock/Bohn follow up with Town/County for wording regarding hydrant needs or hydrant study wording.

## **Dam Failure**

Bohn presented a map that presented dams, including the several High Hazard Dams (HHD) in the County.

- Bohn noted that the inundation areas and Emergency Action Plans (EAPs) were provided by DCR. DCR data included impacted properties.
- Bohn noted there are no public critical facilities – schools, hospitals, elderly centers – in the inundation zones. Bohn suggested a general flooding information, outreach and insurance education be included. He noted that some communities are providing the information in the public community websites/GIS.
- Bohn noted that DCR is about to have dam information on their site and localities can show a link on their sites.
- Chief Jones noted the importance of including all project types and noted past HMP was only looking at emergency management. The plan is looking at all departments, all project types.

## *Bedford Dam Mitigation Strategies*

- Include DCR dam information on locality and regional websites. Incorporate dam public information with in the HMP website and program outreach.

## **Wildfire**

Bohn presented the Bedford wildfire map that included residential density areas and noted those communities that might be cutoff during wildfire events.

- Bohn asked if there are specific plans or development restrictions in wooded areas. There are not specific wooded area development restrictions. Chief Jones noted that the County did coordinate with the Dept. of Forestry to provide Fire Wise property protection best practices and they are provided. Jones noted there is an opportunity to expand and improve the information and outreach component.



## Appendix D: Meeting Documentation

- Bohn asked about the local emergency notification system and what percentage of the community is on the system. Jeff Johnson noted the participation in the notification system is a fairly small percentage. Johnson will provide information on the numbers. Increasing participation should be a mitigation activity. It was noted that many folks are registered to receive emergency notices through local news networks.
- It was noted that the School system has an app that provide snow and weather closure information.
- The Town's emergency warning system, which is a horn on a tower, does not currently work. Implementing warning notification system would be a valuable strategy for the plan. Are there plans in place - such as. Emergency notification system – what percentage on the system. Small population on the local emergency system. Folks are more logged into news notification.

### *Bedford Wildfire Mitigation Strategies*

- Expand fire wise, property protection and other information to guide development decisions.
- Develop outreach to increase participation/registration to the local emergency warning system.
- Repair existing or install a new emergency warning system in the Town.

### *Bedford Wildfire Follow Up Actions*

- Hitchcock follow up to obtain estimate of existing Bedford Emergency System registrants.

### **Tornado and other winds**

Bohn provided summary of wind data and noted data pulled were local attractions – places where there is potential for large gathering.

- Bohn asked if locations, like the D Day Memorial had known sheltering plans.
- Other attractions noted included Peaks of Otter, Popular Forest, Bedford Welcome Center. Smith Mountain Lake, all the local parks. No specific sheltering plans for these locations were noted.
- Chief Jones pointed out that events are held at all the locations. He pointed out that as permits are issued all the departments are informed and provide comment. Emergency access are included. He noted this is the opportunity to include some specifics in this process.
- Bohn presented data on mobile home parks, residential clusters and noted the value of brackets for wind protection and the ability to expand information/outreach to builders. He noted that with confirmation on us of the roof structure brackets reduction in insurance premiums can be obtained.

### *Bedford Tornado/High Wind Mitigation Strategies*

- Incorporate recommendations/review for weather event sheltering or actions within event planning & permitting process.
- Through coordination with property and event owners and rescue/emergency professionals, evaluate or develop emergency plans.
- Develop wind property protection information materials for property owners, developers, builders.

### **Extreme Temperatures**

Bohn noted the plan will include temperature data and will include evaluation/strategy to mitigate impacts of extreme temperatures.





# Appendix D: Meeting Documentation

- It was noted that the County and Town do not have designated cooling centers. However, local churches serve this role, on a case-by-case basis. Public libraries and other public spaces, shopping, etc. are places public congregates during extreme heat or power outages.
- Water sources for the agricultural community were noted; Hitchcock confirmed she has communicated with the Extension agents on unique needs for this community.

## Other Hazards

### Earthquakes:

Bohn noted not prevalent in the area. However, he noted one data set identified was older buildings with unreinforced masonry structures. Bohn noted these types of buildings are most susceptible from earthquake impacts. A strategy being letting facility managers of these facilities, many of which have been built around/expanded, know this and ensure the original structure identified and ensure if an event not to have individuals shelter in these locations.

- List of structures was presented. It was noted that the Bedford Middle School is no longer a school. Was the building that had suffered a recent fire and is being redeveloped into private residential property.

### General Discussion

Bohn asked for any general discussion or other hazard concerns.

- The importance of including a strategy to address stormwater runoff and its impact needs to be in the plan. To include communication with all the stakeholders.
- It was noted that there is current communication and team building on disease response in the community. It is anticipated that actions or future needs will result from this meeting that should be included.
- Chief Jones reiterated the need for communication with Extension and the importance of looking at the timber industry and impact of drought. Also stressed the importance of departmental coordination in emergency response and mitigation execution activities.
- Carroll agreed that the impact of drought and extreme temperatures on the Agricultural community can be an issue. He noted that the BCWA in the past had been approached by a farmer to request water release from a reservoir to address loss of water on property.
- Mary Zirkle stresses that the HMP should be sure to accurately reflect adjustments in the Town boundaries.
- Carroll noted he was aware of water restrictions in 2017 that were more in place based on withdrawal restrictions, not due to lack of capacity. He pointed out that a lot of water use is required for system flushing, which in some areas could be impacted with reduced capacity.

### Bedford General Follow Up Actions

- Communicate with Duis, County, Town to see if any specific mitigation actions should be included as a result of pending disease response meetings.
- Ensure communication with extension and agricultural mitigation activities are incorporated.

## 3. Confirmation Next Draft Plan Completion Steps

Hitchcock noted that meeting summaries would be provided. Also that the CVPDC HMP Technical Advisory Group, whom Chief Jones is a member, will meeting monthly through plan completion. HMP Public Meetings will be held during April, Hitchcock will communicate with each locality to determine schedule and if they want a public meeting. Draft HMP is anticipated for VDEM/FEMA submittal in May and will be brought back to localities during the summer for approval/adoption.



# Appendix D: Meeting Documentation

## Public Meeting Presentation

December 4, 2019 | 5:30 pm – 7:00 pm

The Miller Center

301 Grove Street, Lynchburg

## CVPDC Hazard Mitigation Plan Update



The Miller Center  
301 Grove Street Lynchburg, VA  
December 4, 2019



## Hazard Mitigation Planning

- Authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (amended August 2016); requirement for FEMA mitigation funding eligibility.
- Hazard Mitigation plan identify risks and present strategies to lessen risk.
- Hazard Mitigation programs assist communities implement measures before hazards.
- Hazard mitigation is any action taken to reduce or eliminate risks and vulnerability to people or property from natural hazards.
- Mitigation is a KEY process in reducing the cycle of disaster damage, reconstruction and repeated damage.



## Hazard Mitigation Assistance (HMA) Grants

- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)
- Hazard Mitigation Grant Program (post-disaster)



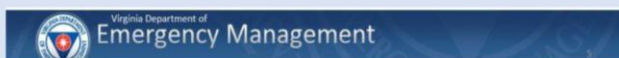
Annual; focused on climate resilience, infrastructure, and non-flood related projects.

- \$90M in FY2018
- Each state \$575K set-aside
- 75% Federal; 25% Local



Annual; focused on mitigation structures with NFIP and have sustained flood claims.

- \$175M in FY2018
- Priority to communities with high NFIP and participating CRC Pgm.
- Up to 100% Federal funding





# Appendix D: Meeting Documentation

## Hazard Mitigation Planning - Saves

Mitigation is a **KEY** process in reducing the cycle of disaster damage, reconstruction and repeated damage.

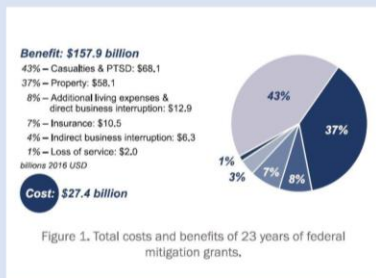


National Benefit-Cost Ratio (BCR) Per Peril		Beyond Code Requirements	Federally Funded
Overall Hazard Benefit-Cost Ratio		\$4:1	\$6:1
	Riverine Flood	\$5:1	\$7:1
	Hurricane Surge	\$7:1	Too few grants
	Wind	\$5:1	\$5:1
	Earthquake	\$4:1	\$3:1
	Wildland-Urban Interface Fire	\$4:1	\$3:1

Source: FEMA Mitigation Saves Study, 2017

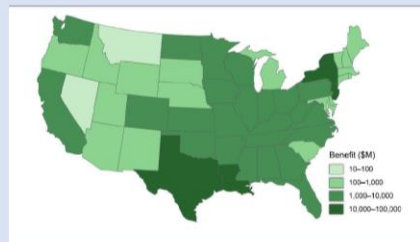


## Hazard Mitigation Program - Saves



Total costs and benefits of 23 years of federal mitigation grants

Source: FEMA, 2017



Aggregate benefit by state from federal grants for flood, wind, earthquake and fire mitigation.

Source: FEMA, 2017



## Hazard Mitigation Plan

<b>Mitigation</b>	The effort to reduce loss of life and property by lessening the impact of disasters.
<b>HM Plan</b>	Evaluate/understand risks (HIRA) from natural hazards and develop long-term strategies to reduce impacts to people, property, and environment.
<b>Risk</b>	Potential losses associated with a hazard, defined in terms of expected probability and frequency, exposure, and consequences.
<b>Vulnerability</b>	Level of exposure of human life and property to damage from natural hazards.
<b>HM Strategies</b>	Specific actions, projects, policies, or process to reduce or eliminate risk. Implementing strategies to achieve HM mission & goals.

### Hazard Categories

1. **Drought** – high temps, well, Agriculture
2. **Fire** – wildfire, urban, sensitive areas,
3. **Flooding** – riverine, flash/street flooding, dam inundation
4. **Geologic** – landslides, earthquakes, karst (sinkholes), drilling
5. **Severe Weather** – ice/snow, tornado, non-rotational wind
6. **Human-caused** – water, electric power failure, information security





# Appendix D: Meeting Documentation

## CVPDC Hazard Mitigation Plan

### HMP Technical Advisory Committee

#### CVPDC Localities

- Water Resources/Utility
- Emergency Services/Public Safety
- Planning

#### VA State Agencies

- Dept. Environmental Quality (DEQ)
- Dept. Conservation & Recreation (DCR)
- Dept. of Health – Central VA Health District
- Dept. Mines, Minerals, & Energy

#### Business/Institutions

- Centra
- Colleges/Universities



## Hazard Identification and Risk Assessment (HIRA)

### Purpose:

Provides factual basis for prioritizing hazard mitigation activities.

### Major Components (Data):

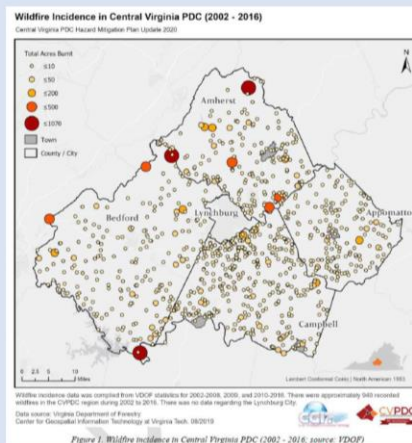
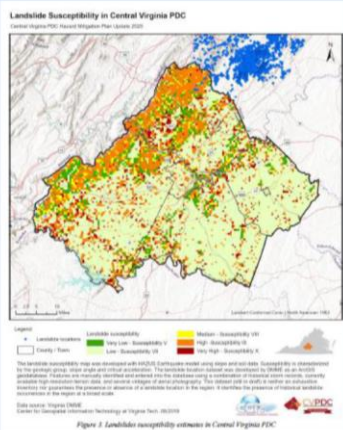
- Identify and profile natural hazards affecting a region (historical data);
- Assess Vulnerability (density, structures, sensitive facilities/communities)
- Estimates Potential Losses (estimated structural values)



### Hazard Intensity / Frequency Sources

Hazard	Data Source	New Modeling (Probability) Data?
Flood		
Flooding – Coastal	FEMA Digital Flood Insurance Rate Maps (DFIRMs)	YES
Flooding – Storm Surge from Hurricanes	FEMA Digital Flood Insurance Rate Maps (DFIRMs)	YES
Wind		
Wind – Hurricane	HAZUS Analysis	YES
Wind – Non-Hurricane	SVPDC Data generated from NWS SevereFest data	YES
Wind – Tornado	SVPDC Data generated from NWS SevereFest data	YES
Earthquake	HAZUS Analysis	YES
Winter Storm	Analysis of National Climatic Data Center Archives	YES

## CVPDC HMP - HIRA







# Appendix D: Meeting Documentation

## HIRA

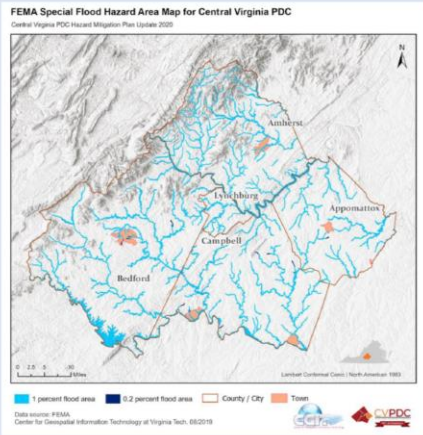


Table 3. Flash Flood Events in the Central Virginia PDC (Source: NCEI database, 1996–2019)

Jurisdiction	No of Flash Flood Events	Property Damage	Crop Damage	Total
Albemarle County*	24	\$ 820,000	\$ 0	\$ 820,000
Appomattox County*	22	\$ 1,189,000	\$ 100,000	\$ 1,289,000
Bedford County*	49	\$ 560,000	\$ 100,000	\$ 660,000
Campbell County*	40	\$ 1,961,000	\$ 500,000	\$ 2,461,000
Lynchburg	11	\$ 18,020,000	\$ 0	\$ 18,020,000

\* Towns included in the county numbers



## Mitigation Strategies – Five Primary Types

- Public Information & Outreach**  
Actions to inform & educate public about hazards & ways to mitigate impact
  - radio/tv spots
  - real estate disclosure
  - preparedness strategies
  - flood/insurance information
  - property evaluation
- Local Plans & Regulations**  
Preventative actions via planning, maintenance, regulatory actions (e.g. Comprehensive Plans)
- Property Protection**  
Measure to protect structures to better withstand hazards or support to lessen impact (e.g. acquisition, retrofits, relocation).
- Structure Projects**  
Lessen impacts through modification of existing or construction new structures (e.g. reservoirs, dam stabilization, storm sewer construction).
- Natural System Resiliency**  
Preserve or restore natural systems to preserve function of natural systems to reduce hazard impacts (e.g. streambank stabilization, wetland restoration, fire resistant landscapes, slope stabilization).



## Examples of Mitigation Activities







# Appendix D: Meeting Documentation

## Examples of Mitigation Activities



## Public Input – Survey & Public Meeting

Area residents, stakeholders and business community are requested and encouraged to provide input about concerns and feedback on how you and your community prepares to be more resilient from natural disaster impacts.

### How to Participate:

1. **Take a Survey:** 6-minute, 14 question survey to provide feedback on natural disaster in your community. Available throughout the region. November 20<sup>th</sup> – December 13<sup>th</sup> [www.cvpdc.org](http://www.cvpdc.org).
2. **Stay Informed:** Visit the CVPDC website for HMP updates, next public meeting, and Draft CVPDC Hazard Mitigation Plan public comment period.
3. **Ask Questions:** Contact Kelly Hitchcock at [kelly.hitchcock@cvpdc.org](mailto:kelly.hitchcock@cvpdc.org) or at 434-845-3491



## CVPDC Hazard Mitigation Plan - Completion Timeline

Activity	Schedule
Public Meeting #1 – Plan & HIRA Intro	December 4, 2019
Community Survey	November 20 <sup>th</sup> – December 13 <sup>th</sup>
Mitigation Strategies – region/locality specific	August 2019 – January 2020
Public Meeting #2 – Comment Draft	February/March 2020; Date(s) TBD
Draft Submitted VDEM & FEMA	March 2020
Localities Grant Eligible	March 2020
FEMA Review Draft CVHMP	March – May 2020
FEMA Comments Incorporated	May
CVPDC HMP Approved FEMA	June 2020
CVPDC HMP Adopted Localities	July – September 2020
FEMA HMA Grant Awards (typically)	October 2020





# Appendix D: Meeting Documentation

## CVPDC Hazard Mitigation Plan

Thank you.  
Kelly Hitchcock  
CVPDC HMP Technical Advisory Committee



### Attendees

#### The CVPDC Hazard Mitigation Plan Public Meeting

The Miller Center  
301 Grove Street, Lynchburg  
Wednesday, December 4, 2019

#### SIGN IN - PLEASE PRINT

Name	Locality	Organization/Citizen	Check to receive future HMP information	Email (needed if you wish future information)
Phyllis Floyd	Campbell Co	citizen	✓	floyd.phyllis@hotmail.com
Bonita Myers-Bigler	Camp Co	Citizen	✓	bnitab@aol.com
Laura Henry-Stue	Amherst County	Off of Lynchburg County	✓	henrystue.l@lynchburgva.gov
Kent White	Lynchburg	City of Lynchburg	✓	Kent.white@lynchburgva.gov
Erin Hawkins	COL		✓	erin.hawkins@lynchburgva.gov
Piper VanDePerre	Lynchburg	Emergency Services	✓	piper.vandeperre@lynchburgva.gov
Melissa Foster	Lynchburg	" "	✓	
JEFF MARTIN	Lynchburg	Water Resources	✓	JEFF.MARTIN@lynchburgva.gov
Jennifer Woelfel	Lynchburg	citizen	✓	jennifer@sustainabilityconsulting.com



# Appendix D: Meeting Documentation

## Public Meeting (webinar format)

June 25, 2020 | 5:30 pm

### Hazard Mitigation Plan Public Meeting

June 25, 2020



Central Virginia Planning District Commission

**HAZARD MITIGATION**

### Agenda



PROJECT  
BACKGROUND



HAZARD  
INFORMATION



MITIGATION  
ACTIONS



NEXT STEPS



### Introduction – Who is Involved?

- Local government – emergency management, public works, water resources, community development, police, fire, and governing bodies.
- Region Planning District Commission – CVPDC
- Federal and State government – FEMA; Dept. of Emergency Management; Dept. of Conservation and Recreation; and Dept. of Mines, Minerals, and Energy.
- Colleges and universities
- Non-profit and private sector
- You!





# Appendix D: Meeting Documentation

## Introduction – Why Are We Here?

- The Region has a Federal Emergency Management Agency (FEMA) approved Hazard Mitigation Plan (HMP) which must be updated every five years. Public meetings are part of this process.
- The HMP provides a process to help local government agencies identify hazard risks and strategies to protect people and property.
- Some grant funding requires an approved HMP with specific mitigation actions defined.



## The Disaster Mitigation Act of 2000

- Revitalized federal planning requirements – State and Local Hazard Mitigation Plans
- Provides Federal Grant Funding Eligibility
  - Hazard Mitigation Grant Program (HMGP)
  - Pre-Disaster Mitigation Program (PDM)
  - Flood Mitigation Assistance (FMA)
- Supports cooperation between state and local authorities on risk reduction measures and expedites funding allocation



## FEMA Grants





## Appendix D: Meeting Documentation

### FEMA Can Assist With:

- Property acquisition
- Structure demolition or relocation
- Structure elevation and reconstruction
- Dry flood proofing on historical and non-residential structures
- Flood risk reduction projects
- Emergency generators



### What's in the Mitigation Plan?

- Community profiles – demographics, employment, growth areas, natural environment, and built environment
- Hazard information and risk assessment – natural, human-caused, and technological hazards
- Mitigation goals, objectives, and actions
- Maintenance strategies – maintenance plan for the next five years







# Appendix D: Meeting Documentation

## What is Risk?

- The potential for damage, loss, or other impacts created by the interaction of natural hazards with community assets.



Source: Local Mitigation Planning Handbook, FEMA 2013.



## Hazard Section of the Plan

- Hazard description
- Geographic location and extent of hazard
- Magnitude and severity
- Previous occurrences
- Relationship to other hazards
- Vulnerability and risk
- Impacts – social, economic, and environmental



## Which Hazards are Covered?

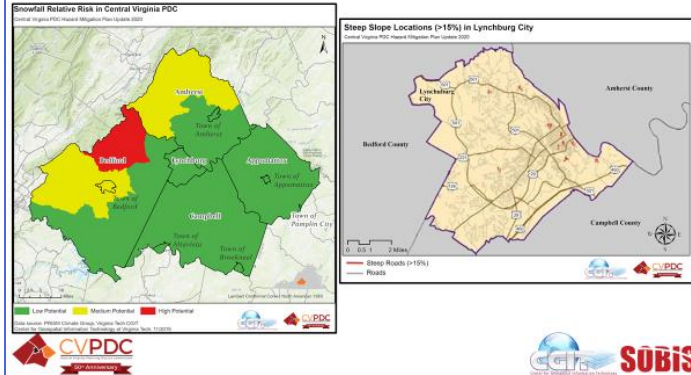
- |                        |                                   |
|------------------------|-----------------------------------|
| • Flood                | • Urban Fire                      |
| • Dam Failure          | • Landslide                       |
| • Severe Thunderstorm  | • Earthquake                      |
| • Tornado              | • Land Subsidence and Karst       |
| • Hurricane            | • Terrorism                       |
| • Hailstorm            | • Hazardous Material Incidents    |
| • Severe Winter Storm  | • Solar Event                     |
| • Extreme Temperatures | • Contagious/Communicable Disease |
| • Fog                  |                                   |
| • Drought              |                                   |
| • Wildfire             |                                   |



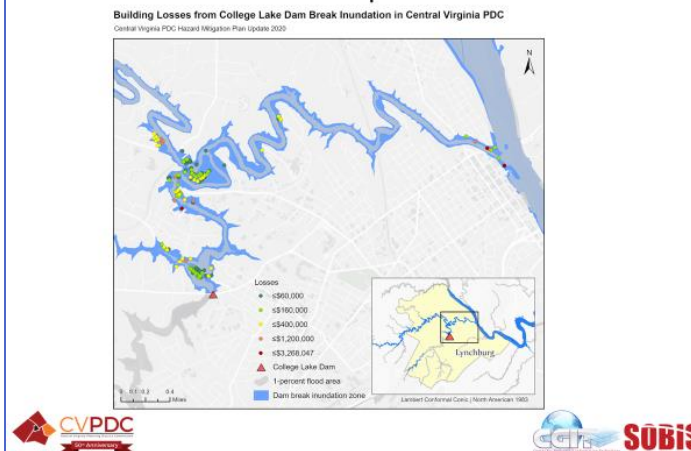


# Appendix D: Meeting Documentation

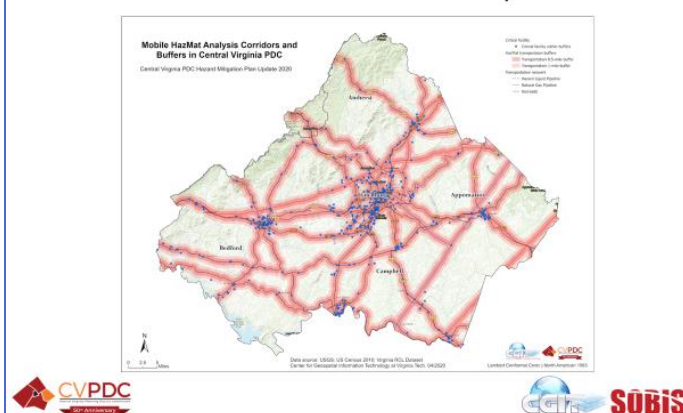
## Winter Storm Example



## Dam Failure Example



## Hazardous Materials Example





# Appendix D: Meeting Documentation

## Who is Impacted?

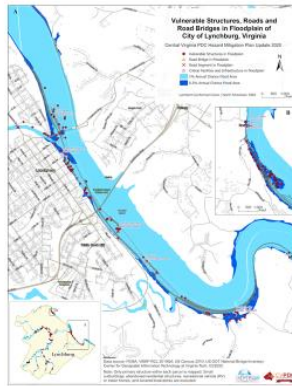
	Population	Households	White	%	Black	%	Hispanic	%	Asian	%	Native Am	%
Bedford County	68,676	27,465	62,035	90.3%	3,909	5.7%	1,090	1.6%	700	1.0%	172	0.3%
1% Floodplain	9,443 (13.8%)	3,965	8,562	90.7%	481	5.1%	160	1.7%	88	0.9%	20	0.2%
0.2% Floodplain	12,129 (17.7%)	5,162	10,825	89.2%	789	6.5%	196	1.6%	105	0.9%	36	0.3%

	Population	Households	Income <\$20k	%	Age <16	%	Age >65	%
Bedford County	68,676	27,465	3,914	5.7%	15,305	22.3%	11,147	16.2%
1% Floodplain	9,443	3,965	646	6.8%	1,969	20.9%	1,672	17.7%
0.2% Floodplain	12,129	5,162	854	7.0%	2,392	19.7%	2,467	20.3%



## What is Impacted?

- Hospitals, schools, and retirement communities
- Police, fire, and emergency operations centers
- Roads and rail
- Utilities
- Hazardous materials facilities
- Tourist sites and large venue facilities



## Dashboards





# Appendix D: Meeting Documentation



## What is Mitigation?

- Merriam-Webster
  - (1) to cause to become less harsh or hostile
  - (2) to make less severe or painful
- FEMA – Any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.



## Types of Mitigation

- Property protection – buyouts, relocation, warning systems, etc.
- Capacity – plans, ordinances, zoning, training, Community Rating System, etc.
- Structural projects – flood control, dam stabilization, green infrastructure, berm installation, etc.
- Public outreach and information - education campaigns, websites, demonstration events, etc.
- Natural system resiliency - streambank and slope stabilization, fire resistant landscapes, wetland restoration, etc.





# Appendix D: Meeting Documentation

## Region's Goals

- Support property and infrastructure fortification programs and projects to lessen hazard impacts to lives, property, and infrastructure.
- Through governmental operations, planning, voluntary and regulatory programs (e.g. code enforcement), and maintenance practices lessen hazard impacts.
- Execute hazard mitigation measures that significantly lessen the impact of natural hazard impact to lives, communities, property, and infrastructure in the region.



## Region's Goals

- Increase public hazard awareness and preparedness knowledge to lessen hazard impacts on individuals, property, and businesses.
- Preserve the function and resiliency of the region's natural resources and sensitive landscapes.



Region Undergoing Hazard Mitigation Plan Update

The CVPDC has contracted with the Virginia Department of Emergency Management (VDEM) and area localities to update the region's Hazard Mitigation Plan update. The plan that will identify and rate potential hazards and estimate hazard and locally specific mitigation activities to reduce human and property impact. Funding for this project is provided by VDEM, FEMA, and CVPDC localities.

The CVPDC has contracted with the Virginia Tech Center for Geospatial Information Technology (CGIT) to guide the pre-disaster planning effort. The CGIT team, which includes contributions by SUBIS, Inc. in partnership with the Hazard Mitigation TAC will coordinate to develop the pre-hazard mitigation plan.

[Hazard Mitigation Plan Update: A Public Input Strategy](#)

A Technical Advisory Committee (TAC) comprised of local and state emergency planning, resource management professionals, business, college, agency, and VDEM staff, and local citizens will coordinate to review and evaluate data, develop strategies, and guide the plan development. The pre-disaster plan will be developed through a public process.

[Public Meetings Schedule: June 2020](#)

Participate to learn about the pre-disaster plan, hazard data and resource information for our area, review draft regional mitigation strategies, and learn how to view and provide comment.

[Draft Regional Hazard Mitigation Strategies](#)

These represent a summary of a menu of mitigation strategies, that can serve as the foundation by which area localities will estimate individual locality mitigation actions. Residents may provide comments on the plan, strategies, and mitigation activities by July 31, 2020.

[CVPDC Hazard Mitigation Plan Draft Plan & Strategy](#)

The Draft CVPDC Hazard Mitigation Plan website will be **open to the public in late July**. Please check back at this page at that time for updates. The CVPDC HMP website will allow for interactive viewing of the full draft plan and individual chapters, regional hazard data and vulnerability maps, the planning process, the regional and individual locality pre-disaster mitigation strategies, and the planning overview and guidance process. Individual hazard maps, data.

[Learn More About Hazard Mitigation Planning](#)

Federal Emergency Management Agency (FEMA)

<https://www.cvpdc.org/regional-initiatives/hazard-mitigation.html>







# Appendix D: Meeting Documentation

## CVPDC Hazard Mitigation Plan Completion Schedule & Public Participation Process

Activity	Schedule
Public Meeting #1 – Plan & HIRA Intro	December 4, 2019
Community Survey	Nov. 20 – Dec. 13, 2019
Mitigation Strategies – Region/Localities	October 2019 – June 2020
Public Meeting #2 – Hazard Review & Strategy Comment	June 2020
Draft CVPDC HMP Plan available for public comment	July 2020
Draft HMP Submitted VDEM & FEMA	July 2020
FEMA Review Draft CVHMP	August – September 2020 (localities able to submit applications)
FEMA Comments Incorporated	September 2020
CVPDC HMP Approved FEMA	September 2020
CVPDC HMP Adopted Localities	September – October 2020



## Mitigation for Homeowners and Businesses (Flood/Dam Failure)

- Buyout the property (pre-flood market value)
- Elevate the property (\$30k-\$100k)
- Dry flood-proofing (\$8k-\$20k)
- Wet flood-proofing (\$2k-\$20k)
- Stormwater management
- Insurance (risk transfer)



## Dry Flood-Proofing

- Dry flood-proofing techniques are designed to prevent floodwater from entering a building.
- Measures include the protection of doors and other openings with permanent or removable flood shields by sealing walls with waterproof coatings, impermeable membranes, or supplemental layers of masonry or concrete.

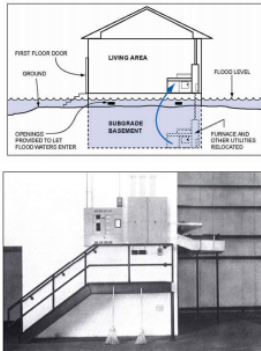




# Appendix D: Meeting Documentation

## Wet Flood-Proofing

- Wet flood-proofing measures allow floodwater to enter a building but limit the damage to the structure and its contents.
- Measures include building utility installations above flood levels, raising electrical sockets, fitting tiled floors so that the building can quickly be returned to use after the flood, and sealing walls with water-resistant building materials.



## Stormwater Management

Bioretention / Raingarden



Planter Box



Rainwater Harvesting

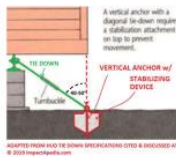


Green Roofs



## Mitigation for Homeowners and Businesses (Wind)

Anchoring



Hurricane Straps



Shutters



Secondary Water Resistance





# Appendix D: Meeting Documentation

## More Information from FEMA

- [https://www.fema.gov/media-library-data/1478272128411-2eca27a89d418bb73e817edfb702cc15/HMA\\_HO\\_Brochure\\_508.pdf](https://www.fema.gov/media-library-data/1478272128411-2eca27a89d418bb73e817edfb702cc15/HMA_HO_Brochure_508.pdf)



## Other Information

- <https://www.lynchburgva.gov/emergency-preparedness>



- <https://www.ready.gov/> - creating plans and emergency kits for the public and businesses.



For more information,  
please contact:

Kelly Hitchcock, Central  
Virginia PDC  
[Kelly.Hitchcock@cvpdc.org](mailto:Kelly.Hitchcock@cvpdc.org)





# Appendix D: Meeting Documentation

## CVPDC Pre-Disaster Mitigation Plan Public Survey

### Central Virginia Pre-Disaster Mitigation Plan Public Survey

Has your home or business been impacted by damage from a natural hazard?

The Central Virginia Planning District Commission (CVPDC) is working with area communities to create a natural hazard pre-disaster plan, or *Hazard Mitigation Plan*, to establish strategies ahead of disasters to lessen the impact to lives and property from natural disaster events. The CVPDC Hazard Mitigation Plan is being developed to lessen the vulnerability of citizens, critical facilities, infrastructure and property to natural disasters.

Advanced thanks for taking about six (6) minutes to participate in this important survey. Your participation will assist in developing the regional pre-disaster plan to make our region more resilient to natural disasters.

1. For this survey, from which Central Virginia Planning District Commission (CVPDC) area participating locality are you responding?

- ☐ Altavista Town
- ☐ Amherst County
- ☐ Amherst Town
- ☐ Appomattox County
- ☐ Appomattox Town
- ☐ Bedford County
- ☐ Bedford Town
- ☐ Brookneal Town
- ☐ Campbell County
- ☐ Lynchburg City



# Appendix D: Meeting Documentation

2. Which options below best define your role in the community?

☐ Resident

☐ Business Operator

☐ Landowner

☐ Local Official

☐ Institutional/Organizational Partner

☐ Other (please specify)

3. Please enter your HOME ADDRESS zip code.

4. How concerned are you about the following natural disasters affecting your community? (Check concern level for each hazard)

	Very Concerned	Somewhat Concerned	Neutral	Not Very Concerned	No Concern
Dam/Levee Failure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drought	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Earthquake	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flood (river/stream overflow)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flood (urban street, stormwater/flash)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heat Wave	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
High Winds (hurricane, tornado, derecho)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Landslide	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Severe Winter Storm (ice, blizzard)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Source Water Contamination	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wildfire	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Urban Fire (large fire/conflagration)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify)

5. Have you been impacted by a natural disaster?

☐ Yes

☐ No

6. Please select the TOP THREE (3) natural hazards you think are the HIGHEST THREAT (likely to cause impact) to your community or neighborhood

☐ Drought

☐ Dam Failure

☐ Earthquake

☐ Erosion

☐ Extreme Temperatures

☐ Flooding (River/Stream)

☐ Flooding (Street/Flash)

☐ Hail Storms

☐ High Winds

☐ Hurricane

☐ Ice Storm

☐ Landslides

☐ Medical Pandemic

☐ Nor'easter Storms

☐ Severe Thunderstorms

☐ Severe Winter Storms

☐ Sinkholes

☐ Tornadoes

☐ Wildfires

☐ Urban Fire (large/conflagration)

☐ Other (please specify)





# Appendix D: Meeting Documentation

7. Which of the following natural hazards have you been impacted by in the last 10 years? (check all that apply)

☐ Dam/Levee Failure

☐ Drought

☐ Earthquake

☐ Flood (river/stream overflow)

☐ Flood (urban street/flash)

☐ Heatwave

☐ High Winds (tornado/derecho)

☐ Landslide

☐ Severe Weather

☐ Wildfire

☐ Urban Fire (large fire/conflagration)

☐ I have NOT been directly impacted by a natural hazard

☐ Other (please specify)

8. Have the following types of weather events become more or less common in your community over the past five (5) years, or have they stayed about the same?

	Much Less Common	Somewhat Less Common	Stayed About the Same	Somewhat More Common	Much More Common	Don't Know
Extreme Temperatures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
High Wind Events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Severe Thunderstorms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Severe Winter Storms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flooding Events (river/stream overflow)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flooding Events (street/flash or stormwater)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Droughts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. In your household, has anyone done any of the following natural disaster preparedness activities? (check all that apply)

☐ Talked about what to do in case of a natural disaster or emergency.

☐ Prepared an emergency kit or assembled emergency supplies (stored food & water, batteries, etc.).

☐ Installed a smoke detector on each level of your home.

☐ Prepared a family/home emergency plan.

☐ Discussed or created a utility shutoff procedure in the event of natural disaster.

☐ Attended a course, or meeting dealing with emergency preparedness (First Aid, CPR, Get Ready).

☐ Signed up to receive an emergency alert of some kind.

☐ Other (please specify)

10. Have you ever received information on how to make your home or business better prepared for natural hazards?

☐ Yes

☐ No

11. Does your street regularly flood or experience sustained puddling during rain events?

☐ Yes

☐ No

If yes, please provide the street name and information about area that floods/holds water.

12. Is there any supplemental insurance on your property? (check all that apply)

☐ Earthquake insurance

☐ Flood insurance

☐ I do not have earthquake or flood insurance

☐ I don't know

☐ Other (please specify)



## Appendix D: Meeting Documentation

13. How do you receive information regarding severe weather events? (check all that apply)

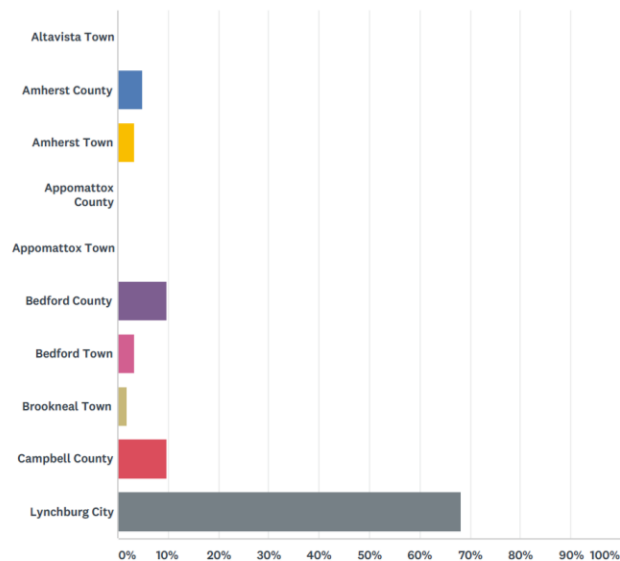
- ☐ Television
- ☐ Radio
- ☐ Cell Phone Service/Apps
- ☐ Social Media (Facebook, Twitter, etc.)
- ☐ Cable TV System Alerts
- ☐ National System (eg NOAA Weather)
- ☐ Other (please specify)

14. Please use this space to provide any questions, comments, concerns regarding natural hazard risks or preparedness.

### CVPDC Pre-Disaster Mitigation Plan Public Survey Results

Q1 For this survey, from which Central Virginia Planning District Commission (CVPDC) area participating locality are you responding?

Answered: 63 Skipped: 0

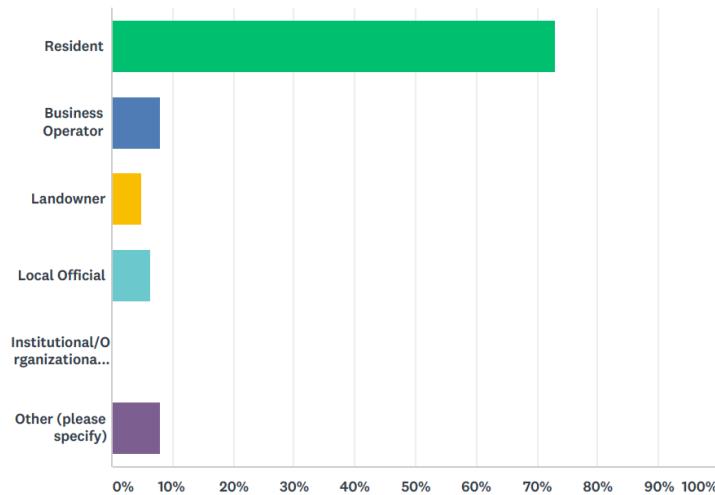




## Appendix D: Meeting Documentation

Q2 Which options below best define your role in the community?

Answered: 63 Skipped: 0



Q3 Please enter your HOME ADDRESS zip code.

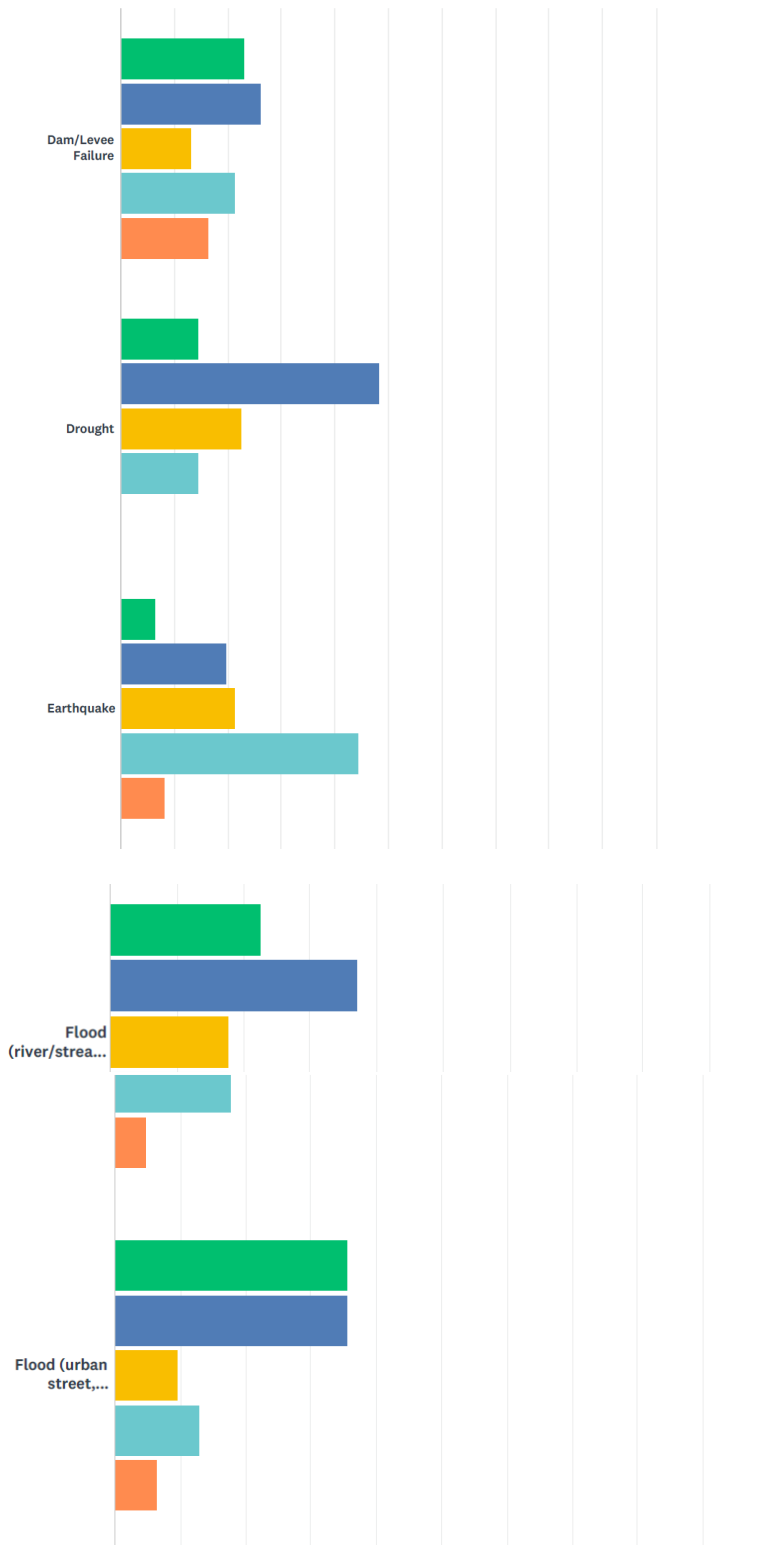
Answered: 62 Skipped: 1



## Appendix D: Meeting Documentation

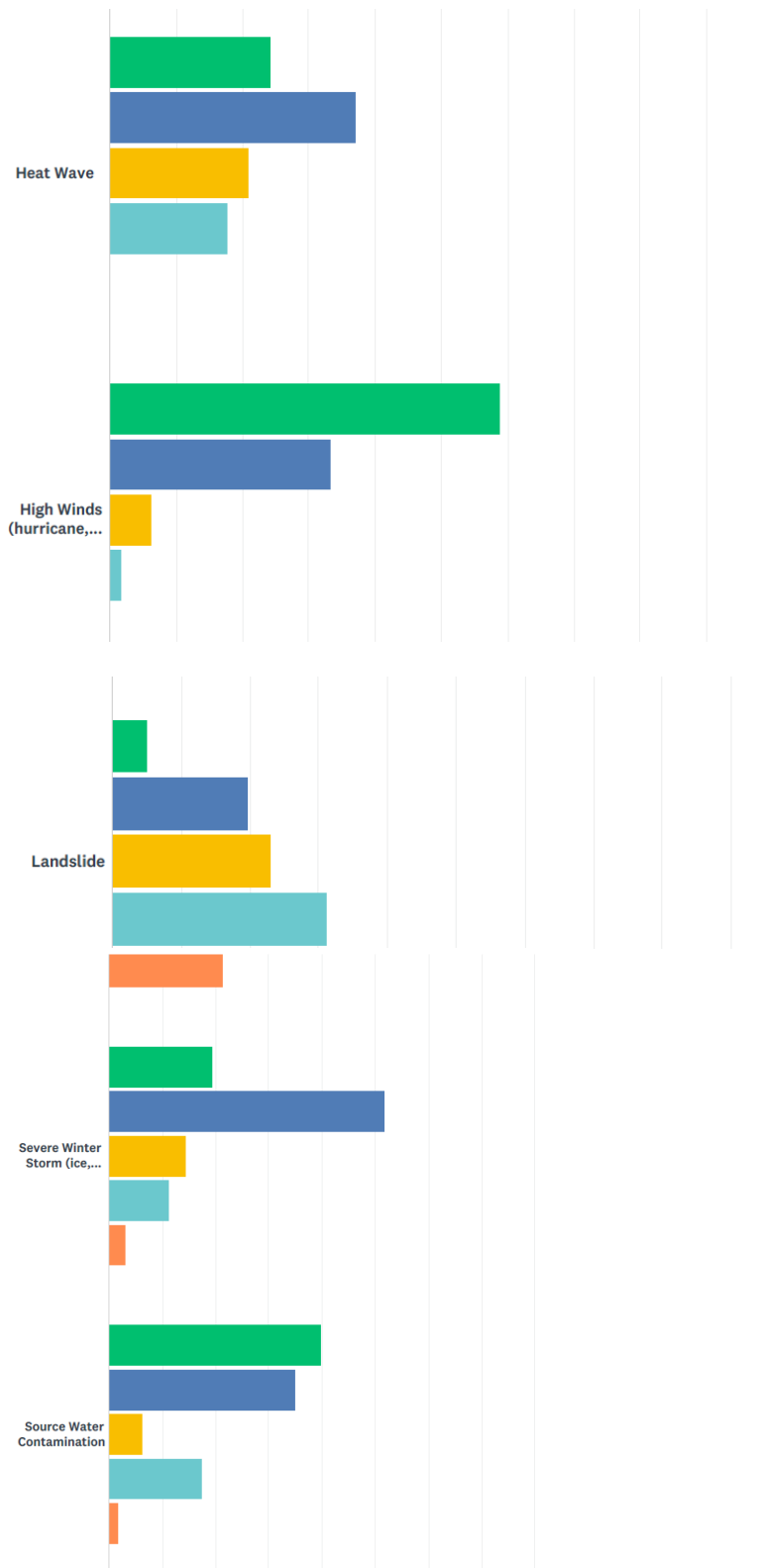
Q4 How concerned are you about the following natural disasters affecting your community? (Check concern level for each hazard)

Answered: 63 Skipped: 0





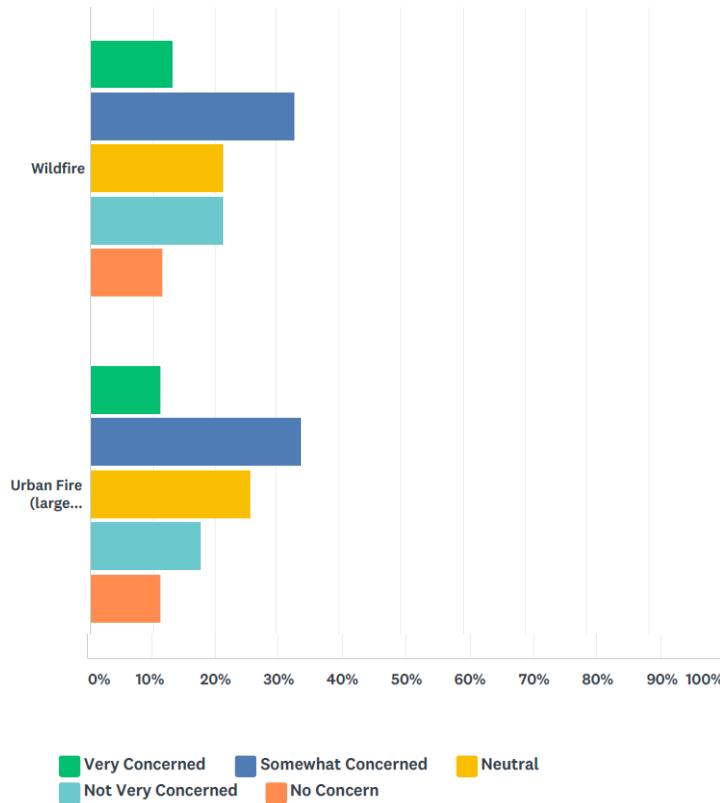
## Appendix D: Meeting Documentation





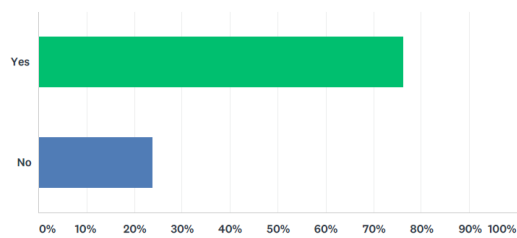


## Appendix D: Meeting Documentation



Q5 Have you been impacted by a natural disaster?

Answered: 63 Skipped: 0

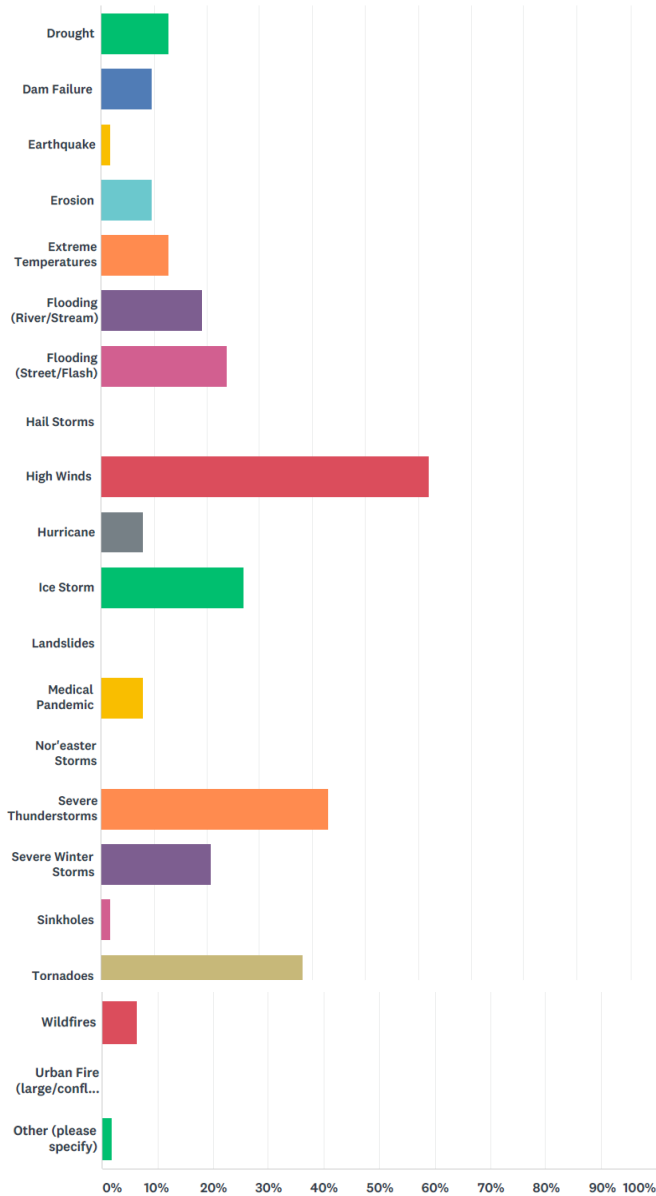




## Appendix D: Meeting Documentation

Q6 Please select the TOP THREE (3) natural hazards you think are the HIGHEST THREAT (likely to cause impact) to your community or neighborhood

Answered: 63 Skipped: 0

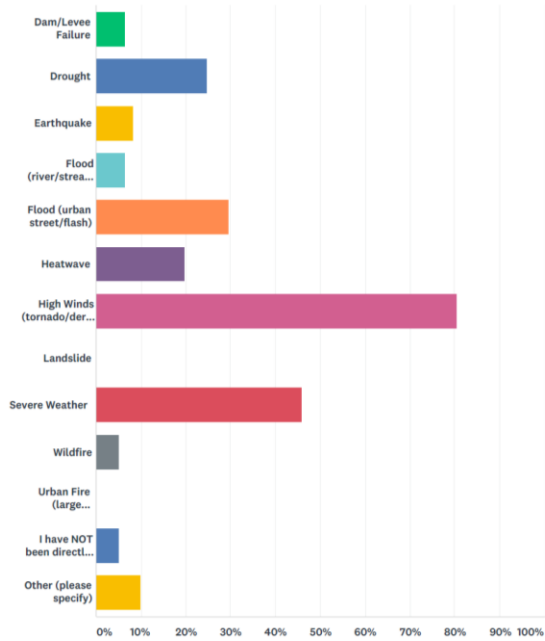




## Appendix D: Meeting Documentation

Q7 Which of the following natural hazards have you been impacted by in the last 10 years?(check all that apply)

Answered: 61 Skipped: 2

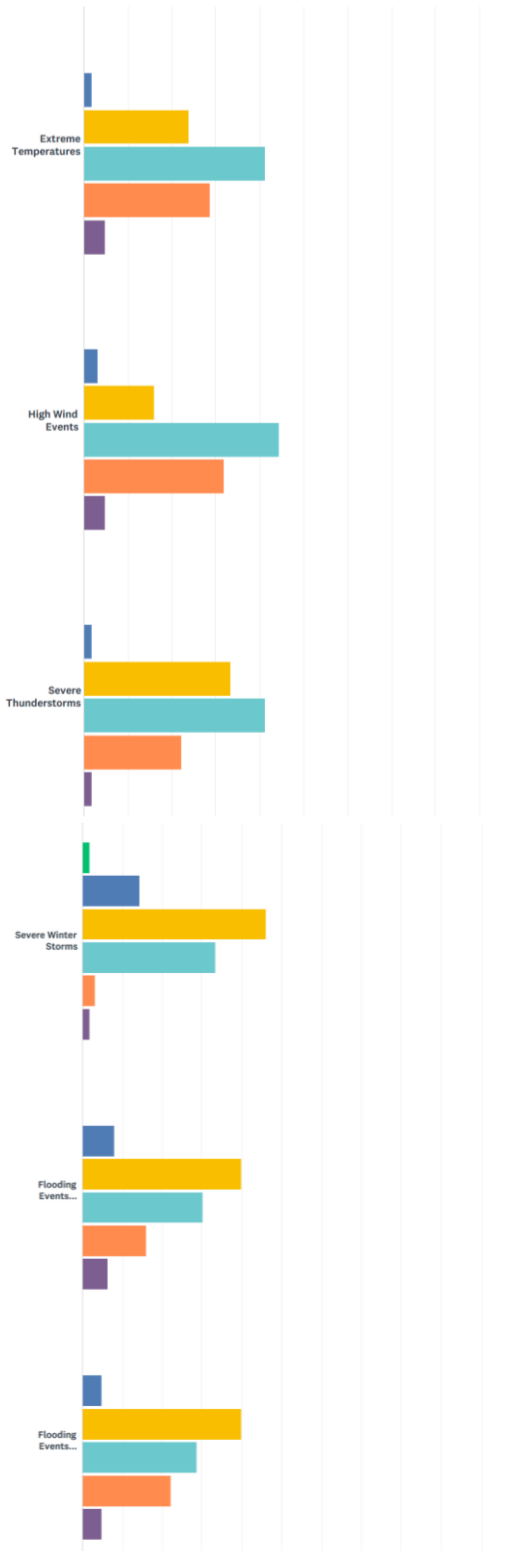




## Appendix D: Meeting Documentation

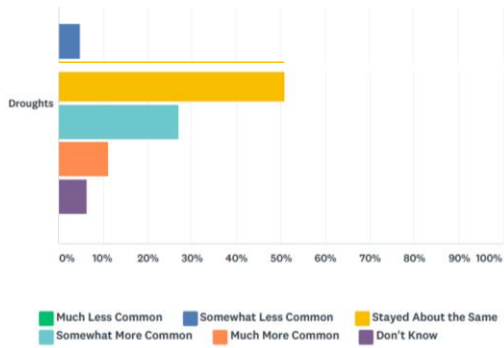
Q8 Have the following types of weather events become more or less common in your community over the past five (5) years, or have they stayed about the same?

Answered: 63 Skipped: 0



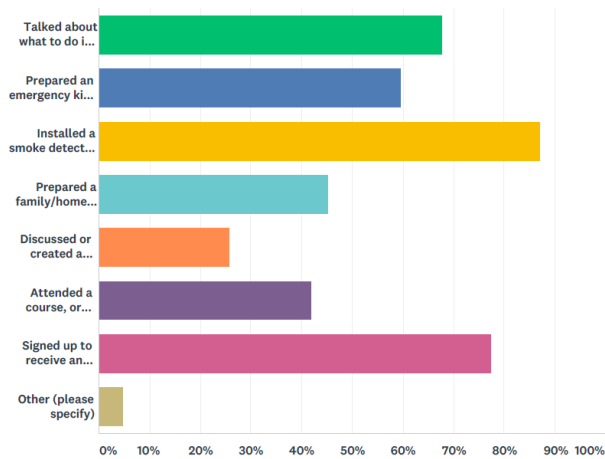


## Appendix D: Meeting Documentation



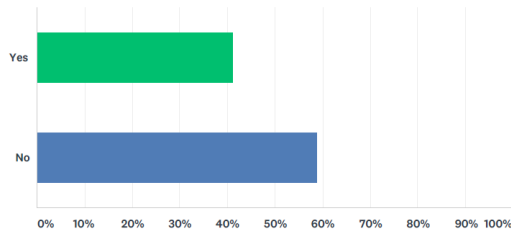
Q9 In your household, has anyone done any of the following natural disaster preparedness activities? (check all that apply)

Answered: 62 Skipped: 1



Q10 Have you ever received information on how to make your home or business better prepared for natural hazards?

Answered: 63 Skipped: 0



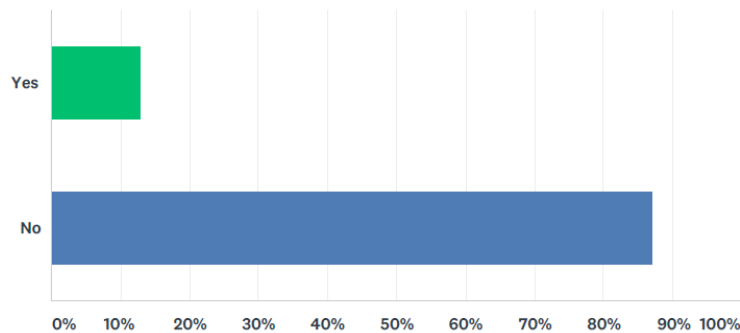




## Appendix D: Meeting Documentation

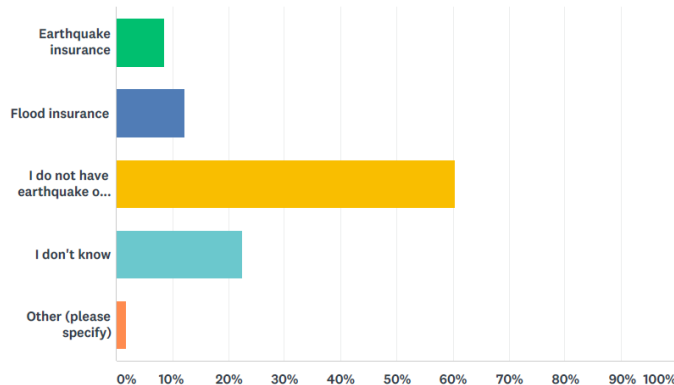
Q11 Does your street regularly flood or experience sustained puddling during rain events?

Answered: 62 Skipped: 1



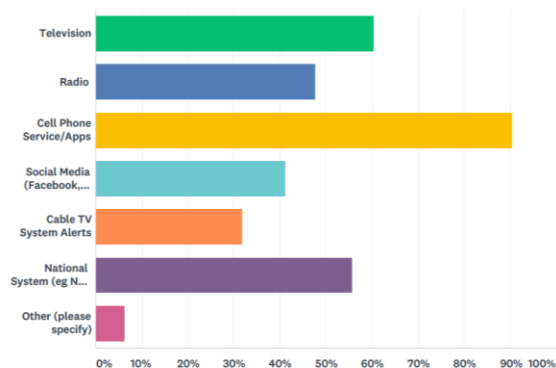
Q12 Is there any supplemental insurance on your property? (check all that apply)

Answered: 58 Skipped: 5



Q13 How do you receive information regarding severe weather events? (check all that apply)

Answered: 63 Skipped: 0





## Appendix D: Meeting Documentation

Q14 Please use this space to provide any questions, comments, concerns regarding natural hazard, or other hazard, risks or preparedness.

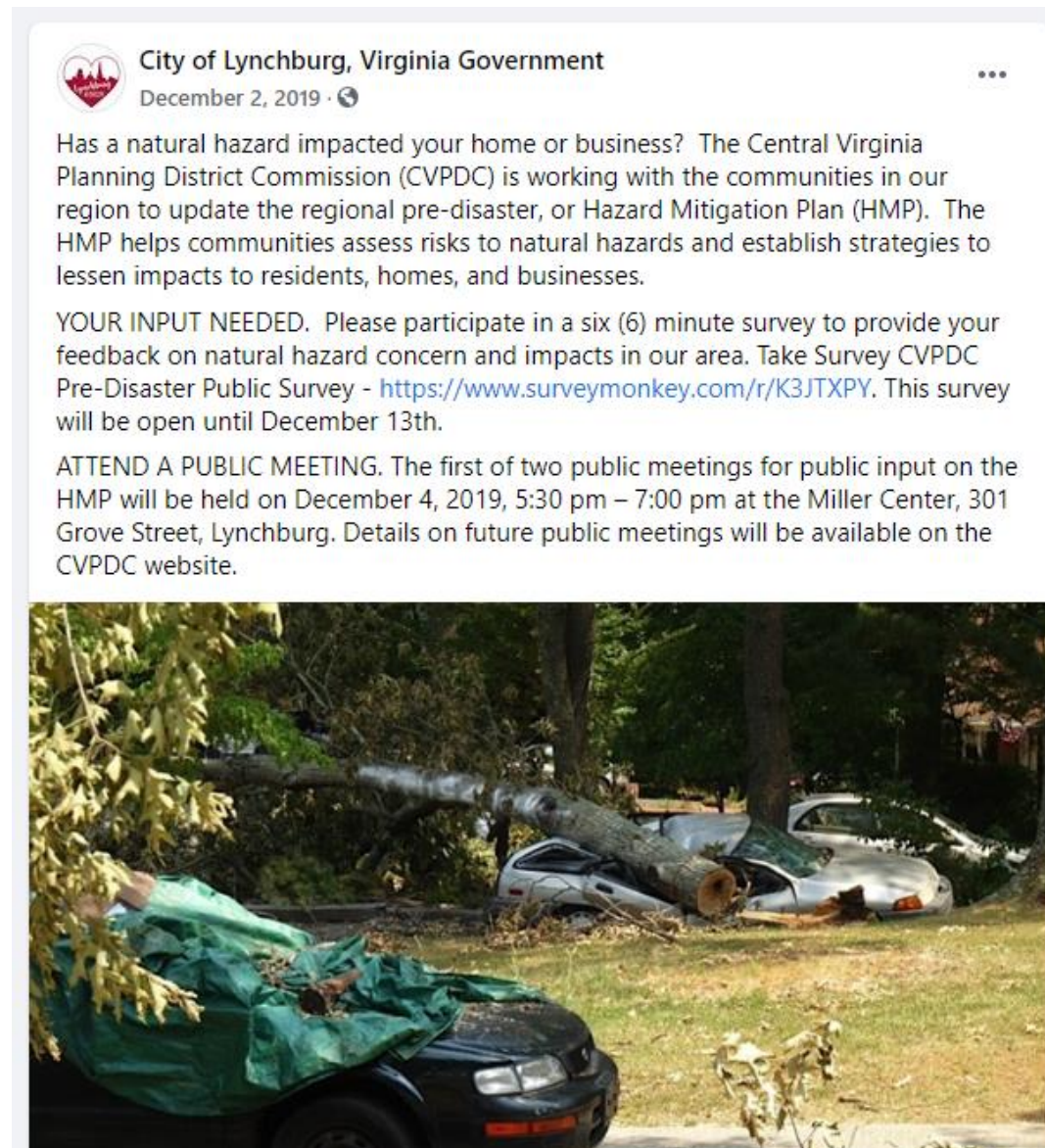
Answered: 12   Skipped: 51



# Appendix E: Public Involvement Documentation

## Appendix E: Public Involvement Documentation

### Social Media





## Appendix E: Public Involvement Documentation



Central Virginia Planning District Commission

June 25 · 🌐



The Regional Hazard Mitigation Plan Public Webinar is tonight at 5:30.

Access the meeting on your computer here: <https://bit.ly/CentralVAHMP>  
or join by phone at: 1-646-558-8656, ID# 86310619766.



THU, JUN 25

Regional Hazard Mitigation Plan Public Meeting Webinar

★ Interested ▾





## Appendix E: Public Involvement Documentation

 Central Virginia Planning District Commission  
June 17 · 🌐

Has your home, business, or community been impacted or damaged by a natural hazard?

Learn how area localities are developing a plan to establish strategies to lessen the overall impact and vulnerability from natural hazards to individuals, families, businesses, and property within our region. Participate in the Public Webinar, Thursday, June 25, 2020 to learn about the pre-disaster plan, hazard natural data and resource information for our area, review draft mitigation str... See More



REGIONAL HAZARD MITIGATION

**PUBLIC WEBINAR**

THURSDAY, JUNE 25 | 5:30PM

Join at: <https://bit.ly/CentralVAHMP>





## Appendix E: Public Involvement Documentation





## Appendix E: Public Involvement Documentation



Central Virginia Planning District Commission

December 4, 2019 · 🌐

...

Has a natural hazard impacted your home or business? The CVPDC is updating the regional pre-disaster, or Hazard Mitigation Plan (HMP). Join us this evening (12/4) at the Miller Center, 301 Grove Street, Lynchburg to learn about the HMP and provide input on your concerns about or impact from natural hazards in our region. Learn more at [www.cvpdc.org](http://www.cvpdc.org).



Central Virginia Planning District Commission

December 2, 2019 · 🌐

...

The region is developing a pre-disaster, or Hazard Mitigation Plan (HMP), to establish strategies to lessen the overall vulnerability of natural hazards to individuals and property. Attend the HMP Public Meeting 5:30 - 7:00 pm, December 4th at the Miller Center, 301 Graves St, Lynchburg to learn and comment on this Plan.



1

3 Shares





## Appendix E: Public Involvement Documentation



Central Virginia Planning District Commission

November 20, 2019 -

...

Has a natural hazard impacted your home or business? The CVPDC is updating the regional pre-disaster, or Hazard Mitigation Plan (HMP). The HMP helps communities assess risk to natural hazards and establish strategies to lessen impacts to residents & property. **YOUR INPUT IS NEEDED:** Please participate in a 6-minute survey to provide your feedback on hazard concern & impacts in our area. Access survey at: <https://www.surveymonkey.com/r/K3JTXPY>.





# Appendix E: Public Involvement Documentation



Amherst County

November 26, 2019 · 🌐

...

## REGIONAL PRE-DISASTER MITIGATION PLAN – COMMUNITY INPUT NEEDED

Has your home, business, or community been impacted or damaged by a natural hazard?

The Central Virginia Planning District Commission (CVPDC) is working with area communities to develop a pre-disaster plan, or Hazard Mitigation Plan, to establish strategies ahead of natural disasters to lessen the overall impact and vulnerability to individuals, families, businesses and property in our region.

### Community Input Needed

Area residents, stakeholders, and business community are asked to provide feedback on your concerns and how you and your community prepare to be more resilient from natural disaster impacts.

### How to Participate

1. Take a Survey. Please take six (6) minutes to provide your feedback on natural disasters in your community. Go to the CVPDC Pre-Disaster Public Survey to participate:

<https://www.surveymonkey.com/r/K3JTXPY>

2. Attend a Public Meeting. There will be at least two project public meetings.

What: CVPDC Hazard Mitigation Plan Public Meeting #1

When: Wednesday, December 4, 2019; 5:30 pm - 7:00 pm

Where: The Miller Center, 301 Grove Street, Lynchburg

3. Stay Informed.

Go to <https://www.cvpdc.org/regional-initiatives/hazard-mitigation.html> to learn more about the regional pre-disaster plan, Hazard Mitigation planning, VDEM and FEMA.



Amherst County

June 17 · 🌐

...

Has a natural hazard impacted your home or business? Join in a public meeting webinar June 25th @ 5:30 to learn about the regional pre-disaster, or Hazard Mitigation Plan (HMP).

Participants will learn about the HMP, proposed strategies to lessen hazard impacts to residents, property and businesses and how to comment on the Plan.

Join at: <https://us02web.zoom.us/j/86310619766>

or toll free, 1-646-558-8656, ID# 86310619766.



## Appendix E: Public Involvement Documentation



Campbell County Department of Public Safety

...

June 9 · 🌐

Has a natural hazard impacted your home or business? Join in a public meeting webinar on June 25, 2020 at 5:30 p.m. to learn about the Regional Pre-Disaster, or Hazard Mitigation Plan (HMP).

Participants will learn about the HMP, proposed strategies to lessen hazard impacts to residents, property and businesses and how to comment on the Plan.

Join at <https://us02web.zoom.us/j/86310619766> or toll free, 1-646-558-8656, ID# 86310619766.





## Appendix E: Public Involvement Documentation



Campbell County Department of Public Safety

November 19, 2019 · 🌐

...

Central Virginia Planning District Commission Requests Community Input for Pre-Disaster Planning

Has your home, business, or community been impacted or damaged by a natural hazard?

The Central Virginia Planning District Commission (CVPDC) is working with area communities to develop a pre-disaster plan, or Hazard Mitigation Plan, to establish strategies ahead of natural disasters to lessen the overall impact and vulnerability to individuals, families, businesses and property... See More



Town of Altavista, Virginia

Page · 1.7K like this · Government Organization

...

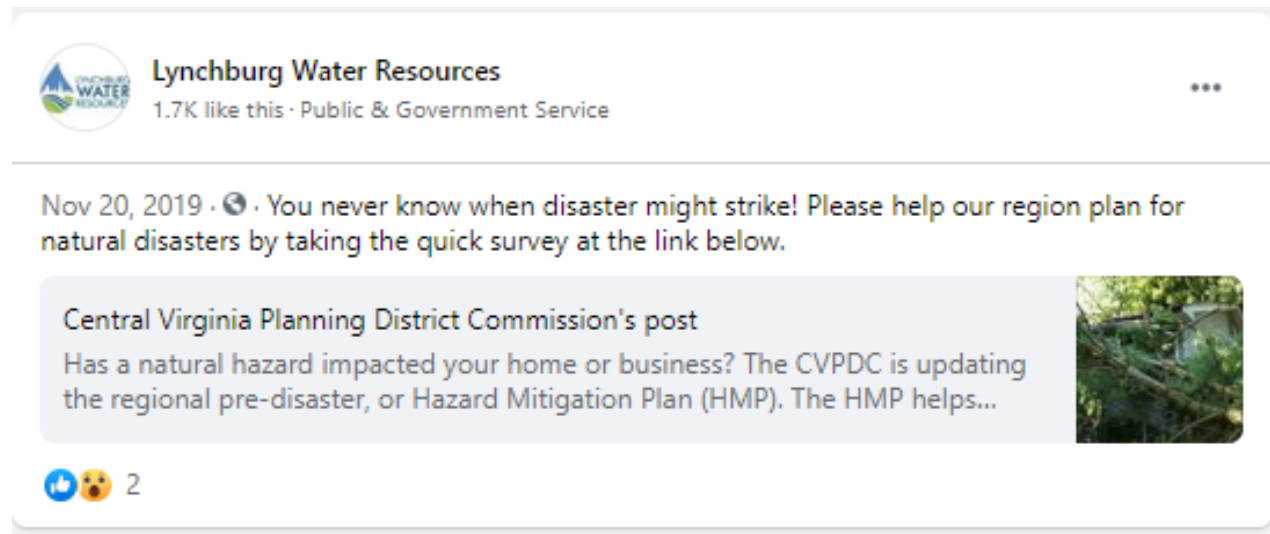
Jun 10 · 🌐 · Has a natural hazard impacted your home or business? Join in a public meeting webinar June 25th @ 5:30 to learn about the regional pre-disaster, or Hazard Mitigation Plan (HMP). Participants will learn about the HMP, proposed strategies to lessen hazard impacts to residents, property and businesses and ho...



👍 3



# Appendix E: Public Involvement Documentation



Central Virginia Planning District Commission

## NEWSLETTER

### Regional Pre-Disaster Mitigation Plan Public Meeting: June 25

Participate in the public webinar to learn more about the regional plan and provide feedback.

Has your home, business, or community been impacted or damaged by a natural hazard? The CVPDC is developing a pre-disaster plan, or Hazard Mitigation Plan, to establish strategies to lessen the vulnerability and impact from natural hazards to individuals, families, businesses, and property in the region.

Community Input Opportunity: **Participate in the Public Webinar, Thursday, June 25<sup>th</sup> at 5:30 p.m.** to hear about the regional hazard data, plan resource information and area draft mitigation strategies. Participants also learn how to directly access the resource information and provide comment on the regional Hazard Mitigation Plan.

#### Meeting Information:

Join the Webinar [here](#), or participate via phone using the information below:

Toll Free: 1-846-558-8656

Meeting ID: 863 1061 9766



# Appendix E: Public Involvement Documentation

Posted on: November 19, 2019

## [ARCHIVED] REGIONAL PRE-DISASTER MITIGATION PLAN – COMMUNITY INPUT NEEDED

### REGIONAL PRE-DISASTER MITIGATION PLAN – COMMUNITY INPUT NEEDED

Has your home, business, or community been impacted or damaged by a natural hazard?

The Central Virginia Planning District Commission (CVPDC) is working with area communities to develop a pre-disaster plan, or Hazard Mitigation Plan, to establish strategies ahead of natural disasters to lessen the overall impact and vulnerability to individuals, families, businesses and property in our region.



#### Community Input Needed

Area residents, stakeholders, and business community are asked to provide feedback on your concerns and how you and your community prepare to be more resilient from natural disaster impacts.

#### How to Participate

1. Take a Survey. Please take six (6) minutes to provide your feedback on natural disasters in your community. Go to [CVPDC Pre-Disaster Public Survey](#) to participate.
2. Attend a Public Meeting. There will be at least two project public meetings.

What: CVPDC Hazard Mitigation Plan Public Meeting #1

When: Wednesday, December 4, 2019; 5:30 pm – 7:00 pm

Where: The Miller Center, 301 Grove Street, Lynchburg

3. Stay Informed.

Go to <https://www.cvpdc.org/regional-initiatives/hazard-mitigation.html> to learn more about the regional pre-disaster plan, Hazard Mitigation planning, VDEM and FEMA.



# Appendix E: Public Involvement Documentation

## Local News Station

NEWSWEATHERCORONAVIRUSFEATURESCHIME INWATCH

### Residents input needed in developing region's pre-disaster or Hazard Mitigation Plan

by Ida Domingo | Monday, November 18th 2019

Remember: Daylight savings time ends at 2:00am November 3, 2019

14341 845-3431

HOMEABOUTCONSOLIDATED SERVICESREGIONAL INITIATIVESCOMMUNITY DEVELOPMENTTRANSPORTATIONRESOURCES

#### Hazard Mitigation

The Federal Emergency Management Agency (FEMA) requires localities develop and maintain a plan that examines the risk and impact of natural disasters and establishes strategies to mitigate or lessen human and property impacts. To ensure FEMA mitigation grant fund eligibility, the mitigation plan must be updated every five years.

*A Hazard Mitigation Plan is developed for an area to assess natural hazards vulnerability and establish strategies to lessen the overall impact and vulnerability to individuals, families, businesses, and property within our region to natural disasters. (CVPDC)*

LYNCHBURG, Va. (WSET) -- The Central Virginia Planning District Commission (CVPDC), through grant funding provided by the Virginia Department of Emergency Management (VDEM), and in partnership with area localities and community stakeholders is developing a pre-disaster plan or Hazard Mitigation Plan.



# Appendix E: Public Involvement Documentation

## Local Newspaper

[https://newsadvance.com/news/local/public-input-wanted-on-central-virginias-hazards/article\\_6d728076-c822-5a6b-961b-176e321fba24.html](https://newsadvance.com/news/local/public-input-wanted-on-central-virginias-hazards/article_6d728076-c822-5a6b-961b-176e321fba24.html)

Public input wanted on Central Virginia's hazards

### Public input wanted on Central Virginia's hazards

By Olivia Johnson Nov 30, 2019

Only \$5 for 5 months



An aerial view of tornado damage along Timberlake Road in Campbell County, pictured on Tuesday, April 17, 2018. News & Advance file photo/Jay Westcott



**L**ocal officials are seeking input from residents to develop a plan that could mitigate damage after disasters — such as the tornadoes and flooding that hit Lynchburg and the surrounding counties in 2018.

On Dec. 4, the Central Virginia Planning District Commission (CVPDC) will hold the first of two public meetings to present a draft update to its Hazard Mitigation Plan — also called a pre-disaster plan — and encourage citizens to give feedback and share concerns regarding how to prepare for natural disasters in their area.

The plan, which localities are required to revise every five years, covers Amherst, Appomattox, Bedford and Campbell counties, the city of Lynchburg, and the towns of Altavista, Amherst, Appomattox, Bedford and Brookneal.

First created in 2006, the plan aims to lessen the negative impact on individuals, businesses and properties when a natural disaster occurs, like flooding, high winds, tornadoes or extreme heat.

“These large natural hazard events are happening, and the cost ... is so



#### Professional Installation

LeafFilter installs on your existing gutters & ends the reoccurring of clogged gutters.

LeafFilter Gutter Guards

[Learn More](#)





# Appendix F: Plan Comments

## Appendix F: Plan Comments

Chapter	Comments
Dam	Double check to see if this is in the base floodplain.
	The point and footprint representing this facility are out of the base floodplain. However, the imagery shows the east corner of the lot is partially in floodplain.
	Are we missing Buffalo River Dam#1 - Mill Creek Reservoir
	Mill Creek Reservoir Dam (aka Buffalo River Dam #4A) is not a high hazard dam in DSIS inventory.
	The New Camp Hydaway Dam, Inventory No. 031035 is not constructed yet. (will be high hazard & has been added to this document) The existing Camp Hydaway Dam, Inventory No. 031013 is currently present upstream of the proposed new and enlarged lake. The existing dam/lake will be decommissioned as part of the overall construction plan of new and enlarged dam/lake.) (This is an unknown hazard dam, once decommissioned the total number of unknown hazard dams will be 21.
Flooding	Provide updated insurance info
	These numbers need to be reviewed.
	Although we removed outbuildings for the economic analysis, can we show how many are exposed to the flood hazard. How many sheds are in the floodplain?
	This is confusing. Is this 178 in the 0.2%?
	Same comment for all communities.
	Is this 4 in each or 4 total?
	Need to update with final number.
	Is this 8 in each of the flood zones or 8 total?
	Need to add the nuclear facility at Mt. Athos. It is still in use by both Framatome and BWXT.
	This is not the only definition of RL or what is used for the list. Recommend adding the full definition related to insurance.
	Replace: "Lynchburg College" with "University of Lynchburg"
	Maybe include the % difference to give the reader an idea of how significant the increase is? I think it could be really useful to add a new table that shows the difference for all the communities between the 2 scenarios. Most people don't understand their flood risk, and it's especially difficult to grasp how this can change when talking about floods by 1%/.2% or 100yr/500yr. These values are going to be a great way to show those impacts, but I wouldn't assume that readers will go back and forth between the tables to figure it out on their own.
	Add: "The Altavista Water Plant and the Intake Pump Station are in the floodplain. (The Plant is in Pittsy..."
	Delete: "Local NFIP coordinators should be contacted for more detailed information." Removed this because they're not allowed to share this information with the public beyond what is in this plan, and I think this makes it sound like they can get additional details if they ask.



# Appendix F: Plan Comments

Chapter	Comments
Droughts	Does the Amherst County number include the Town of Amherst? If so, the number looks low to me.
Earthquakes	<p>This is a very good point, but I think it important to remember that the magnitudes that we have for older EQs are in ML or Mb rather than Mw. For instrumentally measured magnitudes, we indicated the magnitude type in the DMME earthquake database (you can see this in Table 2 below). I think it is important to recognize both...but that might be getting into the weeds too much for a hazard plan.</p> <p>We now use the Moment Magnitude Scale not the Richter Scale. Moment magnitude is a better indicator of the amount of energy released. <a href="https://www.usgs.gov/faqs/moment-magnitude-richter-scale-what-are-different-magnitude-scales-and-why-are-there-so-many?qt-news_science_products=0#qt-news_science_products">https://www.usgs.gov/faqs/moment-magnitude-richter-scale-what-are-different-magnitude-scales-and-why-are-there-so-many?qt-news_science_products=0#qt-news_science_products</a></p> <p>In the vulnerability section, we should also list the older, unreinforced masonry critical facilities that would be highly susceptible to earthquake.</p> <p>We need to look at these numbers. Hazus shouldn't require a magnitude to run the AEL - it runs all the probabilities and annualizes them. Is this a 2500-year event maybe? Also, the Mineral event should probably be moved to the edge of the seismic zone and not put into the middle of Lynchburg.</p>
Extreme Temperatures - Heat	
fog	<p>We could ask the jurisdictions which roads have frequent accidents due to fog and highlight those.</p> <p>Add: "Folks locally know that this area, especially L'burg City, Bedford &amp; Amherst experience fog fairly f..."</p>
Hailstorm	Do we have damage by jurisdiction? I'm thinking we can do an average annualized loss table here. We could do this for all the hazards where we have data on damage amounts. This will help us better compare hazards.
Hazardous Material Incidents	Also worse if had taken place on a warm, sunny day. There were not people on the trail and sitting on Depot grille deck.
Hurricane	<p>Would be good to identify vulnerable critical facilities here - based on building characteristics and generator information. Same as other wind events - could refer to tornado section.</p> <p>Also, need to discuss what makes a structure more susceptible to hurricane damage - similar to tornado.</p>
Land subsidence and Karst	
Landslide	We have received 1-meter LIDAR for this area and there are indeed landslides associated with Hurricane Camille in northern Amherst County. That may be too much new data for this round of edits. May want to save for the next iteration of the hazard plan.



# Appendix F: Plan Comments

Chapter	Comments
	This was so minor, I'm surprised that USGS picked up on it. It was literally just a little burp off of the road embankment. Not really even large enough to add to my landslide database. You can see a picture here: <a href="https://wset.com/news/local/mudslide-on-route-501-in-bedford">https://wset.com/news/local/mudslide-on-route-501-in-bedford</a>
	where did magnitude 6 come from? Magnitude 6 on east coast is different from west coast. Is there a reference?
	It was from the feedback of Anne Witt (DMME): "EQ not large enough here must be M+6.0"
	Yes, we have never had an earthquake in Virginia larger than a M 6.0. This would not be a major factor in LS generation in Virginia. Maybe reword sentence to remove the reference to earthquakes all together and add hurricanes?
Severe thunderstorm	This should be moved to the mitigation section. GI can be used for several of the hazards.
Severe Winter Storm	
Solar Events	
Terrorism	
Tornado Wind	There is an option in the full version of Word to landscape selected text (also pages, this is under the Page Setup options. It will make the document more presentable as an electronic document and still print the way intended.
	Thank Erin for the tip. We will make the final formatting in Word with appropriate page orientations. (Google Doc doesn't support mixed page orientation in one document)
urban fire	(For Amherst, Central VA Training Center is scheduled to close mid-2020; all residents have been relocated off campus, there are only 12 staff working there, almost all of the buildings are empty and not being used, and many of them are derelict. I don't know if all this would impact its listing as a critical facility.) (For Amherst, would the ACSA water plant and major sewage pump station be critical facilities?) (For Amherst, there are many more schools and churches than are listed. The same with fire stations, police stations, and other facilities that are listed under other CVPDC areas) these just critical facilities within urban area rather than entire jurisdiction
Wildfire	This might be better in the mitigation section.
	I don't see red areas in Bedford County. Is there a way to better show those areas?
	Only one pixel is categorized as "very high". Maybe I could merge the "high" and "very high" categories together.
Mitigation	It is easier to reference specific items if they are in a number or letter sequence. I selected letters so they wouldn't conflict with the other numbering.
	communities and governments; referred-to simply as the "region"
	clarify that the objective is information nor education
	Identify public shelters and locations.



## Appendix F: Plan Comments

Chapter	Comments
	This objective fits here much better than were it was. Succeeding sections need renumbering.
	define flood plains
	Note: in I Obj 3 and 4 you identify two specific hazards and provide detail on information and education on fire and floods. What about the other hazards: earthquakes, hurricanes, ice storms, draughts, heat waves, etc. Aren't there comparable detailed materials available? Information? Best practices? Education? Etc. Couldn't you develop a generic list of activities you propose under a generic Objective?
	You can not prevent natural hazards and even for hazmat spills they are difficult for communities to prevent. You can only prepare for them
	Made all the goal statements parallel in structure and internally consistent.
	Preplanning and site visits of what?
	Long and convoluted strategy - needs clarification and rewording
	These individual strategies seem to apply to different stakeholders, is that intended?
	Only two strategies for high winds which would include tornadoes and hurricanes? What about zoning changes? design best practices? etc
	These are three significantly different systems and really deserve three different strategies.
	What are "fire zone practices"?



# Appendix G: Critical Facilities

## Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Amherst	Airport	TIMBERDOODLE AIRPORT	EBENEZER RD	AMHERST	24521	37.5361, -79.0230
Amherst	Airport	FULCHER FAMILY FARMS AIRPORT	519 LITTLE PINEY RD	ROSELAND	22967	37.7251, -79.0831
Amherst	Airport	BUFFALO RIDGE AIRPORT	237 AIRSPORTS DR	AMHERST	24521	37.6053, -79.0164
Amherst	Attractions	MONACAN ANCESTRAL MUSEUM	2003 KENMORE RD	AMHERST	24521	37.3863, -78.8131
Amherst	Attractions	AMHERST COUNTY MUSEUM AND HISTORICAL SOCIETY	154 S MAIN ST	AMHERST	24521	37.3604, -78.8689
Amherst	Campground	OTTER CREEK CAMPGROUND	60809 BLUE RIDGE PKWY	MONROE	24574	37.2631, -78.8494
Amherst	Campground	LYNCHBURG/BLUE RIDGE PARKWAY KOA	6252 ELON RD	MONROE	24574	37.3271, -79.4048
Amherst	Campground	SHADY MOUNTAIN CAMPGROUND	1405 PANTHER FALLS RD	VESUVIUS	24521	37.3485, -79.5720
Amherst	Campground	ORONOCO CAMPGROUND	316 NATURE CAMP TRAIL	VESUVIUS	24483	37.2331, -79.5854
Amherst	College	SWEET BRIAR COLLEGE	151 QUAD	AMHERST	24595	37.2887, -79.4469
Amherst	College	CENTRAL VIRGINIA COMMUNITY COLLEGE - AMHERST CENTER	200 RICHMOND HWY	AMHERST	24521	37.1417, -79.0164
Amherst	Communication Facility	WAMV - AM - COMMUNITY FIRST BROADCASTERS, INC.	531 HIGGINBOTHAM CREEK RD	AMHERST	24521	37.4143, -78.9642
Amherst	Communication Facility	WAMV - AM - COMMUNITY FIRST BROADCASTERS, INC.	104 BUCK HILL DR	AMHERST	24521	37.2717, -79.3359
Amherst	Communication Facility	WBRG - AM - TRI-COUNTY BROADCASTING, INC.	239 RAGLAND RD	MADISON HEIGHTS	24572	37.3779, -79.1222
Amherst	Communication Facility	WVGM - AM - 3 DAUGHTERS MEDIA, INC.	181 MAIN ST	MADISON HEIGHTS	24572	37.3254, -79.2012
Amherst	Communication Facility	WKPA - AM - SEVEN HILLS MEDIA, INC.	185 INTEGRITY LN	MADISON HEIGHTS	24572	37.1077, -79.5925
Amherst	Communication Facility	WYYD - FS - CAPSTAR TX, LLC	1850 MISTOVER DR	MONROE	24574	37.1188, -79.6028
Amherst	Communication Facility	WZZU - FM - CENTENNIAL LICENSING, LLC	1915 MISTOVER DR	MONROE	24574	37.1126, -79.6092





# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Amherst	Communication Facility	W283AZ - FX - BRENT EPPERSON	239 RAGLAND RD	MADISON HEIGHTS	24572	37.2654, -79.0428
Amherst	Communication Facility	WVBE-FM - FM - MEL WHEELER, INC	1608 MONACAN PKWY	MADISON HEIGHTS	24572	37.4137, -79.1443
Amherst	Communication Facility	WWZW - FM - FIRST MEDIA RADIO, LLC	46840 BLUE RIDGE PKWY	BUENA VISTA	24416	37.4206, -79.1439
Amherst	Communication Facility	WRMV-LP - FL - FELLOWSHIP COMMUNITY CHURCH AND CHRISTIAN SCHOOLS	110 CHURCH ST	MADISON HEIGHTS	24572	37.4142, -79.1543
Amherst	Communication Facility	WSNZ - FM - ALOHA STATION TRUST, LLC	181 MAIN ST	MADISON HEIGHTS	24572	37.4038, -79.1520
Amherst	Communication Facility	WJJX - FM - CAPSTAR TX, LLC	273 ROUND TOP TRL	MADISON HEIGHTS	24572	37.4393, -79.1699
Amherst	Communication Facility	WJJX - FS - CAPSTAR TX, LLC	1850 MISTOVER DR	MONROE	24574	37.4149, -79.1565
Amherst	Communication Facility	WLNI - FM - CENTENNIAL LICENSING, LLC	181 MAIN ST	MADISON HEIGHTS	24572	37.3803, -79.1963
Amherst	Communication Facility	WNRS-FM - FM - STU-COMM, INC	1915 MISTOVER DR	MONROE	24574	37.4162, -79.1403
Amherst	Communication Facility	W204AZ - FX - CALVARY CHAPEL OF LYNCHBURG	273 ROUND TOP TRL	MADISON HEIGHTS	24572	37.3305, -79.5360
Amherst	Electrical Substation	ELECTRICAL SUBSTATION	311 PLUNKETT ST	AMHERST	24521	37.1300, -79.2697
Amherst	Electrical Substation	ELECTRICAL SUBSTATION	688 ORANGE ST	MADISON HEIGHTS	24572	37.3713, -78.8244
Amherst	Electrical Substation	ELECTRICAL SUBSTATION	720 BLUE RIDGE AVE	MADISON HEIGHTS	24572	37.5729, -79.1270
Amherst	Electrical Substation	ELECTRICAL SUBSTATION	1551 DAWN DR	MADISON HEIGHTS	24572	37.5867, -79.0520
Amherst	Electrical Substation	ELECTRICAL SUBSTATION	2188 MCGHEE ST	AMHERST	24521	37.0699, -79.5819
Amherst	Electrical Substation	ELECTRICAL SUBSTATION	8908 BIG ISLAND HWY	AMHERST	24521	37.4428, -79.6045
Amherst	Electrical Substation	ELECTRICAL SUBSTATION	1026 CHURCHILL RD	MONROE	24574	37.0834, -79.5951
Amherst	Electrical Substation	ELECTRICAL SUBSTATION	2746 MT ATHOS RD	MONROE	24574	37.0622, -79.5601
Amherst	Electrical Substation	ELECTRICAL SUBSTATION	22239 TIMBERLAKE RD	MONROE	24574	37.2232, -79.7753
Amherst	Electrical Substation	ELECTRICAL SUBSTATION	3770 CANDLERS MOUNTAIN RD	LYNCHBURG	24503	37.1397, -79.6464



# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Amherst	Emergency Operations Center	AMHERST COUNTY EMERGENCY OPERATIONS CENTER	874 BLUE RIDGE AVE	AMHERST	24521	37.1548, -79.6994
Amherst	Energy Facility	CUSHAW HYDRO POWER PLANT	139 LANCER LN	MONROE	24526	37.0595, -79.4468
Amherst	Energy Facility	SNOWDEN HYDRO POWER PLANT	219 TROJAN LN	BIG ISLAND	24526	37.0998, -79.6246
Amherst	Fire Stations	GREIF BROTHERS PACKAGING CORPORATION - RIVERVILLE MILL FIRE BRIGADE AND EMERGENCY MEDICAL SERVICES	578 LAWYERS RD	GLADSTONE	24553	37.2234, -79.6669
Amherst	Fire Stations	AMHERST VOLUNTEER FIRE DEPARTMENT	1271 VOLUNTEER RD	AMHERST	24521	37.1569, -79.4332
Amherst	Fire Stations	PEDLAR VOLUNTEER FIRE AND RESCUE	1901 TATE SPRINGS RD	AMHERST	24521	37.4704, -79.1918
Amherst	Fire Stations	MONELISON VOLUNTEER FIRE DEPARTMENT	3180 FORT AVE	MADISON HEIGHTS	24572	37.2370, -79.4137
Amherst	Gas Facility	GAS FACILITY	3621 CANDLERS MOUNTAIN RD	AMHERST	24521	37.3073, -79.6844
Amherst	HazMat Facility	GREIF PACKAGING CONTAINERBOARD MILL	1324 MITCHELL BELL RD	GLADSTONE	24521	37.1944, -79.5664
Amherst	HazMat Facility	OLD VIRGINIA BRICK CO	4201 MURRAY PL	MADISON HEIGHTS	24572	37.2147, -79.4621
Amherst	HazMat Facility	LYNCHBURG STEEL & SPECIALTY CO INC	FOUNDER'S LN	MONROE	24574-2758	37.1583, -79.6617
Amherst	HazMat Facility	THOMAS ROAD LANDFILL (AMSTED IND-GRIFFIN PIPE PRODUCTS CO)	16538 SMITH MOUNTAIN LAKE PKWY	MADISON HEIGHTS	24572	37.1417, -79.5865
Amherst	Law Enforcement	AMHERST COUNTY SHERIFFS OFFICE	1604 GRAVES MILL RD	AMHERST	24521	37.4505, -79.6346
Amherst	Law Enforcement	AMHERST POLICE DEPARTMENT	931 ASHLAND AVE	AMHERST	24521	37.0605, -79.4484
Amherst	Law Enforcement	CENTRAL VIRGINIA TRAINING CENTER POLICE DEPARTMENT	1203 ROUNDTREE DR	MADISON HEIGHTS	24572	37.5760, -79.3379
Amherst	Public Health	AMELON IMMEDIATE CARE	200 CLARION RD	MADISON HEIGHTS	24572	37.5744, -79.3247
Amherst	Schools	SOLID ROCK BAPTIST CHURCH	521 COLONY RD	MADISON HEIGHTS	24572	37.7170, -79.2893
Amherst	Schools	TEMPLE CHRISTIAN SCHOOL	1073 FATHER JUDGE RD	MADISON HEIGHTS	24572	37.7488, -79.2653
Amherst	Schools	AMELON ELEMENTARY	1916 REDFIELDS RD	MADISON HEIGHTS	24572	37.3372, -78.9372
Amherst	Schools	AMHERST COUNTY HIGH	198 EVERGREEN AVE	AMHERST	24521	37.3945, -78.6395



# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Amherst	Schools	AMHERST EDUCATIONAL CENTER	176 KIDS PL	MADISON HEIGHTS	24572	37.2108, -79.0496
Amherst	Schools	AMHERST ELEMENTARY	2020 CHURCH ST	AMHERST	24521	37.1116, -78.9304
Amherst	Schools	AMHERST MIDDLE	185 LEARNING LN	AMHERST	24521	37.3644, -79.1797
Amherst	Schools	CENTRAL ELEMENTARY	1032 BIBLE LN	AMHERST	24521	37.3951, -79.1515
Amherst	Schools	ELON ELEMENTARY	1071 WOODBERRY SQUARE PL	MADISON HEIGHTS	24572	37.3977, -79.1842
Amherst	Schools	MADISON HEIGHTS ELEMENTARY	729 BLUE RIDGE AVE	MADISON HEIGHTS	24572	37.3757, -79.2263
Amherst	Schools	MONELISON MIDDLE	100 ASHWOOD DR	MADISON HEIGHTS	24572	37.4374, -79.1708
Amherst	Schools	PLEASANT VIEW ELEMENTARY	1374 RIVERMONT ACADEMY RD	MONROE	24574	37.3589, -79.1844
Amherst	Schools	TEMPERANCE ELEMENTARY	1027 HUDDLESTON DR	AMHERST	24521	37.3503, -79.1797
Amherst	Schools	CENTRAL VIRGINIA TRAINING CENTER	1 CAVALIER CIRCLE	MADISON HEIGHTS	24572	37.4169, -79.1714
Amherst	Schools	OLD DOMINION JOB CORPS CENTER	100 LIBERTY MINUTEMEN DR	MONROE	24521	37.5563, -79.0797
Amherst	Service Authority	AMHERST COUNTY SERVICE AUTHORITY WATER OFFICE	1200 LANE ACCESS RD	MADISON HEIGHTS	24572	37.5840, -79.0483
Amherst	Sewer Pump Station	PUMP STATION	4690 PEAKS RD	AMHERST	24521	37.3524, -79.2286
Amherst	Sewer Pump Station	SEWER PUMP STATION	1134 FANCY FARM RD	AMHERST	24521	37.3446, -79.4987
Amherst	Special Population Facility - Nursing Home	FAIRMONT CROSSING REHABILITATION AND HEALTH CARE CENTER	215 EVERGREEN AVE	AMHERST	24521	37.3611, -78.8292
Amherst	Special Population Facility - Nursing Home	JOHNSON SENIOR CENTER INC.	4400 HYDRO ST	AMHERST	24521	37.5397, -79.0528
Amherst	Special Populations Facility - Detention Facility	AMHERST COUNTY ADULT DETENTION CENTER	165 GORDONS FAIRGROUND RD	MADISON HEIGHTS	24572	37.5397, -79.0917
Amherst	Special Populations Facility - Detention Facility	AMHERST COUNTY JAIL / SHERIFF	147 YOUNGER DR	AMHERST	24521	37.3475, -79.5234
Amherst	Wastewater Treatment Plant	RUTLEDGE CREEK WWTP	1000 FRANKLIN AVE	AMHERST	24521	37.4208, -79.1152
Amherst	Wastewater Treatment Plant	LANUM WATER FILTRATION PLANT	1355 ELON RD	MADISON HEIGHTS	24572	37.0384, -78.9420
Amherst	Wastewater Treatment Plant	AMHERST WATER TREATMENT PLANT	208 GRANDVIEW DR	AMHERST	24521	37.3717, -78.8350



# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Amherst	Water Storage Facility	WATER TANK	2438 PAMPLIN RD	AMHERST	24521	37.1647, -79.6343
Amherst	Water Storage Facility	UNION HILL WATER TANK	1424 MARVIN DR	AMHERST	24521	37.4272, -79.1235
Amherst	Water Storage Facility	UNKNOWN WATER FACILITY	210 CASCADE DR	MADISON HEIGHTS	24572	37.1225, -79.2890
Amherst	Water Storage Facility	WATER TANK	574 HIGH POINT RD	MADISON HEIGHTS	24572	37.4644, -79.1233
Amherst	Water Storage Facility	WATER TANK	1662 CAPEWOOD DR	MADISON HEIGHTS	24572	37.4070, -79.2322
Amherst	Water Storage Facility	WATER TANK	1132 MOUNTAIN WATER DR	MADISON HEIGHTS	24572	37.4275, -79.2231
Amherst	Water Storage Facility	WATER TANK	1375 W LONDON PARK DR	AMHERST	24521	37.4703, -79.3762
Appomattox	Airport	NASHS AIRPORT	162 AIRPORT DR	APPOMATTOX	24522	37.5609, -79.1915
Appomattox	Airport	STATE POLICE DIVISION THREE HELIPORT	132 POLICE TOWER RD	APPOMATTOX	24522	37.3207, -79.6329
Appomattox	Airport	HIGHVIEW FARMS AIRPORT	2212 PROMISE LAND RD	APPOMATTOX	24522	37.5632, -79.1936
Appomattox	Airport	SKOVHUS AIRPORT	469 VINEYARD RD	CONCORD	24538	37.4208, -79.1152
Appomattox	Attractions	AMERICAN CIVIL WAR MUSEUM - APPOMATTOX	159 HORSESHOE RD	APPOMATTOX	24522	37.2856, -79.0901
Appomattox	Campground	PARADISE LAKE FAMILY CAMPGROUND	1265 WEST LAKE RD	SPOUT SPRING	24593	37.4501, -79.0748
Appomattox	Campground	HOLLIDAY LAKE STATE PARK CAMPGROUND	2763 STATE PARK RD	APPOMATTOX	24522	37.2855, -79.0899
Appomattox	College	CENTRAL VIRGINIA COMMUNITY COLLEGE - APPOMATTOX CENTER	132 CARVER LN	APPOMATTOX	24522	37.3490, -79.1679
Appomattox	Communication Facility	WOWZ - AM - PERCEPTION MEDIA, INC.	330 COUNTRY VIEW LN	APPOMATTOX	24522	37.7270, -79.3065
Appomattox	Communication Facility	WTTX-FM - FM - POSITIVE ALTERNATIVE RADIO, INC	330 COUNTRY VIEW LN	APPOMATTOX	24522	37.4704, -79.3762
Appomattox	Electrical Substation	ELECTRICAL SUBSTATION	585 GEORGE ST	APPOMATTOX	24522	37.4201, -79.1317
Appomattox	Electrical Substation	ELECTRICAL SUBSTATION	306 CANDLERS MOUNTAIN RD	APPOMATTOX	24522	37.1973, -79.3517
Appomattox	Electrical Substation	ELECTRICAL SUBSTATION	935 WATERLICK RD	GLADSTONE	24553	37.1973, -79.3517
Appomattox	Emergency Operations Center	APPOMATTOX COUNTY EMERGENCY OPERATIONS CENTER	240 THIRD DIVISION LOOP	APPOMATTOX	24522	37.3858, -79.6686



## Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Appomattox	Fire Stations	APPOMATTOX VOLUNTEER FIRE DEPARTMENT	10770 LEE JACKSON HWY	APPOMATTOX	24522	37.4272, -79.1235
Appomattox	Fire Stations	PAMPLIN VOLUNTEER FIRE DEPARTMENT AND EMERGENCY MEDICAL SERVICES	2401 ATHERHOLT RD	PAMPLIN	23958	37.3717, -78.8350
Appomattox	Gas Facility	WILLIAMS / TRANSCO GAS PIPELINE STATION	600 MAIN ST	APPOMATTOX	24522	37.4704, -79.3762
Appomattox	HazMat Facility	THOMASVILLE FURNITURE IND INC-VIRGINIA OPERATIONS (CLOSED)	3 ABRASIVE AVE	APPOMATTOX	24522	37.4690, -79.0073
Appomattox	HazMat Facility	TIGER FUEL COMPANY	130 COMMERCE ST	APPOMATTOX	24522	37.5609, -79.1915
Appomattox	Law Enforcement	APPOMATTOX COUNTY SHERIFFS OFFICE / APPOMATTOX COUNTY JAIL	2200 LANDOVER PL	APPOMATTOX	24522	37.3591, -79.1587
Appomattox	Law Enforcement	VIRGINIA STATE POLICE DIVISION 3 AREA 21 - HEADQUARTERS	5615 SEMINOLE AVE	APPOMATTOX	24522	37.1608, -79.2241
Appomattox	Schools	APPOMATTOX CHRISTIAN ACADEMY	600 EDMUND ST	APPOMATTOX	24522	37.3490, -79.1679
Appomattox	Schools	APPOMATTOX COUNTY HIGH	12718 MONETA RD	APPOMATTOX	24522	37.4272, -79.1235
Appomattox	Schools	APPOMATTOX ELEMENTARY	1 LITTLE PATRIOT DR	APPOMATTOX	24522	37.5641, -79.1926
Appomattox	Schools	APPOMATTOX MIDDLE	12400 EAST LYNCHBURG-SALEM TPKE	APPOMATTOX	24522	37.4689, -79.0069
Appomattox	Schools	APPOMATTOX PRIMARY	1044 OTTER RIVER DR	APPOMATTOX	24522	37.3591, -79.1588
Appomattox	Sewer Pump Station	SEWER PUMP STATION	1309 TOWNGATE RD	APPOMATTOX	24522	37.3190, -79.2759
Appomattox	Sewer Pump Station	PUMP STATION	11325 E LYNCHBURG SALEM TPKE	APPOMATTOX	24522	37.3490, -79.1679
Appomattox	Sewer Pump Station	PUMP STATION	1601 NICHOLS RD	APPOMATTOX	24522	37.3490, -79.1679
Appomattox	Sewer Pump Station	PUMP STATION	1455 BELMONT DR	APPOMATTOX	24522	37.1975, -79.3519
Appomattox	Special Population Facility - Nursing Home	BABCOCK MANOR INC.	1806 TAYLOR FORD RD	APPOMATTOX	24522	37.3493, -79.1684
Appomattox	Special Population Facility - Nursing Home	APPOMATTOX HEALTH & REHABILITATION CENTER	7933 ELON RD	APPOMATTOX	24522	37.3592, -79.1587
Appomattox	Special Populations Facility - Detention Facility	APPOMATTOX COUNTY JAIL	257 TROJAN RD	APPOMATTOX	24522	37.3416, -78.9880
Appomattox	Wastewater Treatment Plant	APPOMATTOX WATER RECLAMATION FACILITY	180 MOSELEY LN	APPOMATTOX	24522	37.4703, -79.3761
Appomattox	Wastewater Treatment Plant	APPOMATTOX TRICKLING FILTER PLANT	1287 PURDUM MILL RD	APPOMATTOX	24522	37.2855, -79.0900
Appomattox	Water Booster Pump Station	WATER PUMP STATION	902 HELM ST	APPOMATTOX	24522	37.2866, -79.0900





## Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Appomattox	Water Storage Facility	WATER TOWER	106 RIDGEVIEW DR	PAMPLIN	23958	37.2866, -79.0900
Appomattox	Water Storage Facility	WATER TANK	5 BLACKWATER RD	SPOUT SPRING	24593	37.3151, -79.6348
Bedford	Airport	MILLER AIRPORT	2390 BELLS MILL RD	GOODE	24556	37.3592, -79.1587
Bedford	Airport	ROBINSON AIRPORT	1588 PATTERSON MILL RD	BEDFORD	24523	37.3207, -79.6326
Bedford	Airport	JOHNSON FOX FIELD AIRPORT	1376 HARVEYS CREEK RD	MONETA	24121	37.6947, -79.0120
Bedford	Airport	HAWK RIDGE AIRPORT	1228 TUMBLEWEED LN	BEDFORD	24523	37.4062, -79.0772
Bedford	Airport	NEW LONDON AIRPORT	1261 WHEELS DR	FOREST	24551	37.4266, -79.0846
Bedford	Airport	SMITH MOUNTAIN LAKE AIRPORT	1759 BUCCANEER RD	MONETA	24121	37.4564, -79.1243
Bedford	Airport	LAKEVIEW AERODROME AIRPORT	2026 SKYWAY DR	MONETA	24121	37.5614, -79.0125
Bedford	Airport	RED BIRDS AIRYARD AIRPORT	1184 DIANE DR	MONETA	24121	37.5937, -79.0322
Bedford	Attractions	NATIONAL D-DAY MEMORIAL	3 OVERLORD CIR	BEDFORD	24523	37.5103, -79.2283
Bedford	Campground	EAGLES ROOST CAMPGROUND	15267 SMITH MOUNTAIN LAKE PKWY	HUDDLESTON	24104	37.4900, -79.1237
Bedford	Campground	PEAKS OF OTTER CAMPGROUND	10454 PEAKS RD	BEDFORD	24523	37.5637, -79.1928
Bedford	Campground	SMITH MOUNTAIN LAKE STATE PARK	1619 OVERNIGHT RD	HUDDLESTON	24104	37.4303, -78.9263
Bedford	Campground	MITCHELL'S POINT MARINA & CAMPGROUND	3508 TRADING POST RD	HUDDLESTON	24104	37.3452, -78.8140
Bedford	Campground	MOORMAN MARINA	1510 MOORMAN RD	GOODVIEW	24101	37.5070, -78.7826
Bedford	Campground	WATERFRONT PARK CAMPGROUND	1184 WATERFRONT DR	MONETA	24121	37.3746, -79.5021
Bedford	Campground	HANNABASS-CROUCH CAMPGROUND	1241 HANNABASS DR	GOODVIEW	24095	37.3356, -79.5225
Bedford	Campground	TRI-COUNTY MARINA	1261 SUNRISE LOOP	LYNCH STATION	24571	37.3334, -79.5123
Bedford	Campground	ISLE OF PINES SUBDIVISION CAMPGROUND	ACROSS FROM 3930 ISLE OF PINES DR	MONETA	24121	37.3393, -79.5414
Bedford	Campground	SPRING VALLEY FARM CAMPGROUND	2077 MEADORS SPUR RD	MONETA	24121	37.3401, -79.5042
Bedford	Campground	CAMP LOWMAN	11738 LEESVILLE RD	LYNCH STATION	24571	37.3460, -79.4897
Bedford	Campground	CAMP SACAJAWEA--GIRL SCOUTS	2124 FOX HILL RD	LYNCHBURG	24503	37.4599, -79.4651



# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Bedford	Campground	LEGACY INTERNATIONAL--GLOBAL YOUTH VILLAGE	1020 LEGACY DR	BEDFORD	24523	37.5411, -79.3978
Bedford	Campground	THE WOODS ADVENTURE & CONFERENCE RETREAT (LEASED)	1336 SIMMONS MILL RD	THAXTON	24174	37.4259, -79.0374
Bedford	Campground	CAMP KARMA	2058 STONE MOUNTAIN RD	BEDFORD	24523	37.3230, -79.2586
Bedford	Campground	CHURCH OF GOD IN VIRGINIA--BEDFORD CAMP	1149 CIDER MILL RD	BEDFORD	24523	37.3273, -79.1830
Bedford	Campground	HALESFORD HARBOUR RV PARK RESORT	1336 CAMPERS PARADISE TRL	MONETA	24121	37.3266, -79.1555
Bedford	Campground	SWEETWATER RV PARK	4474 WHITE HOUSE RD	MONETA	24121	37.3073, -79.2162
Bedford	Campground	THOMAS ROAD OUTPOST	7794 SHEEP CREEK RD	BEDFORD	24523	37.3307, -78.9933
Bedford	Campground	TUCK-A-WAY CAMPGROUND	1312 SUNRISE LOOP	LYNCH STATION	24571	37.2772, -79.1062
Bedford	College	CENTRAL VIRGINIA COMMUNITY COLLEGE - BEDFORD CENTER	1635 VENTURE BLVD	BEDFORD	24523	37.3726, -79.1076
Bedford	Communication Facility	WBLT - AM - 3 DAUGHTERS MEDIA, INC.	1225 WINDSOR DR	BEDFORD	24523	37.4043, -79.0595
Bedford	Communication Facility	WSLK - AM - SMILE BROADCASTING, LLC	1084 HENDRICKS STORE RD	MONETA	24121	37.3754, -79.1681
Bedford	Communication Facility	WYYD - FM - CAPSTAR TX, LLC	3523 NO BUSINESS MOUNTAIN RD	BIG ISLAND	24526	37.3873, -79.1555
Bedford	Communication Facility	WZZI - FM - CENTENNIAL LICENSING, LLC	2966 FLAT TOP RD	BEDFORD	24523	37.3894, -79.1222
Bedford	Communication Facility	WXCF-FM - FM - WVJT, LLC	3523 NO BUSINESS MOUNTAIN RD	BIG ISLAND	24526	37.4062, -79.1339
Bedford	Communication Facility	WRXT - FM - POSITIVE ALTERNATIVE RADIO, INC	1686 HILLANDALE RD	THAXTON	24174	37.4194, -79.1447
Bedford	Communication Facility	WIQO-FM - FM - WVJT, LLC	3523 NO BUSINESS MOUNTAIN RD	BIG ISLAND	24526	37.4329, -79.2292
Bedford	Communication Facility	W40BM - TX - TRINITY BROADCASTING NETWORK	3523 NO BUSINESS MOUNTAIN RD	BIG ISLAND	24526	37.4345, -79.1653
Bedford	Communication Facility	WSET-TV - DT - WSET INCORPORATED	2968 FLAT TOP RD	BEDFORD	24523	37.4622, -79.1872
Bedford	Communication Facility	WWCW - DT - GB LYNCHBURG LICENSING LLC	2966 FLAT TOP RD	BEDFORD	24523	37.4620, -79.1889
Bedford	Electrical Substation	ELECTRICAL SUBSTATION	8445 VILLAGE HWY	BEDFORD	24523	37.3617, -79.1798
Bedford	Electrical Substation	ELECTRICAL SUBSTATION	247 DRUMMER ST	BEDFORD	24523	37.3736, -79.2045



## Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Bedford	Electrical Substation	ELECTRICAL SUBSTATION	92 TUMBLEWOOD TRL	BEDFORD	24523	37.4093, -79.1644
Bedford	Electrical Substation	ELECTRICAL SUBSTATION	1124 MT ATHOS RD	BEDFORD	24523	37.4445, -79.1962
Bedford	Electrical Substation	ELECTRICAL SUBSTATION	4215 MURRAY PL	BEDFORD	24523	37.3638, -79.1720
Bedford	Electrical Substation	ELECTRICAL SUBSTATION	2651 CLOVER PL	BEDFORD	24523	37.3116, -79.5052
Bedford	Electrical Substation	ELECTRICAL SUBSTATION	500 PEAKS VIEW DR	BEDFORD	24523	37.2781, -79.1024
Bedford	Electrical Substation	ELECTRICAL SUBSTATION	1901 ELM ST	BIG ISLAND	24526	37.5854, -79.0497
Bedford	Emergency Operations Center	BEDFORD COUNTY EMERGENCY OPERATIONS CENTER / BEDFORD CITY EMERGENCY OPERATIONS CENTER	186 SOUTH MAIN ST	BEDFORD	24523	37.3559, -78.8296
Bedford	Energy Facility	BEDFORD SOLAR	115 TAYLOR ST	BEDFORD	24523	37.3351, -79.4810
Bedford	Energy Facility	GEORGIA-PACIFIC BIG ISLAND PLANT	179 MORTON LN	BIG ISLAND	24526	37.1188, -79.2735
Bedford	Energy Facility	COLEMAN FALLS DAM HYDRO PLANT	90 COURTHOUSE LN	COLEMAN FALLS	24536	37.5351, -79.3573
Bedford	Energy Facility	HOLCOMB ROCK DAM HYDRO PLANT	510 9TH ST	HOLCOMB ROCK	24503	37.5021, -79.3006
Bedford	Energy Facility	SMITH MOUNTAIN DAM HYDRO PLANT	132 AMER COURT	SANDY LEVEL	24141	37.5036, -79.2628
Bedford	Fire Stations	BEDFORD COUNTY DEPARTMENT OF FIRE AND RESCUE COMPANY 7 - HUDDLESTON FIRE DEPARTMENT STATION 3	12253 SMITH MOUNTAIN LAKE PKWY	HUDDLESTON	24104	37.0931, -79.4022
Bedford	Fire Stations	MONETA VOLUNTEER FIRE DEPARTMENT STATION 3	5377 SMITH MOUNTAIN LAKE PKWY	MONETA	24095	37.4630, -79.1867
Bedford	Fire Stations	SAUNDERS VOLUNTEER FIRE DEPARTMENT STATION 2	1645 THOMAS JEFFERSON RD	HUDDLESTON	24104	37.0413, -79.5356
Bedford	Fire Stations	HUDDLESTON VOLUNTEER FIRE DEPARTMENT	719 CONFEDERATE BLVD	HUDDLESTON	24104	37.5929, -79.3813
Bedford	Fire Stations	BEDFORD COUNTY DEPARTMENT OF FIRE AND RESCUE COMPANY 8 - MONETA FIRE COMPANY STATION 2	3477 SMITH MOUNTAIN LAKE PKWY	BEDFORD	24523	37.5736, -79.3715
Bedford	Fire Stations	BEDFORD COUNTY DEPARTMENT OF FIRE AND RESCUE - HEADQUARTERS	315 BEDFORD AVE	BEDFORD	24523	37.2336, -79.1911
Bedford	Fire Stations	HARDY VOLUNTEER FIRE DEPARTMENT	801 CLAY ST	HARDY	24101	37.4343, -79.1647
Bedford	Fire Stations	BEDFORD COUNTY DEPARTMENT OF FIRE AND RESCUE COMPANY 19 -	697 VILLAGE HWY	VINTON	24179	37.3970, -79.2284



## Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
		STEWARTSVILLE-CHAMBLISSBURG FIRE COMPANY STATION 2				
Bedford	Fire Stations	CHAMBLISSBURG FIRST AID AND RESCUE SQUAD INCORPORATED	12573 RICHMOND HWY	GOODVIEW	24179	37.3559, -79.2275
Bedford	Fire Stations	SAUNDERS VOLUNTEER FIRE DEPARTMENT	3640 WATERLICK RD	HUDDLESTON	24104	37.4461, -79.2148
Bedford	Fire Stations	HUDDLESTON VOLUNTEER FIRE DEPARTMENT INCORPORATED	103 WICKLIFFE AVE	HUDDLESTON	24104	37.4025, -79.1400
Bedford	Fire Stations	FOREST VOLUNTEER FIRE DEPARTMENT	1280 MAIN ST	FOREST	24551	37.3821, -79.1813
Bedford	Fire Stations	BEDFORD COUNTY DEPARTMENT OF FIRE AND RESCUE COMPANY 7 - HUDDLESTON FIRE DEPARTMENT STATION 2	7797 JORDANTOWN RD	HUDDLESTON	24104	37.4026, -79.1590
Bedford	Fire Stations	BEDFORD COUNTY DEPARTMENT OF FIRE AND RESCUE COMPANY 3 - BOONSBORO FIRE AND RESCUE COMPANY	12737 NORTH OLD MONETA RD	LYNCHBURG	24503	37.2748, -79.0994
Bedford	Fire Stations	BEDFORD FIRE DEPARTMENT	2394 PAMPLIN RD	BEDFORD	24523	37.3289, -79.2016
Bedford	Fire Stations	BIG ISLAND VOLUNTEER FIRE DEPARTMENT INCORPORATED	1835 GRAVES MILL RD	BIG ISLAND	24526	37.0851, -79.5288
Bedford	Fire Stations	STEWARTSVILLE-CHAMBLISSBURG VOLUNTEER FIRE COMPANY	1613 OAKWOOD ST	VINTON	24179	37.1954, -79.6854
Bedford	Fire Stations	MONTVALE VOLUNTEER FIRE DEPARTMENT	3300 RIVERMONT AVE	MONTVALE	24122	37.0540, -79.5830
Bedford	Fire Stations	MONETA VOLUNTEER FIRE DEPARTMENT STATION 1	3300 RIVERMONT AVE	MONETA	24121	37.2134, -79.4118
Bedford	Fire Stations	SHADY GROVE VOLUNTEER FIRE DEPARTMENT	2001 UNIVERSITY BLVD	THAXTON	24174	37.2265, -79.5554
Bedford	HazMat Facility	TRIDENT SEAFOODS BEDFORD PLANT	940 ORANGE ST	BEDFORD	24523-3303	37.1600, -79.0717
Bedford	HazMat Facility	SAM MOORE FURNITURE LLC	1556 DAWN DR	BEDFORD	24523	37.4006, -79.0568
Bedford	HazMat Facility	SAFETY-KLEEN SYSTEMS	16090 STEWARTSVILLE RD	VINTON	24179-5490	37.3092, -79.5023
Bedford	HazMat Facility	BLUE RIDGE WOOD PRESERVING INCORPORATED	1220 HENDRICKS STORE RD	MONETA	24121	37.2361, -79.8109
Bedford	HazMat Facility	GRAN TEE INVESTMENTS	GARNET ST AND CONCORD TPKE	BEDFORD	24523-2168	37.3782, -79.1683
Bedford	HazMat Facility	GEORGIA PACIFIC CORP - BIG ISLAND MILL	1619 WYTHE RD	BIG ISLAND	24526	37.2576, -79.7224
Bedford	HazMat Facility	RUBATEX CORP PLANT 2	861 FIBRE PLANT RD	BEDFORD	24523	37.5120, -78.9083



## Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Bedford	HazMat Facility	NYDREE FLOORING LLC (CLOSED)	24 PRICE AVE	FOREST	24551-0289	37.2535, -79.7111
Bedford	HazMat Facility	TRANSMONTAIGNE - MONTVALE PIEDMONT TERMINAL	2801 FORT AVE	MONTVALE	24122	37.1085, -79.5773
Bedford	HazMat Facility	BARR LABORATORIES INC	12660 E LYNCHBURG SALEM TPKE	FOREST	24551	37.1584, -79.4801
Bedford	HazMat Facility	WINOA USA (W ABRASIVES)	351 ELMWOOD LN	BEDFORD	24523-1802	37.3563, -79.2837
Bedford	HazMat Facility	CUSTOM TRUCK ONE SOURCE	2624 LAKESIDE DR	FOREST	24551	37.3496, -78.8151
Bedford	HazMat Facility	BUCKEYE TERMINALS, LLC - ROANOKE TERMINAL	213 OLD GRAVES MILL RD	MONTVALE	24122	37.1689, -79.4540
Bedford	HazMat Facility	COMMSCOPE TECHNOLOGIES LLC	163 KABLER LN	FOREST	24551	37.5847, -79.0505
Bedford	HazMat Facility	WHEELABRATOR LANDFILL (WINOA USA, INC.)	3346 HORSESHOE BEND RD	BEDFORD	24523	37.4507, -79.2614
Bedford	Law Enforcement	BEDFORD POLICE DEPARTMENT	1317 LOLA AVE	BEDFORD	24523	37.3365, -79.5242
Bedford	Law Enforcement	BEDFORD COUNTY SHERIFFS OFFICE - HEADQUARTERS	30 MONICA BLVD	BEDFORD	24523	37.4137, -79.1459
Bedford	Law Enforcement	VIRGINIA STATE POLICE DIVISION 6 AREA 41 - BEDFORD	2406 ATHERHOLT RD	BEDFORD	24523	37.2328, -79.2920
Bedford	Public Health	SURGERY CENTER OF CENTRAL VIRGINIA	339 COURT ST	FOREST	24551	37.2753, -79.1021
Bedford	Public Health	BEDFORD MEMORIAL HOSPITAL	215 MAIN ST	BEDFORD	24523	37.3127, -79.1953
Bedford	Public Health	BEDFORD FAMILY URGENT CARE	1204 BEDFORD AVE	BEDFORD	24523	37.3504, -78.9803
Bedford	Schools	MINERAL SPRINGS CHRISTIAN SCHOOL	806 BURKS HILL RD	VINTON	24179	37.3309, -79.2529
Bedford	Schools	BLUE RIDGE MONTESSORI SCHOOL	503 LONGWOOD AVE	LYNCHBURG	24502	37.0481, -78.9403
Bedford	Schools	PRECEPT SCHOOLS OF VIRGINIA	807 COLLEGE ST	BEDFORD	24523	37.1199, -79.2755
Bedford	Schools	FOREST MIDDLE	1114 SCHOOLDAYS RD	FOREST	24551	37.5346, -79.3606
Bedford	Schools	GOODVIEW ELEMENTARY	1234 EAGLE CIRCLE	GOODVIEW	24095	37.2716, -79.7933
Bedford	Schools	HUDDLESTON ELEMENTARY	3420 BODY CAMP RD	HUDDLESTON	24104	37.3850, -79.7305
Bedford	Schools	JEFFERSON FOREST HIGH	1 SCHOLAR LN	FOREST	24551	37.1868, -79.6134
Bedford	Schools	LIBERTY HIGH	1095 GOLDEN EAGLE DR	BEDFORD	24523	37.2698, -78.6844
Bedford	Schools	BEDFORD SCIENCE AND TECHNOLOGY CENTER	1293 GOLDEN EAGLE DR	BEDFORD	24523	37.6725, -79.2171





# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Bedford	Schools	MONETA ELEMENTARY	1138 WILDCAT RD	MONETA	24121	37.4698, -79.1188
Bedford	Schools	MONTVALE ELEMENTARY	1245 THAXTON SCHOOL RD	MONTVALE	24122	37.3197, -79.7185
Bedford	Schools	NEW LONDON ACADEMY ELEMENTARY	1255 PATRIOT PL	FOREST	24551	37.3452, -78.8740
Bedford	Schools	OTTER RIVER ELEMENTARY	5946 BROOKNEAL HWY	GOODE	24556	37.4951, -79.0568
Bedford	Schools	BEDFORD ELEMENTARY	202 HORIZON DR	BEDFORD	24523	37.2811, -78.9325
Bedford	Schools	BEDFORD MIDDLE	2812 GREENVIEW DR	BEDFORD	24523	37.1457, -79.0481
Bedford	Schools	BEDFORD PRIMARY	2183 SUNNYMEADE RD	BEDFORD	24523	37.3879, -79.0990
Bedford	Schools	BIG ISLAND ELEMENTARY	19 GEORGE ST	BIG ISLAND	24526	37.4032, -79.1277
Bedford	Schools	BOONSBORO ELEMENTARY	1003 LYNCH MILL RD	LYNCHBURG	24503	37.3721, -79.1607
Bedford	Schools	BODY CAMP ELEMENTARY	904 BEDFORD AVE	BEDFORD	24523	37.3369, -79.4993
Bedford	Schools	FOREST ELEMENTARY	133 CHARLOTTE ST	FOREST	24551	37.3388, -79.5035
Bedford	Schools	STAUNTON RIVER HIGH	100 LAXTON RD	MONETA	24121	37.1097, -79.2855
Bedford	Schools	STAUNTON RIVER MIDDLE	320 BEE DR	MONETA	24121	37.4208, -79.1413
Bedford	Schools	STEWARTSVILLE ELEMENTARY	194 DENNIS RIDDLE DR	GOODVIEW	24095	37.1333, -79.2658
Bedford	Schools	THAXTON ELEMENTARY	9339 VILLAGE HWY	THAXTON	24174	37.1225, -79.0313
Bedford	Schools	THOMAS JEFFERSON ELEMENTARY	194 DENNIS RIDDLE DR	FOREST	24551	37.3893, -79.1575
Bedford	Sewer Pump Station	MONETA WWTP/ INFLUENT PUMP STATION PS 3	219 MUSTANG RD	MONETA	24121	37.3811, -79.2192
Bedford	Sewer Pump Station	PUMP STATION #9	1725 WHITFIELD DR	BEDFORD	24523	37.1453, -79.2742
Bedford	Sewer Pump Station	PUMP STATION #1	4099 OLIVER ST	MONETA	24121	37.4024, -79.1521
Bedford	Sewer Pump Station	SEWER PUMP STATION #2	1577 VILLAGE CT	MONETA	24121	37.3760, -79.1601
Bedford	Sewer Pump Station	SEWER PUMP STATION #4	1720 WHITFIELD DR	MONETA	24121	37.2727, -79.8138
Bedford	Sewer Pump Station	LAKE VISTA PUMP STATION	1108 BEALE TRAIL RD	FOREST	24551	37.1622, -79.6325
Bedford	Sewer Pump Station	FOREST MIDDLE SCHOOL PUMP STATION	1097 WESTCOVE RD	FOREST	24551	37.1122, -79.2782
Bedford	Sewer Pump Station	FARMINGTON PUMP STATION	12970 SMITH MOUNTAIN LAKE PKWY	FOREST	24551	37.3269, -79.1939
Bedford	Sewer Pump Station	PUMP STATION #6	116 FAWN HAVEN LN	BEDFORD	24523	37.3639, -79.1721
Bedford	Sewer Pump Station	PUMP STATION #10	1014 ORANGE ST	BEDFORD	24523	37.4086, -79.0541



## Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Bedford	Sewer Pump Station	NEW LONDON PUMP STATION	1032 PARKHALL RD	FOREST	24551	37.1253, -79.2856
Bedford	Sewer Pump Station	PUMP STATION #1	109 FAWN HAVEN LN	BEDFORD	24523	37.4061, -79.1583
Bedford	Sewer Pump Station	PUMP STATION #4	1015 DOULTON CIR	BEDFORD	24523	37.3350, -79.5093
Bedford	Sewer Pump Station	PUMP STATION #7	1175 MARINERS WAY	BEDFORD	24523	37.3889, -79.1678
Bedford	Sewer Pump Station	PUMP STATION #2	2326 LAKE RETREAT RD	BEDFORD	24523	37.3719, -79.1631
Bedford	Sewer Pump Station	PUMP STATION #5	1178 HOOPER RD	BEDFORD	24523	37.5328, -79.3556
Bedford	Sewer Pump Station	PUMP STATION #12	7 TIMBEROAK CT	BEDFORD	24523	37.4071, -79.1318
Bedford	Sewer Pump Station	PUMP STATION #8	20105 LEESVILLE RD	BEDFORD	24523	37.3356, -79.5178
Bedford	Sewer Pump Station	MONTVALE PUMP STATION	208 DRUMMER ST	MONTVALE	24122	37.1187, -79.2734
Bedford	Sewer Pump Station	PUMP STATION	24 ALPINE DR	HUDDLESTON	24104	37.3661, -79.2467
Bedford	Sewer Pump Station	LIFT STATION	51 FNB DR	HUDDLESTON	24104	37.3913, -79.1621
Bedford	Sewer Pump Station	PUMP STATION	176 CAMPBELL HWY	HUDDLESTON	24104	37.3693, -79.1646
Bedford	Sewer Pump Station	PUMP STATION #3	31 WEBBS WAY DR	BEDFORD	24523	37.5107, -78.9101
Bedford	Sewer Pump Station	LIFT STATION	180 MOSELEY LN	HUDDLESTON	24104	37.3527, -79.1890
Bedford	Sewer Pump Station	LIFT STATION	576 LAWYERS RD	HUDDLESTON	24104	37.3664, -79.3023
Bedford	Sewer Pump Station	LIFT STATION	13238 WARDS RD	LYNCHBURG	24503	37.3675, -79.1730
Bedford	Sewer Pump Station	LIFT STATION	2781 LIBERTY MOUNTAIN DR	HUDDLESTON	24104	37.4027, -79.0595
Bedford	Sewer Pump Station	LIFT STATION	56 BRUSH TAVERN DR	HUDDLESTON	24104	37.3881, -79.7316
Bedford	Sewer Pump Station	LIFT STATION	50 ROWSE DR	FOREST	24551	37.4628, -79.1475
Bedford	Special Population Facility - Nursing Home	ENGLISH MEADOWS ELKS HOME CAMPUS	2081 LANGHORNE RD	BEDFORD	24523	37.5075, -79.1230
Bedford	Special Population Facility - Nursing Home	BEDFORD COUNTY NURSING HOME	633 COOK AVE	BEDFORD	24523	37.3755, -79.2423
Bedford	Special Population Facility - Nursing Home	CARRIAGE HILL	13055 WEST LYNCHBURG/SALEM TPKE	BEDFORD	24523	37.0687, -78.9728
Bedford	Special Population Facility - Nursing Home	RUNK & PRATT OF FOREST INC.	1300 ENTERPRISE DR	FOREST	24551	37.3809, -79.3143
Bedford	Special Population Facility - Nursing Home	WOODHAVEN NURSING HOME	7443 ELON RD	MONTVALE	24122	37.3758, -79.1649



## Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Bedford	Special Population Facility - Nursing Home	CAMPBELL REST HOME	1400 FLORIDA AVE	BEDFORD	24523	37.3735, -79.1713
Bedford	Special Populations Facility - Detention Facility	BEDFORD ADULT DETENTION CENTER	287 LEARNING LN	BEDFORD	24523	37.3977, -79.1655
Bedford	Wastewater Treatment Plant	MONTVALE WASTEWATER TREATMENT	9405 VILLAGE HWY	MONTVALE	24122	37.3783, -79.1694
Bedford	Wastewater Treatment Plant	BEDFORD WASTEWATER TREATMENT PLANT	20 RICKY VAN SHELTON DR	BEDFORD	24523	37.3627, -78.8375
Bedford	Wastewater Treatment Plant	MONETA REGIONAL WWTP	1622 WHITE HOUSE RD	MONETA	24121	37.0543, -78.9513
Bedford	Wastewater Treatment Plant	SMITH MOUNTAIN LAKE WATER TREATMENT FACILITY	1500 RADFORD CHURCH RD	MONETA	24121	37.3441, -79.5536
Bedford	Wastewater Treatment Plant	NEW FILTER PLANT TRS 1-4	1132 MOUNTAIN WATER DR	BEDFORD	24523	37.3065, -79.3008
Bedford	Water Booster Pump Station	WATER PUMP STATION - 5 (TOWN OF BEDFORD WATER)	1650 WATERLICK RD	BEDFORD	24523	37.3842, -79.7342
Bedford	Water Booster Pump Station	WATER PUMP STATION - 1 (WOODS LANDING PUMP STATION)	113 PHELPS RD	LYNCHBURG	24503	37.1314, -79.2916
Bedford	Water Booster Pump Station	WATER PUMP STATION - 2 (CAPEWOOD DR. WELL NO. 5 BUILDING)	185 LITTLE PATRIOT DR	HUDDLESTON	24104	37.3699, -79.1615
Bedford	Water Booster Pump Station	WATER PUMP STATION - 3 (DEERWOOD WELL HOUSE)	216 ETHEL ST	HUDDLESTON	24104	37.3739, -79.1746
Bedford	Water Booster Pump Station	WATER PUMP STATION - 4 (FOX RUNN WATER PUMP STATION)	146 CLARK ST	LYNCHBURG	24503	37.3734, -79.2536
Bedford	Water Storage Facility	MILL LANE GROUND TANK, 5,000,000 GALLON	733 SPOUT SPRING RD	LYNCHBURG	24505	37.3981, -79.1412
Bedford	Water Storage Facility	HUNTINGWOOD TANK, 2,000,000 GALLON	4690 PEAKS RD	LYNCHBURG	24505	37.4111, -79.0506
Bedford	Water Storage Facility	MARVIN DRIVE WATER TANK	6861 COTTONTOWN RD	VINTON	24179	37.3462, -79.5526
Bedford	Water Storage Facility	WATER TANK	852 ORANGE ST	MONETA	24121	37.4411, -79.1398
Bedford	Water Storage Facility	WELL LOT RIDGEVIEW SC 1	123 RADIO RD	LYNCHBURG	24503	37.3522, -78.8268
Bedford	Water Storage Facility	IVY CR TANK	1622 WHITE HOUSE RD	FOREST	24551	37.2211, -78.9516
Bedford	Water Storage Facility	CASCADE FOREST LT 14 B-2 WATER TANK	180 MOSELEY LN	VINTON	24179	37.4057, -79.0501
Bedford	Water Storage Facility	BP #665-05 TANK 100% COMP FOR 2006	1287 PURDUM MILL RD	MONETA	24121	37.3106, -79.2837
Bedford	Water Storage Facility	MTN VIEW SHORES LT60A WELL LOT	2301 CONCORD TPKE	HUDDLESTON	24104	37.2088, -79.3079
Bedford	Water Storage Facility	TANK	1355 ELON RD	BEDFORD	24523	37.1397, -78.8988



# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Bedford	Water Storage Facility	WATER TANK LOT PB 43/196	1500 RADFORD CHURCH RD	FOREST	24551	37.3133, -79.0395
Bedford	Water Storage Facility	RESERVOIR HILL	9625 LEESVILLE RD	BEDFORD	24523	37.1644, -79.0155
Campbell	Airport	BROOKNEAL/CAMPBELL COUNTY AIRPORT	133 RUNWAY RD	GLADYS	24554	37.2181, -79.2915
Campbell	Airport	LYNCHBURG RGNL/PRESTON GLENN FLD AIRPORT	702 HANGAR RD	LYNCHBURG	24502	37.0436, -78.9599
Campbell	Airport	BREEZY KNOLL AIRPORT	2501 BEAR CREEK RD	RUSTBURG	24588	37.1986, -79.2365
Campbell	Attractions	AVOCA MUSEUM	1514 MAIN ST	ALTAVISTA	24517	37.2333, -79.2527
Campbell	Campground	LYNCHBURG RV RESORT	439 MOLLIES CREEK RD	GLADYS	24554	37.0621, -79.0722
Campbell	Campground	HAT CREEK CAMP	7165 HAT CREEK RD	BROOKNEAL	24528	37.3111, -79.2691
Campbell	Communication Facility	WODI - AM - THE RAIN BROADCASTING, INC.	123 RADIO RD	BROOKNEAL	24528	37.2770, -79.1013
Campbell	Communication Facility	WKDE - AM - D.J. BROADCASTING, INC.,	1203 AVONDALE DR	ALTAVISTA	24517	37.1462, -79.3675
Campbell	Communication Facility	W293BY - FX - PAUL H. PASSINK	1336 TOWER HILL RD	RUSTBURG	24588	37.1826, -79.0394
Campbell	Communication Facility	WWEM - FM - EDUCATIONAL MEDIA CORP	1336 TOWER HILL RD	RUSTBURG	24588	37.0322, -78.8980
Campbell	Communication Facility	WWMC - FM - LIBERTY UNIVERSITY, INC	2570 CANDLERS MOUNTAIN RD	LYNCHBURG	24502	37.3932, -79.0612
Campbell	Communication Facility	WRVL - FM - LIBERTY UNIVERSITY, INC	1850 UPHILL TRL	EVINGTON	24550	37.1246, -79.2399
Campbell	Communication Facility	WRVL - FS - LIBERTY UNIVERSITY, INC	1850 UPHILL TRL	EVINGTON	24550	37.1733, -79.0476
Campbell	Communication Facility	W246CF - FX - POSITIVE ALTERNATIVE RADIO, INC	1510 MONOGRAM RD	LYNCHBURG	24502	37.0909, -79.0739
Campbell	Communication Facility	WKDE-FM - FM - D.J. BROADCASTING, INC	125 FERNBROOKE DR	ALTAVISTA	24517	37.1175, -79.2256
Campbell	Communication Facility	WKHF - FM - UNITED STATES CP, LLC	2570 CANDLERS MOUNTAIN RD	LYNCHBURG	24502	37.3924, -79.1664
Campbell	Communication Facility	W208AP - FX - VIRGINIA TECH FOUNDATION, INC	1510 MONOGRAM RD	LYNCHBURG	24502	37.3489, -79.1811
Campbell	Communication Facility	W227BG - FX - ONECOM, INC	1667 TIMBERLAKE DR	LYNCHBURG	24502	37.4174, -79.1441
Campbell	Communication Facility	W231CE - FX - CALVARY CHAPEL OF TWIN FALLS, INC	2570 CANDLERS MOUNTAIN RD	LYNCHBURG	24502	37.1140, -79.2889
Campbell	Communication Facility	W237CL - FX - CALVARY CHAPEL OF LYNCHBURG	2570 CANDLERS MOUNTAIN RD	LYNCHBURG	24502	37.0474, -78.9424
Campbell	Communication Facility	WTLU-CA - CA - LIBERTY UNIVERSITY, INC.	1850 UPHILL TRL	EVINGTON	24550	37.1103, -79.2899



# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Campbell	Communication Facility	WTLU-CA - TX - LIBERTY UNIVERSITY, INC.	2550 CANDLERS MOUNTAIN RD	LYNCHBURG	24502	37.2775, -79.1024
Campbell	Communication Facility	WTLU-LD - LD - LIBERTY UNIVERSITY, INC.	1510 MONOGRAM RD	LYNCHBURG	24502	37.3304, -79.1938
Campbell	Communication Facility	W33AD - TX - GETHSEMANE BAPTIST CHURCH	599 DOSS RD	CONCORD	24538	37.3306, -79.2030
Campbell	Communication Facility	W60BM - TX - COMMONWEALTH PUBLIC BROADCASTING CORPORATION	1336 TOWER HILL RD	RUSTBURG	24588	37.3342, -79.5213
Campbell	Communication Facility	WDRG-LP - TX - PAUL H. PASSINK	1333 TOWER HILL RD	RUSTBURG	24588	37.3115, -79.5054
Campbell	Communication Facility	W04CI - TX - GETHSEMANE BAPTIST CHURCH	1333 TOWER HILL RD	RUSTBURG	24588	37.5853, -79.0498
Campbell	Communication Facility	WTLU-CD - DC - LIBERTY UNIVERSITY, INC	1510 MONOGRAM RD	LYNCHBURG	24502	37.3555, -78.8307
Campbell	Electrical Substation	AEP JOSHUA FALLS SUBSTATION	120 BLACKWATER ST	LYNCHBURG	24504	37.5856, -79.0521
Campbell	Electrical Substation	ELECTRICAL SUBSTATION	182 IRVINGTON SPRINGS RD	LYNCHBURG	24502	37.4156, -79.1427
Campbell	Electrical Substation	ELECTRICAL SUBSTATION	425 BIRCH ST	LYNCHBURG	24502	37.3377, -79.5496
Campbell	Electrical Substation	ELECTRICAL SUBSTATION	4370 HYDRO ST	RUSTBURG	24588	37.3618, -78.8688
Campbell	Electrical Substation	ELECTRICAL SUBSTATION	200 OLD TRENTS FERRY RD	LYNCHBURG	24501	37.3581, -79.1757
Campbell	Electrical Substation	ELECTRICAL SUBSTATION	2660 GLASS AVE	CONCORD	24538	37.4125, -79.1447
Campbell	Electrical Substation	ELECTRICAL SUBSTATION	6224 OLD MILL RD	RUSTBURG	24588	37.4134, -79.1442
Campbell	Electrical Substation	ELECTRICAL SUBSTATION	304 MORGAN ST	LYNCHBURG	24501	37.4156, -79.1195
Campbell	Electrical Substation	ELECTRICAL SUBSTATION	130 LINDEN AVE	LYNCHBURG	24504	37.3589, -79.1845
Campbell	Emergency Operations Center	CAMPBELL COUNTY EMERGENCY OPERATIONS CENTER	800 MAIN ST	RUSTBURG	24588	37.3773, -79.2442
Campbell	Energy Facility	ALTAVISTA POWER STATION	1000 BRD ST	ALTAVISTA	24517	37.3513, -79.5172
Campbell	Energy Facility	LEESVILLE HYDRO PLANT	131 OLD COLONY RD	LYNCH STATION	24563	37.4383, -79.1875
Campbell	Fire Stations	EVINGTON VOLUNTEER FIRE DEPARTMENT - SUBSTATION	14276 WYATTS WAY	RUSTBURG	24588	37.4377, -79.1883
Campbell	Fire Stations	VIRGINIA DEPARTMENT OF FORESTRY - CAMPBELL COUNTY	861 FIBRE PLANT RD	RUSTBURG	24588	37.4087, -79.1776
Campbell	Fire Stations	LYNCHBURG REGIONAL AIRPORT AIRCRAFT RESCUE FIRE FIGHTING	9960 STEWARTSVILLE RD	LYNCHBURG	24502	37.4171, -79.1711
Campbell	Fire Stations	GLADYS VOLUNTEER FIRE DEPARTMENT	135 2ND ST	GLADYS	24554	37.4681, -79.1166





# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Campbell	Fire Stations	BWX TECHNOLOGIES NUCLEAR OPERATIONS DIVISION EMERGENCY TEAM	1065 LEE JACKSON HWY	LYNCHBURG	24504	37.3263, -79.5022
Campbell	Fire Stations	EVINGTON VOLUNTEER FIRE DEPARTMENT STATION 1 - HEADQUARTERS	133 AMER COURT	EVINGTON	24550	37.4115, -79.1493
Campbell	Fire Stations	RUSTBURG VOLUNTEER FIRE DEPARTMENT	101 SHADY GROVE DR	RUSTBURG	24588	37.4047, -79.1628
Campbell	Fire Stations	LYN-DAN HEIGHTS VOLUNTEER FIRE DEPARTMENT	2444 PUMPING STATION RD	LYNCHBURG	24501	37.4200, -79.1220
Campbell	Fire Stations	CONCORD VOLUNTEER FIRE DEPARTMENT	891 PARTRIDGE CREEK RD	CONCORD	24538	37.4521, -79.1168
Campbell	Fire Stations	BROOKVILLE-TIMBERLAKE VOLUNTEER FIRE DEPARTMENT	7989 NEW CHAPEL RD	FOREST	24551	37.4700, -79.1175
Campbell	Fire Stations	BROOKNEAL VOLUNTEER FIRE DEPARTMENT	10218 BROOKNEAL HWY	BROOKNEAL	24528	37.5700, -79.0585
Campbell	Fire Stations	ALTAVISTA FIRE COMPANY	230 MEGGINSON LN	ALTAVISTA	24517	37.4564, -79.1137
Campbell	Gas Facility	GAS FACILITY - COLUMBIA GAS OF VIRGINIA	1345 FALLING CREEK RD	SPOUT SPRING	24593	37.5875, -79.0453
Campbell	Gas Facility	GAS FACILITY	34 COMMUNICATIONS LN	GLADYS	24554	37.5696, -79.0318
Campbell	HazMat Facility	LANE HOME FURNISHINGS	701 5TH ST	ALTAVISTA	24517	37.5693, -79.0361
Campbell	HazMat Facility	ABBOTT LABORATORIES - ROSS PRODUCTS DIVISION	1518 MAIN ST	ALTAVISTA	24517	37.5136, -79.1956
Campbell	HazMat Facility	GEORGIA-PACIFIC BROOKNEAL OSB	11795 BROOKNEAL HWY	GLADYS	24554	37.4320, -79.1337
Campbell	HazMat Facility	TIMKEN CO ALTAVISTA BEARING PLANT	2097 DEARING FORD RD.	ALTAVISTA	24517	37.4546, -79.1132
Campbell	HazMat Facility	BGF INDUSTRIES	3600 CANDLERS MOUNTAIN RD	ALTAVISTA	24517-1513	37.6028, -79.2474
Campbell	HazMat Facility	BANKER STEEL CO LLC	205 FRAZIER RD	LYNCHBURG	24502	37.6931, -79.0817
Campbell	HazMat Facility	BWX TECHNOLOGIES INC - R&D (CLOSED)	319 RUTHERFORD ST	LYNCHBURG	24504-5448	37.4155, -79.1196
Campbell	HazMat Facility	SCHRADER-BRIDGEPORT INTERNATIONAL	3700 MAYFLOWER DR	ALTAVISTA	24517-1020	37.5536, -79.1392
Campbell	HazMat Facility	DOMINION - ALTAVISTA POWER STATION	1320 WARDS FERRY RD	ALTAVISTA	24517	37.3491, -78.8166
Campbell	HazMat Facility	LYNCHBURG CASTING INDUSTRIES	4615 MURRAY PL	LYNCHBURG	24504	37.3449, -78.8262
Campbell	HazMat Facility	BROOKNEAL CHIP MILL	1 ABRASIVE AVE	BROOKNEAL	24528	37.3524, -78.8381



# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Campbell	HazMat Facility	DAN RIVER INC - BROOKNEAL PLANT 2 (CLOSED)	586 THOMAS RD	BROOKNEAL	24528	37.3558, -78.8254
Campbell	HazMat Facility	A.O. SMITH ELECTRICAL PRODUCTS COMPANY (CLOSED)	4800 BOONSBORO RD	ALTAVISTA	24517-1040	37.3594, -78.8340
Campbell	HazMat Facility	FRAMATOME INC.	6185 DUNDEE RD	LYNCHBURG	24504	37.2865, -79.8352
Campbell	Historic Site	BLENHEIM	3906 NOWLINS MILL RD	CONCORD	24538	37.3885, -79.2419
Campbell	Historic Site	MOUNT ATHOS	1638 MT ATHOS RD	LYNCHBURG	24504	37.3697, -79.4976
Campbell	Historic Site	FEDERAL HILL	724 TURKEY FOOT RD	FOREST	24551	37.3693, -79.3096
Campbell	Historic Site	WALNUT HILL	129 JOHNSON MOUNTAIN RD	EVINGTON	24550	37.2627, -79.7807
Campbell	Historic Site	HARPERS MILL	3771 HAT CREEK RD	BROOKNEAL	24528	37.1634, -79.4718
Campbell	Historic Site	IVANHOE	302 IVANHOE TRAIL	LYNCHBURG	24504	37.3761, -79.3033
Campbell	Historic Site	THE ROCK HOUSE	10456 BEAR CREEK RD	GLADYS	24554	37.3717, -79.4980
Campbell	Historic Site	BELMONT FARMS	10273 LEESVILLE RD	EVINGTON	24550	37.3272, -79.5251
Campbell	Historic Site	CAT ROCK SLUICE	STAUNTON SCENIC RIVER MILE 9.85	BROOKNEAL	24528	37.1860, -79.6125
Campbell	Historic Site	PHILLIPS-ROBERTSON	2086 DEARBORN RD	EVINGTON	24550	37.3759, -79.7084
Campbell	Historic Site	CAREYSWOOD	8291 COLONIAL HWY	EVINGTON	24550	37.3066, -79.3056
Campbell	Historic Site	GREEN HILL	378 PANNILLS RD	GLADYS	24554	37.3648, -79.4338
Campbell	Historic Site	GROVE PLANTATION	151 CLOSEBURN MANOR DR	LYNCHBURG	24502	37.3263, -79.5357
Campbell	Historic Site	HISTORIC COURTHOUSE	774 VILLAGE HWY	RUSTBURG	24588	37.3394, -79.5217
Campbell	Historic Site	NEW GLASGO	2839 LEESVILLE RD	LYNCH STATION	24571	37.3407, -79.5320
Campbell	Historic Site	OAKDALE	384 MOSEBROOK DR	GLADYS	24554	37.5314, -79.4161
Campbell	Historic Site	RED HILL	1250 RED HILL RD	BROOKNEAL	24528	37.4529, -79.2608
Campbell	Historic Site	SIX MILE BRIDGE	MOUNT ATHOS RD & JAMES RIVER	LYNCHBURG	24504	37.2254, -79.5179
Campbell	Historic Site	THE MANSION	1580 MANSION BRIDGE RD	ALTAVISTA	24517	37.3757, -79.3079
Campbell	Historic Site	SHADY GROVE	3159 MOLLIES CREEK RD	GLADYS	24554	37.2412, -79.6228



# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Campbell	Historic Site	WHITEHALL	910 WHITEHALL RD	LONG ISLAND	24569	37.2411, -79.6264
Campbell	Historic Site	OAK GROVE	7940 GLADYS RD	ALTAVISTA	24517	37.2716, -79.7898
Campbell	Large Population Venue	ALTAVISTA AREA YMCA FAMILY CENTER	1000 FRANKLIN AVE	ALTAVISTA	24517	37.3539, -79.6076
Campbell	Law Enforcement	BROOKNEAL POLICE DEPARTMENT	1971 UNIVERSITY BLVD	BROOKNEAL	24528	37.3567, -79.2884
Campbell	Law Enforcement	ALTAVISTA POLICE DEPARTMENT	907 CLAY ST	ALTAVISTA	24517	37.1967, -79.0848
Campbell	Law Enforcement	CAMPBELL COUNTY SHERIFFS OFFICE	905 COURT ST	RUSTBURG	24588	37.3394, -79.2598
Campbell	Law Enforcement	LYNCHBURG REGIONAL AIRPORT POLICE DEPARTMENT	521 COLONY RD	LYNCHBURG	24502	37.3407, -79.2326
Campbell	Law Enforcement	VIRGINIA STATE POLICE DIVISION 3 AREA 20 - LYNCHBURG	3506 WARDS RD	LYNCHBURG	24502	37.3270, -79.1455
Campbell	Schools	BETHEL MENNONITE SCHOOL	19965 LEESVILLE RD	GLADYS	24554	37.3213, -79.1857
Campbell	Schools	TIMBERLAKE CHRISTIAN SCHOOLS	479 CAMP NINE RD	FOREST	24551	37.1324, -79.2831
Campbell	Schools	TREE OF LIFE ACADEMY	201 VILLAGE HWY	LYNCHBURG	24502	37.1095, -79.2953
Campbell	Schools	CLEARVIEW CHRISTIAN SCHOOL	1671 VILLAGE HWY	RUSTBURG	24588	37.0521, -78.9443
Campbell	Schools	DESMOND T DOSS JR ACADEMY	555 VILLAGE HWY	LYNCHBURG	24502	37.3457, -79.2355
Campbell	Schools	ALTAVISTA ELEMENTARY	155 BEE DR	ALTAVISTA	24517	37.3458, -79.2396
Campbell	Schools	ALTAVISTA HIGH	474 WILLIAM CAMPBELL DR	ALTAVISTA	24517	37.2519, -79.1824
Campbell	Schools	BROOKNEAL ELEMENTARY	377 DENNIS RIDDLE DR	BROOKNEAL	24528	37.3360, -78.9787
Campbell	Schools	BROOKVILLE HIGH	377 DENNIS RIDDLE DR	LYNCHBURG	24502	37.2519, -79.1824
Campbell	Schools	BROOKVILLE MIDDLE	400 V E S RD	LYNCHBURG	24502	37.3278, -79.2186
Campbell	Schools	CAMPBELL COUNTY TECHNICAL CENTER	693 LEESVILLE RD	RUSTBURG	24588	37.2672, -79.0683
Campbell	Schools	CONCORD ELEMENTARY	2125 LANGHORNE RD	CONCORD	24538	37.2690, -79.1076
Campbell	Schools	CORNERSTONE LEARNING CENTER	5039 BOONSBORO RD	RUSTBURG	24588	37.2766, -79.0849
Campbell	Schools	LEESVILLE ROAD ELEMENTARY	520 ELDON ST	LYNCHBURG	24502	37.2739, -79.1036
Campbell	Schools	RUSTBURG CORRECTIONAL CENTER UNIT #9	3024 FOREST HILLS CIR	RUSTBURG	24588	37.3438, -79.2375
Campbell	Schools	RUSTBURG ELEMENTARY	122 FLEETWOOD DR	RUSTBURG	24588	37.1131, -79.0069
Campbell	Schools	RUSTBURG HIGH	1517 JACKSON ST	RUSTBURG	24588	37.2519, -79.1853
Campbell	Schools	RUSTBURG MIDDLE	401 MONTICELLO AVE	RUSTBURG	24588	37.2519, -79.1853



# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Campbell	Schools	TOMAHAWK ELEMENTARY	1350 LIGGATES RD	LYNCHBURG	24502	37.4533, -79.1909
Campbell	Schools	WILLIAM CAMPBELL HIGH	501 LEESVILLE RD	GLADYS	24554	37.3435, -79.2054
Campbell	Schools	YELLOW BRANCH ELEMENTARY	3020 WARDS FERRY RD	RUSTBURG	24588	37.4125, -79.1778
Campbell	Schools	YELLOW BRANCH ELEMENTARY ANNEX	409 PERRYMONT AVE	RUSTBURG	24588	37.4446, -79.2268
Campbell	Service Authority	CAMPBELL COUNTY UTILITY AND SERVICE AUTHORITY OFFICE	180 MOSELEY LN	RUSTBURG	24502	37.3987, -79.1724
Campbell	Sewer Pump Station	OAKDALE PUMP STATION	300 COOPER WAY	LYNCHBURG	24502	37.4171, -79.2055
Campbell	Sewer Pump Station	LEESVILLE ROAD PUMP STATION	103 LYNBROOK RD	LYNCHBURG	24502	37.3956, -79.2061
Campbell	Sewer Pump Station	RUSTBURG 886 PUMP STATION	350 DENNIS RIDDLE DR	RUSTBURG	24588	37.4057, -79.1441
Campbell	Sewer Pump Station	WHITESTONE PUMP STATION	228 MONICA BLVD	LYNCHBURG	24502	37.4044, -79.1798
Campbell	Sewer Pump Station	SHEETZ PUMP STATION	468 EWING DR	LYNCHBURG	24502	37.3863, -79.1744
Campbell	Sewer Pump Station	RUSTBURG 501 PUMP STATION	585 CHRISTIAN SPRINGS RD	RUSTBURG	24588	37.3622, -79.2083
Campbell	Sewer Pump Station	RUSTBURG ELEMENTARY SCHOOL PUMP STATION	967 ROSES MILL RD	RUSTBURG	24588	37.3609, -79.2059
Campbell	Sewer Pump Station	RUSTBURG WWTP PUMP STATION	153 HISTORIC RIVERVIEW WAY	RUSTBURG	24588	37.3895, -79.1882
Campbell	Sewer Pump Station	LAWYERS ROAD PUMP STATION	179 RANDOLPH ST	LYNCHBURG	24501	37.4184, -79.1953
Campbell	Sewer Pump Station	FLAT CREEK PUMP STATION	165 ROYAL CIR	LYNCHBURG	24501	37.4167, -79.1931
Campbell	Sewer Pump Station	460 EAST PUMP STATION	110 SUBSTATION LN	LYNCHBURG	24502	37.4074, -79.1467
Campbell	Sewer Pump Station	TIMBERLAKE BAPTIST CHURCH PUMP STATION	139 INDUSTRIAL PARK DR	LYNCHBURG	24502	37.4515, -79.2067
Campbell	Sewer Pump Station	BRAXTON PARK PUMP STATION	245 NIKONHA LN	LYNCHBURG	24502	37.3895, -79.1882
Campbell	Sewer Pump Station	LEESVILLE ESTATES PUMP STATION	3389 S AMHERST HWY	EVINGTON	24550	37.4057, -79.1512
Campbell	Sewer Pump Station	LYNBROOK PUMP STATION	1915 MISTOVER DR	RUSTBURG	24588	37.3808, -79.2037
Campbell	Sewer Pump Station	YELLOW BRANCH PUMP STATION	302 FALLING CREEK RD	RUSTBURG	24588	37.3603, -79.1722
Campbell	Sewer Pump Station	LIBERTY RIDGE PUMP STATION	281 CO OP LN	LYNCHBURG	24502	37.3796, -79.2022
Campbell	Sewer Pump Station	SENECA PARK PUMP STATION	7666 WATT ABBITT RD	RUSTBURG	24588	37.3658, -79.1898
Campbell	Sewer Pump Station	CAMPBELL CO UTIL AND SERV AUTH/SEWER PUMP STATION	9645 LEESVILLE RD	EVINGTON	24550	37.3978, -79.1670



# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Campbell	Special Population Facility - Nursing Home	AUTUMN CARE OF ALTAVISTA	208 GRISTMILL RD	ALTAVISTA	24517	37.3918, -79.1410
Campbell	Special Population Facility - Nursing Home	RUNK AND PRATT AT LIBERTY RIDGE	501 VES RD	LYNCHBURG	24502	37.3940, -79.1373
Campbell	Special Population Facility - Nursing Home	RUNK & PRATT RESIDENTIAL ADULT CARE OF LYNCHBURG	1213 LONG MEADOWS DR	LYNCHBURG	24502	37.4227, -79.1467
Campbell	Special Population Facility - Nursing Home	LIBERTY RIDGE HEALTH & REHAB CENTER	104 WOOD LN	LYNCHBURG	24502	37.3609, -79.2059
Campbell	Special Population Facility - Nursing Home	HERITAGE HALL-BROOKNEAL	6007 LEE JACKSON HWY	BROOKNEAL	24528	37.4384, -79.2112
Campbell	Special Populations Facility - Detention Facility	RUSTBURG CORRECTIONAL UNIT #9	156 DAVIS ST	RUSTBURG	24588	37.4134, -79.1639
Campbell	Special Populations Facility - Detention Facility	CAMPBELL COUNTY ADULT DETENTION CENTER	229 DANCING CREEK RD	RUSTBURG	24588	37.4074, -79.1660
Campbell	Wastewater Treatment Plant	BROOKNEAL TOWN - FALLING RIVER	9645 LEESVILLE RD	BROOKNEAL	24528	37.4313, -79.1229
Campbell	Wastewater Treatment Plant	BROOKNEAL TOWN - STAUNTON RIVER	130 COMMERCE ST	BROOKNEAL	24528	37.3390, -79.2378
Campbell	Wastewater Treatment Plant	OTTER RIVER WATER TREATMENT PLANT	9625 LEESVILLE RD	EVINGTON	24550	37.5917, -79.0524
Campbell	Wastewater Treatment Plant	ALTAVISTA WASTEWATER PLANT	1200 LANE ACCESS RD	ALTAVISTA	24517	37.3662, -78.8433
Campbell	Wastewater Treatment Plant	CONCORD WASTEWATER PLANT	9405 VILLAGE HWY	CONCORD	24538	37.3670, -78.8281
Campbell	Wastewater Treatment Plant	RUSTBURG WASTEWATER PLANT	180 MOSELEY LN	RUSTBURG	24588	37.3656, -78.8299
Campbell	Wastewater Treatment Plant	ALTAVISTA WATER TREATMENT PLANT	20 RICKY VAN SHELTON DR	HURT	24563	37.3481, -78.8272
Campbell	Water Booster Pump Station	RT 24 FINISHED PUMP STATION	1132 MOUNTAIN WATER DR	EVINGTON	24550	37.1722, -79.6121
Campbell	Water Booster Pump Station	RT 622 PUMP STATION	208 GRANDVIEW DR	LYNCHBURG	24501	37.3412, -79.5171
Campbell	Water Storage Facility	WATER TANK	572 WAUGHS FERRY RD	CONCORD	51031	37.1516, -79.6488
Campbell	Water Storage Facility	OTTER RIVER WATER TANK	1162 UNION HILL RD	EVINGTON	24550	37.1820, -79.6157
Campbell	Water Storage Facility	EVINGTON WATER TANK	114 HUNTER RD	EVINGTON	24550	37.1408, -79.6169
Campbell	Water Storage Facility	RUSTBURG WATER TANK	221 MAIN ST	RUSTBURG	24588	37.3953, -79.2606
Campbell	Water Storage Facility	STEEL STORAGE TANK - BRIARCLIFF	45 LIVESTOCK RD	LYNCHBURG	24502	37.3707, -79.3107
Campbell	Water Storage Facility	CONCORD WATER TANK	1803 SUNBURST RD	CONCORD	24538	37.3845, -79.3008
Campbell	Water Storage Facility	ELEVATED STEEL STORAGE TANK	2537 DEARING FORD RD	LYNCHBURG	24502	37.3894, -79.5516





# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Campbell	Water Storage Facility	WATER TANK	955 RANDOLPH LN	ALTAVISTA	24517	37.3129, -79.4887
Campbell	Water Storage Facility	WATER TANK #2	20335 LEESVILLE RD	ALTAVISTA	24517	37.3027, -79.3246
Campbell	Water Storage Facility	WATER TANK	4520 CANDLERS MOUNTAIN RD	ALTAVISTA	24517	37.3524, -79.5363
Campbell	Water Storage Facility	WATER TANK	4821 FORT AVE	ALTAVISTA	24517	37.3501, -79.5097
Campbell	Water Storage Facility	STEEL WATER TANK	302 MOUNTAINVIEW DR	BROOKNEAL	24528	37.3368, -79.5602
Campbell	Water Storage Facility	STEEL WATER TANK	139 HIGHVIEW DR	BROOKNEAL	24528	37.3504, -79.5224
Campbell	Water Storage Facility	TANGLEWOOD STORAGE TANK	139 WRIGHT SHOP RD	RUSTBURG	24502	37.3559, -79.5081
Campbell	Water Storage Facility	ELEVATED STEEL STORAGE TANK	116 LYTTLETON LN	EVINGTON	24502	37.3189, -79.5029
Campbell	Water Storage Facility	ALTAVISTA WATER TOWER	137 SMOKEY HOLLOW RD	ALTAVISTA	24517	37.3537, -79.5212
Campbell	Water Storage Facility	NARUNA WATER SYSTEM STEEL GROUND STORAGE TANK	211 COMMUNITY LN	GLADYS	24576	37.3788, -79.7098
Campbell	Water Storage Facility	LEESVILLE ROAD STORAGE TANK	201 DEERWOOD DR	LYNCHBURG	24505	37.0934, -79.5646
Campbell	Water Storage Facility	500,000 GALLON WATER TANK	223 FOX RUNN DR	LYNCHBURG	24505	37.0985, -79.5831
Lynchburg	Airport	FALWELL AIRPORT	4306 RICHMOND HWY	LYNCHBURG	24501	37.0874, -79.5700
Lynchburg	Attractions	LYNCHBURG MUSEUM	901 COURT ST	LYNCHBURG	24504	37.3388, -79.4941
Lynchburg	Attractions	POINT OF HONOR MUSEUM	112 CABELL ST	LYNCHBURG	24504	37.0964, -79.5785
Lynchburg	Attractions	LEGACY MUSEUM OF AFRICAN AMERICAN HISTORY	403 MONROE ST	LYNCHBURG	24504	37.0877, -79.5715
Lynchburg	Attractions	ANN SPENCER HOUSE & GARDEN MUSEUM	1313 PIERCE ST	LYNCHBURG	24501	37.4284, -79.2657
Lynchburg	Attractions	MAIER MUSEUM OF ART	1 QUINLAN ST	LYNCHBURG	24503	37.0902, -79.5649
Lynchburg	Attractions	OLD CITY CEMETERY	206 MONROE ST	LYNCHBURG	24504	37.0923, -79.5690
Lynchburg	Attractions	HISTORIC SANDUSKY FOUNDATION - CIVIL WAR MUSEUM	757 SANDUSKY DR	LYNCHBURG	24502	37.3756, -79.3006
Lynchburg	Attractions	AMAZEMENT SQUARE CHILD MUSEUM	27 9TH ST	LYNCHBURG	24504	37.3418, -79.2340
Lynchburg	College	SYLVAIN MELLOUL INTERNATIONAL HAIR ACADEMY	3405 CANDLERS MOUNTAIN RD	LYNCHBURG	24502	37.3294, -79.2170
Lynchburg	College	VIRGINIA UNIVERSITY OF LYNCHBURG	2058 GARFIELD AVE	LYNCHBURG	24501	37.2768, -79.1071
Lynchburg	College	LYNCHBURG COLLEGE	1501 LAKESIDE DR	LYNCHBURG	24501	37.3234, -79.2479



# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Lynchburg	College	MILLER-MOTTE TECHNICAL COLLEGE- LYNCHBURG	1011 CREEKSIDE LN	LYNCHBURG	24502	37.3254, -79.1924
Lynchburg	College	RANDOLPH COLLEGE	2500 RIVERMONT AVE	LYNCHBURG	24503	37.2795, -79.1011
Lynchburg	College	CENTRAL VIRGINIA COMMUNITY COLLEGE	3506 WARDS RD	LYNCHBURG	24502	37.2698, -79.1067
Lynchburg	College	LIBERTY UNIVERSITY	1971 UNIVERSITY BLVD	LYNCHBURG	24515	37.2723, -79.0980
Lynchburg	College	CENTRA COLLEGE OF NURSING	905 LAKESIDE DR SUITE A	LYNCHBURG	24501	37.3138, -79.1947
Lynchburg	College	AMERICAN NATIONAL UNIVERSITY - LYNCHBURG VA CAMPUS	104 CANDLEWOOD CT	LYNCHBURG	24502	37.3096, -79.1830
Lynchburg	Communication Facility	WLLL - AM - HUBBARD'S ADVERTISING AGENCY, INC.	319 CHAPEL LN	LYNCHBURG	24501	37.3414, -79.1840
Lynchburg	Communication Facility	WLVA - AM - TRUTH BROADCASTING CORPORATION	122 BEACON HILL PL	LYNCHBURG	24503	37.3308, -79.2464
Lynchburg	Electrical Substation	ELECTRICAL SUBSTATION	200 AMELON SQUARE	LYNCHBURG	24501	37.3248, -79.2589
Lynchburg	Electrical Substation	ELECTRICAL SUBSTATION	1368 AMERICAN WAY	LYNCHBURG	24501	37.3027, -79.2425
Lynchburg	Electrical Substation	ELECTRICAL SUBSTATION	22 LEXINGTON PARK DR	LYNCHBURG	24501	37.2895, -79.1699
Lynchburg	Electrical Substation	ELECTRICAL SUBSTATION	9625 LEESVILLE RD	LYNCHBURG	24504	37.2510, -79.1847
Lynchburg	Electrical Substation	AEP ELECTRICAL SUBSTATION	11418 LEESVILLE RD	LYNCHBURG	24504	37.3349, -79.1752
Lynchburg	Electrical Substation	ELECTRICAL SUBSTATION	154 SPRING MILL RD	LYNCHBURG	24503	37.2364, -79.1732
Lynchburg	Electrical Substation	ELECTRICAL SUBSTATION	111 OAKDALE CIR	LYNCHBURG	24503	37.6091, -79.0384
Lynchburg	Electrical Substation	ELECTRICAL SUBSTATION	521 WISE ST	LYNCHBURG	24503	37.2075, -79.2997
Lynchburg	Electrical Substation	ELECTRICAL SUBSTATION	521 WISE ST	LYNCHBURG	24502	37.1240, -79.2881
Lynchburg	Electrical Substation	ELECTRICAL SUBSTATION	1301 PARK AVE	LYNCHBURG	24502	37.3376, -79.1735
Lynchburg	Electrical Substation	ELECTRICAL SUBSTATION	1618 MELINDA DR	LYNCHBURG	24501	37.3782, -79.2364
Lynchburg	Electrical Substation	ELECTRICAL SUBSTATION	1618 MELINDA DR	LYNCHBURG	24503	37.4127, -79.1760
Lynchburg	Emergency Operations Center	LYNCHBURG CITY EMERGENCY COMMUNICATION CENTER	179 MORTON LN	LYNCHBURG	24502	37.3429, -79.5349
Lynchburg	Energy Facility	REUSENS DAM HYDRO PLANT	4467 S. AMHERST HWY	LYNCHBURG	24503	37.3116, -79.5016
Lynchburg	Fire Stations	LYNCHBURG FIRE DEPARTMENT STATION 4 - BIRCH STREET	1128 SHINGLE BLOCK RD	LYNCHBURG	24503	37.4083, -79.1758
Lynchburg	Fire Stations	LYNCHBURG FIRE DEPARTMENT STATION 7 - LAKESIDE DRIVE	8569 BROOKNEAL HWY	LYNCHBURG	24501	37.3684, -79.1815



## Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Lynchburg	Fire Stations	LYNCHBURG FIRE DEPARTMENT STATION 8 - OLD GRAVES MILL ROAD	1570 MOUNT ATHOS RD	LYNCHBURG	24502	37.4026, -79.1419
Lynchburg	Fire Stations	LYNCHBURG FIRE DEPARTMENT STATION 5 - PEAKLAND	1305 FALLING CREEK RD	LYNCHBURG	24503	37.3309, -79.2169
Lynchburg	Fire Stations	LYNCHBURG FIRE DEPARTMENT STATION 2 - GRACE STREET	1220 BANDY MILL RD	LYNCHBURG	24504	37.5791, -79.0377
Lynchburg	Fire Stations	LYNCHBURG FIRE DEPARTMENT STATION 3 - FORT HILL	4201 MURRAY PL	LYNCHBURG	24502	37.3254, -79.5454
Lynchburg	Fire Stations	LYNCHBURG FIRE DEPARTMENT STATION 6 - MILLER PARK	10643 STEWARTSVILLE RD	LYNCHBURG	24501	37.3785, -79.2379
Lynchburg	Fire Stations	R R DONNELLEY INCORPORATED FIRE BRIGADE	10624 COLONIAL HWY	LYNCHBURG	24501	37.3758, -79.2467
Lynchburg	Fire Stations	LYNCHBURG FIRE DEPARTMENT STATION 1 - CLAY STREET	4893 LEXINGTON TPKE	LYNCHBURG	24504	37.4508, -79.1909
Lynchburg	Gas Facility	GAS FACILITY	119 TAYLOR ST	LYNCHBURG	24504	37.4358, -79.1848
Lynchburg	HazMat Facility	WESTROCK CONVERTING COMPANY	1801 CONCORD TPKE	LYNCHBURG	24504-3637	37.3365, -79.1762
Lynchburg	HazMat Facility	HANSON INDUSTRIES INC	3300 JOHN CAPRON RD.	LYNCHBURG	24501-5042	37.4130, -79.1824
Lynchburg	HazMat Facility	U.S. PIPE (FORMER GRIFFIN PIPE PRODUCTS CO LLC)	10 ADAMS ST	LYNCHBURG	24504	37.0422, -78.9320
Lynchburg	HazMat Facility	GNB INC	2800 CARROLL AVE.	LYNCHBURG	24501-4911	37.3558, -79.2416
Lynchburg	HazMat Facility	WAYTEC ELECTRONICS CORP	1104 MCCONVILLE RD.	LYNCHBURG	24502	37.3535, -78.8473
Lynchburg	HazMat Facility	SLOCUM ADHESIVES CORPORATION	1409 BUCHANAN ST	LYNCHBURG	24501	37.5791, -79.0572
Lynchburg	HazMat Facility	PEPSI BOTTLING GROUP	121 BRADLEY DR	LYNCHBURG	24502	37.3717, -79.1993
Lynchburg	HazMat Facility	C.R. HUDGINS PLATING, INC.	800 CRADDOCK ST	LYNCHBURG	24502	37.3466, -78.8254
Lynchburg	HazMat Facility	OLD DOMINION WOOD PRODUCTS	9363 LEE JACKSON HWY	LYNCHBURG	24505	37.3981, -79.7539
Lynchburg	HazMat Facility	ALLEN-MORRISON SIGNAGE COMPANY	104 WOOD LN	LYNCHBURG	24501	37.4077, -79.1725
Lynchburg	HazMat Facility	PARKER HANNIFIN CORPORATION - POWERTRAIN DIVISION	1000 DILLARD DR	LYNCHBURG	24501-5023	37.3571, -79.2415
Lynchburg	HazMat Facility	LYNCHBURG FOUNDRY CO LOWER BASIN PLANT	3550 MAYFLOWER DR	LYNCHBURG	24504	37.3446, -79.5075
Lynchburg	HazMat Facility	SMITH MOUNTAIN INDUSTRIES INC	1191 VENTURE DR.	FOREST	24551	37.2673, -79.0678



## Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Lynchburg	HazMat Facility	BANKER STEEL CO LLC - 30997	3420 CANDLERS MOUNTAIN RD	LYNCHBURG	24501	37.4088, -79.0947
Lynchburg	HazMat Facility	DELTA STAR INC.	11685 W LYNCHBURG SALEM TPKE	LYNCHBURG	24501	37.3940, -79.1371
Lynchburg	HazMat Facility	SIMPLIMATIC ENG CO	ONE MILLRACE DR	LYNCHBURG	24502-2908	37.5854, -79.0498
Lynchburg	HazMat Facility	DAVIS FROST INC	4225 MURRAY PL	LYNCHBURG	24506	37.3375, -79.5083
Lynchburg	HazMat Facility	NORCRAFT COMPANIES	813 LYNCHBURG AVE	LYNCHBURG	24502	37.3555, -78.8308
Lynchburg	HazMat Facility	WORLD COLOR PROCUREMENT LLC (CLOSED)	1070 OIL TERMINAL RD	LYNCHBURG	24501	37.2774, -79.1029
Lynchburg	HazMat Facility	CB FLEET CO	5114 WOODALL RD	LYNCHBURG	24506	37.4127, -79.1451
Lynchburg	HazMat Facility	WESTOVER DAIRY	1000 ROBINS RD	LYNCHBURG	24506	37.4065, -79.1571
Lynchburg	HazMat Facility	RR DONNELLEY PRINTING COMPANY	1724 MOUNT ATHOS RD	LYNCHBURG	24501-5099	37.3719, -79.7094
Lynchburg	HazMat Facility	PORTERS GROUP LLC	2006 GRACE ST	LYNCHBURG	24506	37.3552, -78.8155
Lynchburg	HazMat Facility	FLOWSERVE CORPORATION	2084 FORT AVE	LYNCHBURG	24502	37.0522, -78.9340
Lynchburg	HazMat Facility	TRI TECH LABORATORIES INC	984 AIRPORT RD	LYNCHBURG	24504-3516	37.3336, -79.5067
Lynchburg	Large Population Venue	CITY STADIUM	215 EAST MAIN ST	LYNCHBURG	24501	37.0376, -78.9391
Lynchburg	Large Population Venue	LIBERTY VINES CONVOCATION CENTER	1345 FALLING CREEK RD	LYNCHBURG	24502	37.5844, -79.0304
Lynchburg	Large Population Venue	ACADEMY CENTER OF THE ARTS	115 TAYLOR ST	LYNCHBURG	24504	37.1721, -79.6131
Lynchburg	Law Enforcement	BABCOCK AND WILCOX POLICE DEPARTMENT	1229 COUNTY FARM RD	LYNCHBURG	24504	37.3278, -78.8500
Lynchburg	Law Enforcement	LIBERTY UNIVERSITY POLICE DEPARTMENT	1902 GRACE ST	LYNCHBURG	24502	37.3968, -79.1141
Lynchburg	Law Enforcement	LYNCHBURG CITY SHERIFFS OFFICE	20212 LEESVILLE RD	LYNCHBURG	24504	37.4846, -79.1664
Lynchburg	Law Enforcement	LYNCHBURG POLICE DEPARTMENT	173 BROCKMAN PARK DR	LYNCHBURG	24504	37.1405, -79.6163
Lynchburg	Law Enforcement	CENTRAL VIRGINIA COMMUNITY COLLEGE POLICE	201 LILLIAN LN	LYNCHBURG	24502	37.2113, -79.2988
Lynchburg	Public Health	VIRGINIA BAPTIST HOSPITAL	510 7TH ST	LYNCHBURG	24503	37.3788, -79.5592
Lynchburg	Public Health	CENTRA SPECIALTY HOSPITAL	87 COURTHOUSE LN	LYNCHBURG	24503	37.6003, -79.0356
Lynchburg	Public Health	SURGERY CENTER OF LYNCHBURG	4308 WARDS RD	LYNCHBURG	24501	37.1123, -79.2740



# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Lynchburg	Public Health	LYNCHBURG GENERAL HOSPITAL	1065-G AIRPORT RD	LYNCHBURG	24501	37.3364, -78.9771
Lynchburg	Public Shelter - Cooling Center	COLLEGE HILL CENTER	811 JACKSON ST	LYNCHBURG	24504	37.2729, -79.0977
Lynchburg	Public Shelter - Cooling Center	SALVATION ARMY	2211 PARK AVE	LYNCHBURG	24501	37.1045, -79.2833
Lynchburg	Schools	VIRGINIA EPISCOPAL SCHOOL	2501 LINKHORNE DR	LYNCHBURG	24503	37.3506, -78.8111
Lynchburg	Schools	BRIDGES TREATMENT CENTER	2525 LINKHORNE DR	LYNCHBURG	24502	37.3897, -79.5531
Lynchburg	Schools	HOLY CROSS REGIONAL CATHOLIC SCHOOL	1208 POLK ST	LYNCHBURG	24501	37.4969, -79.2465
Lynchburg	Schools	JAMES RIVER DAY SCHOOL	4641 LOCKSVIEW RD	LYNCHBURG	24503	37.0640, -79.5463
Lynchburg	Schools	NEW VISTAS SCHOOL	409 PERRYMONT AVE	LYNCHBURG	24501	37.0667, -79.5411
Lynchburg	Schools	RIVERMONT SCHOOL	1201 FLOYD ST	LYNCHBURG	24501	37.4396, -79.2746
Lynchburg	Schools	NEW COVENANT SCHOOLS	5828 APACHE LN	LYNCHBURG	24501	37.2348, -79.2367
Lynchburg	Schools	LYNCHBURG DAY SERVICES	100 MOUNTAIN VIEW RD	LYNCHBURG	24504	37.3147, -79.2263
Lynchburg	Schools	LAUREL REGIONAL SPECIAL EDUCATION CENTER	805 CHINOOK PL	LYNCHBURG	24501	37.3402, -78.9882
Lynchburg	Schools	FORT HILL COMMUNITY SCHOOL	115 KENWOOD PL	LYNCHBURG	24502	37.2109, -79.2992
Lynchburg	Schools	HERITAGE ELEMENTARY	600 MANSFIELD AVE	LYNCHBURG	24502	37.2315, -79.2848
Lynchburg	Schools	HERITAGE HIGH	1730 SEABURY AVE	LYNCHBURG	24502	37.2790, -79.0892
Lynchburg	Schools	HUTCHERSON EARLY LEARNING CENTER	1400 FLORIDA AVE	LYNCHBURG	24502	37.3250, -79.2276
Lynchburg	Schools	LINKHORNE ELEMENTARY	405 CABELL ST	LYNCHBURG	24503	37.3345, -78.9764
Lynchburg	Schools	LINKHORNE MIDDLE	3020 WARDS FERRY RD	LYNCHBURG	24503	37.3404, -79.2361
Lynchburg	Schools	PAUL LAURENCE DUNBAR MIDDLE FOR INNOVATION	4330 MORNINGSIDE DR	LYNCHBURG	24504	37.3548, -79.1686
Lynchburg	Schools	PAUL MUNRO ELEMENTARY	210 SMYTH ST	LYNCHBURG	24503	37.4114, -79.1549
Lynchburg	Schools	PERRYMONT ELEMENTARY	2111 MEMORIAL AVE	LYNCHBURG	24502	37.4113, -79.1542
Lynchburg	Schools	ROBERT S. PAYNE ELEMENTARY	241 HANGER RD	LYNCHBURG	24501	37.4107, -79.1548
Lynchburg	Schools	SANDUSKY ELEMENTARY	7901 RICHMOND HWY	LYNCHBURG	24502	37.1270, -79.2904
Lynchburg	Schools	LIBERTY CHRISTIAN ACADEMY	562 JONES ST	LYNCHBURG	24502	37.1271, -79.2903
Lynchburg	Schools	SANDUSKY MIDDLE	419 JONES ST	LYNCHBURG	24502	37.1382, -79.2685
Lynchburg	Schools	SHEFFIELD ELEMENTARY SCHOOL	148 HUNTER ST	LYNCHBURG	24502	37.1135, -79.2989





# Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Lynchburg	Schools	T.C. MILLER ELEMENTARY FOR INNOVATION	1622 WHITE HOUSE RD	LYNCHBURG	24501	37.5637, -79.0741
Lynchburg	Schools	WILLIAM M. BASS ELEMENTARY	999 ELM ST	LYNCHBURG	24501	37.5600, -79.0178
Lynchburg	Schools	LYNCHBURG JUVENILE DETENTION HOME	1436 BRIDGEWATER BAY DR	LYNCHBURG	24501	37.0616, -78.9495
Lynchburg	Schools	CROSSROADS / SINGLE POINT OF ENTRY	13080 S OLD MONETA RD	LYNCHBURG	24504	37.0472, -78.9428
Lynchburg	Schools	CENTRAL VIRGINIA GOVERNOR'S SCHOOL	1442 RADFORD CHURCH RD	LYNCHBURG	24502	37.2783, -79.1650
Lynchburg	Schools	BEDFORD HILLS ELEMENTARY	2474 COTTONTOWN RD	LYNCHBURG	24503	37.3098, -79.2552
Lynchburg	Schools	DEARINGTON ELEMENTARY / INNOVATION	101 ASHWOOD DR	LYNCHBURG	24501	37.1437, -79.2665
Lynchburg	Schools	E.C. GLASS HIGH	1715 HELMSDALE DR	LYNCHBURG	24501	37.1334, -79.0244
Lynchburg	Special Population Facility - Nursing Home	BENTLEY COMMONS AT LYNCHBURG	1201 LANGHORNE RD	LYNCHBURG	24502	37.4490, -79.2456
Lynchburg	Special Population Facility - Nursing Home	MEDICAL CARE CENTER	189 MONICA BLVD	LYNCHBURG	24501	37.4454, -79.2753
Lynchburg	Special Population Facility - Nursing Home	CARRINGTON, THE	1320 ENTERPRISE DR	LYNCHBURG	24501	37.3549, -79.1690
Lynchburg	Special Population Facility - Nursing Home	LYNCHBURG HEALTH & REHABILITATION CENTER	STATE ROUTE 691	LYNCHBURG	24502	37.3819, -79.1819
Lynchburg	Special Population Facility - Nursing Home	GUGGENHEIMER HEALTH AND REHAB CENTER	108-112 SENIOR ST	LYNCHBURG	24504	37.3319, -79.2153
Lynchburg	Special Population Facility - Nursing Home	HERITAGE GREEN ASSISTED LIVING	2249 MURRELL RD	LYNCHBURG	24502	37.3441, -79.1734
Lynchburg	Special Population Facility - Nursing Home	WESTMINSTER CANTERBURY OF LYNCHBURG	1350 LONGWOOD AVE	LYNCHBURG	24503	37.3817, -79.1821
Lynchburg	Special Population Facility - Nursing Home	WILLIAMS HOME INCORPORATED	1477 DRAPER RD.	LYNCHBURG	24503	37.2703, -78.6845
Lynchburg	Special Population Facility - Nursing Home	AVANTE AT LYNCHBURG	9363 LEE JACKSON HWY	LYNCHBURG	24501	37.2710, -79.8533
Lynchburg	Special Population Facility - Nursing Home	SUMMIT ASSISTED LIVING	4839 HOLCOMB ROCK RD	LYNCHBURG	24502	37.4900, -79.1360
Lynchburg	Special Population Facility - Nursing Home	VALLEY VIEW RETIREMENT COMMUNITY	2074 FORD RD	LYNCHBURG	24502	37.4759, -79.1175
Lynchburg	Special Population Facility - Nursing Home	THE ELMS OF LYNCHBURG	479 CAMP NINE RD	LYNCHBURG	24501	37.4415, -79.0886



## Appendix G: Critical Facilities

County	Facility Type	Facility	Address/Location	City/Place	ZIP Code	Coordinates
Lynchburg	Special Population Facility - Nursing Home	SUMMIT HEALTH AND REHABILITATION CENTER	219 RIVERVIEW RD	LYNCHBURG	24502	37.4366, -79.1240
Lynchburg	Special Populations Facility - Detention Facility	LYNCHBURG REGIONAL JUVENILE DETENTION CENTER	575 UNION HILL RD	LYNCHBURG	24501	37.5343, -79.0994
Lynchburg	Special Populations Facility - Detention Facility	LYNCHBURG ADULT DETENTION CENTER	1981 LOWESVILLE RD	LYNCHBURG	24504	37.3520, -78.9093
Lynchburg	Transportation Hub	KEMPER STREET STATION	825 KEMPER ST	LYNCHBURG	24501	37.1407, -79.6108
Lynchburg	Wastewater Treatment Plant	LYNCHBURG CITY SEWAGE TREATMENT	2301 CONCORD TPKE	LYNCHBURG	24504	37.3976, -79.2588
Lynchburg	Water Storage Facility	GROUND STORAGE TANK, 2,000,000 GALLON	40 COUNTY AIRPORT RD	LYNCHBURG	24505	37.4205, -79.3045
Lynchburg	Water Storage Facility	GROUND STORAGE TANK, 1,400,000 GALLON	125 MILL LANE RD	LYNCHBURG	24505	37.2786, -79.8101
Lynchburg	Water Storage Facility	RESERVOIR 10,500,000 GALLON	207 FOX HOLLOW RD	LYNCHBURG	24505	37.1271, -79.6431
Lynchburg	Water Storage Facility	GROUND STORAGE TANK, 4,500,000 GALLON	3770 CANDLERS MOUNTAIN RD	LYNCHBURG	24505	37.0626, -79.5470
Lynchburg	Water Storage Facility	CANDLERS MOUNTAIN GROUNDS STORAGE TANK, 1,000,000	1221 NARROWS LN	LYNCHBURG	24505	37.3779, -79.5584
Lynchburg	Water Storage Facility	FORT AVENUE STORAGE TANK #1, 2,000,000	1562 CAPEWOOD DR	LYNCHBURG	24505	37.3091, -79.3423
Lynchburg	Water Storage Facility	STORAGE TANK #2, 500,000 GALLONS	1830 RADFORD CHURCH RD	LYNCHBURG	24505	37.3246, -79.5201



# Appendix H: Hazard Events

## Appendix H: Hazard Events

### Hazard events in the news report

#### Flooding, 2018

##### Lynchburg

#### Sources:

- <https://www.accuweather.com/en/weather-news/breaking-potential-college-lake-dam-failure-spurs-evacuations-in-lynchburg-virginia/70005672>
- <https://www.bbc.com/news/world-us-canada-45054961>

#### Tornado, 2018

##### (Counties of Amherst, Campbell, and Bedford, and City of Lynchburg)

A tornado struck Lynchburg and the counties of Amherst and Campbell on April 15, 2018. The line of storms brought heavy rain, some hail, and violent wind gusts causing damage to property and infrastructure (Williamson, 2018). The tornado first touched down in northwest Campbell County causing damage to roofs and trees. According to a preliminary report by the National Weather Services in Blacksburg, the tornado was rated EF2<sup>131</sup> and it had an estimated wind speed of 130 mph, a path length of 20.4 miles, and a maximum path width of 600 yards (The News and Advance, 2018). Six people in Amherst and two in Lynchburg suffered injuries and no fatalities were reported (Faulconer, 2018). According to AEP, 1657 customers in Amherst County, 1981 in Campbell County, and 10177 customers in Lynchburg were affected by the power outage (Williamson, 2018). The tornado uprooted big mature trees and snapped telephone poles damaging the nearby structures.

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<sup>131</sup> EF - Enhanced Fujita scale, which classifies tornadoes in six categories of strength ranging from EF-0 at the weakest to EF-5 at the strongest. EF2 - strong tornado with a maximum wind speeds of 111-135 mph.



## Appendix H: Hazard Events

A mobile home park in Lynchburg was damaged by the tornado, with some minor damage to roofs of other houses in the area (National Weather Service Blacksburg). Roakes, Public Safety Director of Amherst County reported, 'A total of 146 homes in Amherst County were identified as having tornado-related damage, with 21 beyond repair'. The most severe damage was centered around the Elon area. Initial reports estimated the structural damage in Amherst County at \$3.685 million (The News and Advance, 2018). These numbers are expected to rise as the inspections continue. In Campbell County, around 15 to 20 businesses and a handful of homes were reported as damaged (Seidel, 2018).

Debris scattered after the tornado



[Photo by Lindsey Jenkins](#)

House located on Silver Springs Drive overturned by the tornado



[Photo by Lathan Goumas](#)

### References

1. The News and Advance. April 17, 2018. Update: Number of structures damaged by tornado climbs retrieved from [http://www.newsadvance.com/news/local/update-number-of-structures-damaged-by-tornado-climbs/article\\_c67fda02-4224-11e8-acc2-5b9d81c52993.html](http://www.newsadvance.com/news/local/update-number-of-structures-damaged-by-tornado-climbs/article_c67fda02-4224-11e8-acc2-5b9d81c52993.html)
2. Williamson, Jeff. 2018. Thousands without power after severe weather hits region. 10 News retrieved from <https://www.wsls.com/news/virginia/lynchburg/more-than-19000-without-power-after-severe-weather-hits-region>
3. U.S. National Weather Service Blacksburg, VA  
<https://www.facebook.com/NWSBlacksburg/posts/1749285475130381>
4. Falconer, Justin. April 16, 2018. Severe storm damage in Lynchburg area; weather service calls storm 'tornadic'. Richmond Times-Dispatch. retrieved from [http://www.richmond.com/weather/severe-storm-damage-in-lynchburg-area-weather-service-calls-storm/article\\_6ddadff8-d25d-55e9-81fc-5a679dde7419.html](http://www.richmond.com/weather/severe-storm-damage-in-lynchburg-area-weather-service-calls-storm/article_6ddadff8-d25d-55e9-81fc-5a679dde7419.html)
5. Seidel, David. April 15, 2018. Severe Storms, Tornadoes Cause Damage; Touchdown Confirmed in Lynchburg area, Danville, Craig County. retrieved from <http://wvtf.org/post/severe-storms-tornadoes-cause-damage-touchdown-confirmed-lynchburg-area-danville-craig-county>



# Appendix H: Hazard Events

## Tornado, 2016

### (Appomattox County)

In February, 2016, Evergreen Community in Appomattox County, was struck by an EF3 <sup>132</sup> tornado and it had a wind speed of 165 mph. The tornado resulted in death of one person and seven injuries, and left more than 40 families homeless. It had a path length of 13 miles and a width of 400 yards starting from southeast of Appomattox and ending west of the Holiday Lake State Park (Monfort, 2016). Evergreen and Red House communities of Appomattox were severely affected by the tornado (Wise, 2016). Evergreen neighborhood was shattered into pieces and was left with smashed cars, destroyed belongings, and some building foundations without floors (Monfort, 2016).

The tornado damaged buildings and downed trees in some parts of the County. Appomattox County Officials stated, at least 100 homes in the area were affected of which 20 were completely destroyed by the tornado. Several residents of the county were affected by power outages. Additionally, phone lines were down in some areas which affected the emergency communication (Monfort, 2016). Two temporary shelters were set up for the people whose houses were damaged by the storm.

[House damaged in the Appomattox County tornado](#)

[Tornado damage along Richmond County Highway in Appomattox County](#)



Photos by Jill Nance

## References

1. Monfort, Ashley. 2016. Tornado that hit Appomattox was EF-3 with winds up to 165 MPH. retrieved from <http://www.nbc12.com/story/31315571/tornado-that-hit-appomattox-was-ef-3-with-winds-up-to-165-mph>
2. Wise, Scott. February 26, 2016. Drone footage captures heartbreaking images over tornado damage. Retrieved from <http://wtvr.com/2016/02/26/appomattox-drone-footage/>

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<sup>132</sup> EF3 - A category defined as having wind speed of up to 165 mph





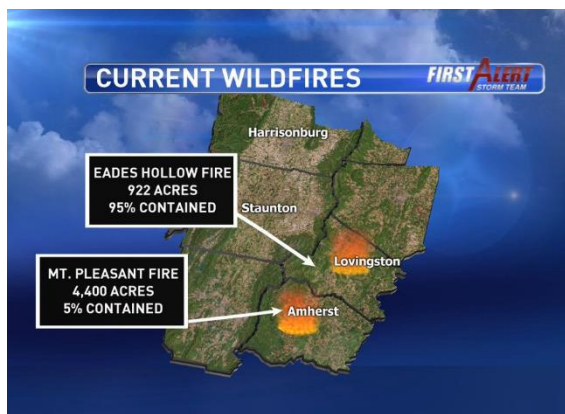
# Appendix H: Hazard Events

## Wildfire, 2016

### (Amherst County)

Counties of Amherst and Campbell were impacted by a wildfire called the Mt. Pleasant Fire in November, 2016. The fire started near the George Washington National Forest and spread to private land in the Mount Pleasant area (Walsh, 2016). The forest fire in Amherst County continued for about a week and burned more than 11,000 acres, approximately 12 miles northwest of the town of Amherst (ABC, 2016). According to the fire officials, strong winds and low humidity contributed to the rapid spread of the fire in the region. No injuries and damage to houses was reported. Heavy smoke was reported in the surrounding areas due to southerly winds gusting over the valley.

#### [Location of November, 2016 wildfires in Central Virginia](#)



Posted by Aubrey Urbanowicz on Twitter

#### [Smoke rises from the forest fire in George Washington National Forest,](#)



Photo by Lathan Goumas

Following the event, Mount Pleasant National Scenic Area and several roads in the region were closed to the public until the fire was contained completely.

## References

1. Tyree, Elizabeth., Ann, Ashley. November 22, 2016. Amherst County wildfire grows to 4,800 acres, national teams brought in to help. retrieved from <http://wset.com/news/local/amherst-county-wildfire-grows-to-2700-acres-national-teams-brought-in-to-help>
2. ABC. November 29, 2016. Mount Pleasant fire in Amherst County now 95 percent contained. retrieved from <http://www.whsv.com/content/news/Mount-Pleasant-fire-in-Amherst-County-now-95-percent-contained-403602666.html>



## Appendix H: Hazard Events

3. Walsh, Toshi. November 26, 2016. Amherst County wildfire moves to 11,000 acres; almost half contained, officials say. Richmond Times - Dispatch. retrieved from [http://www.richmond.com/news/virginia/amherst-county-wildfire-moves-to-acres-almost-half-contained-officials/article\\_3de59779-ae48-54a9-97bd-53950e59aed5.html](http://www.richmond.com/news/virginia/amherst-county-wildfire-moves-to-acres-almost-half-contained-officials/article_3de59779-ae48-54a9-97bd-53950e59aed5.html)



# Appendix H: Hazard Events

## Derailment of Train carrying Crude Oil, 2014 (Lynchburg)

In May of 2014, a crude oil carrying train in route from Chicago to Virginia derailed in Lynchburg sending three tankers rushing into the James River (Nunez, 2014). One of the tumbled tankers ruptured spilling almost 30,000 gallons of crude oil that either burned or washed away further into the river (Martz, 2016). The accident caused approximately \$ 1.2 million in damage alone, not including environmental remediation (NTSB). The incident did not cause any deaths or injuries and no damage to nearby buildings was reported (Dave, 2014). There were no reports of environmental impacts beyond Lynchburg (Springston, 2014).

Three CSX tankers sink in the James River



[Photo by Autumn Parry](#)

Crude Oil carrying train derailed in Lynchburg



[Photo by Mark Mellette](#)

The fire and spill after the derailment prompted immediate evacuations in six blocks along the riverfront, affecting 350 residents and 20 businesses in the downtown district (The News and Advance). At the spill site, remaining oil which was not burned was soaked from the river using various absorbent devices (Roanoke Times). Additionally, people in the region were advised by the state health officials to avoid swimming or paddling in the river (Roanoke Times).

### References

1. Nunez, Christina. May 2 2014. Oil Train Derails in Lynchburg, Virginia. National Geographic. retrieved from <https://news.nationalgeographic.com/news/energy/2014/04/140430-oil-train-derails-in-lynchburg-virginia/>
2. Martz, Michael. March 2, 2016. Report: Lynchburg oil train derailment could have been prevented. The News and Advance. retrieved from [http://www.newsadvance.com/work\\_it\\_lynchburg/news/report-lynchburg-oil-train-derailment-could-have-been-prevented/article\\_b81c3cfa-e095-11e5-8d3a-4323733baf51.html](http://www.newsadvance.com/work_it_lynchburg/news/report-lynchburg-oil-train-derailment-could-have-been-prevented/article_b81c3cfa-e095-11e5-8d3a-4323733baf51.html)



## Appendix H: Hazard Events

3. NTSB. National Transportation Safety Board Railroad Accident Brief. retrieved from <https://www.nts.gov/investigations/AccidentReports/Reports/RAB1601.pdf>
4. Dave, Paresh. April 30, 2014. Oil tanker train derails in Lynchburg, Va., triggering fire and spill. Los Angeles Times. retrieved from <http://www.latimes.com/nation/nationnow/la-na-nn-lynchburg-virginia-train-derailment-20140430-story.html>
5. Springston, Rex. May 7, 2014. Crude oil spilled from train may be in James River mud. Richmond Times-Dispatch. Retrieved from [http://www.roanoke.com/news/crude-oil-spilled-from-train-may-be-in-james-river/article\\_141d2a48-d65a-11e3-ad4f-001a4bcf6878.html](http://www.roanoke.com/news/crude-oil-spilled-from-train-may-be-in-james-river/article_141d2a48-d65a-11e3-ad4f-001a4bcf6878.html)



# Appendix H: Hazard Events

## Rain Storm, 2013

### (Lynchburg, Campbell County)

The July 11, 2013 rainstorm in Lynchburg resulted in the closure of several key roads (Parts of Sussex Street, Campbell Avenue, Florida Avenue, and Greenwood Drive). Reports stated that after the rainstorm, the total amount of rainfall in Lynchburg for the year 2013 at that point was more as compared to 2012.

The Concord Area of Campbell County received about 3 inches of rain and was hard hit by the storm. This affected the traffic in the area as water gushed out of parking lots onto the roads and there was limited visibility. The rainfall overwhelmed the city's pipes and there were 8 to 10 incidents of water driving sewage into people's basements. Additionally, there were a dozen or more instances of manhole covers popping open and sewage water overflowing because of the water pressure.

Sandusky Drive near Oakdale Drive in Lynchburg flooded  
after the storm



## References

1. Pounds, Jessie., Mohrmann, Barrett. July 11, 2013. Streets, basements flood in heavy rains in Lynchburg. The News and Advance. retrieved from [http://www.newsadvance.com/news/local/streets-basements-flood-in-heavy-rains-in-lynchburg/article\\_2804fdb8-ea62-11e2-a5b2-001a4bcf6878.html](http://www.newsadvance.com/news/local/streets-basements-flood-in-heavy-rains-in-lynchburg/article_2804fdb8-ea62-11e2-a5b2-001a4bcf6878.html)





# Appendix H: Hazard Events

## Derecho<sup>133</sup>, 2012

Severe Storms and Straight Line winds, 2012 June (4072) - Amherst, Campbell, Appomattox, Bedford  
(FEMA Disaster Declarations)

The city of Lynchburg and surrounding regions were affected by a highly destructive storm known as 'Derecho' on June 29, 2012 (The News and Advance, 2018). The storm had a wind speed of 75 mph and it caused one of the largest power outages in Appalachian Power's history (Stuart, 2012). Approximately 70,000 customers in the Lynchburg region lost electricity (The News and Advance, 2018).

The public sewage treatment station in Lynchburg also lost electricity and was powerless for 24 hours. As a result of this, 2.5 million gallons of untreated wastewater was dumped into the James River (Springston, 2012). Additionally, millions more gallons of partially treated wastewater entered the river before the treatment plant became fully functional (Source). The Lynchburg plant did not have any backup generators and generally relied on nearby sources in case of a power outage (Springston, 2012). The City of Lynchburg had not planned for a region-wide event where multiple sources of electricity would fail simultaneously.

Damaged power poles, broken power lines, fallen trees affected many homes and businesses in the region. According to FEMA, the estimated damage of the storm was \$5.3 million (ABC 13, 2012). City Manager stated that a significant portion of the cost was from immediate clean-up.

Fallen tree and damaged power lines on Langhorne Ave Link Road home damaged by a huge Oak tree



Source: Photo by Parker Michels-Boyce/The News & Advance

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<sup>133</sup> A derecho forms when the winds from several different thunderstorms join forces to produce one large gust of wind.



# Appendix H: Hazard Events

Following the event many cooling shelters were opened in Lynchburg and the surrounding counties which provided a relief to the people affected by the outage and the heat wave accompanied by the storm (The news and Advance).

## References

1. The News and Advance. March 2, 2018. From the archives: Derecho 2012. retrieved from [http://www.newsadvance.com/news/local/from-the-archives-derecho/collection\\_3da0e42c-1e61-11e5-95c6-a76ecaba2d74.html#1](http://www.newsadvance.com/news/local/from-the-archives-derecho/collection_3da0e42c-1e61-11e5-95c6-a76ecaba2d74.html#1)
2. ABC 13. September 11th 2012. Derecho Costs Lynchburg \$5.3 Million. retrieved from <http://wset.com/archive/derecho-costs-lynchburg-53-million>
3. Springston, Rex. July 4, 2012. Partially treated sewage released in the James River at Lynchburg. Richmond Times - Dispatch. retrieved from [http://www.richmond.com/news/partially-treated-sewage-released-in-the-james-river-at-lynchburg/article\\_04c5c396-281d-57c2-956f-cd4012107578.html](http://www.richmond.com/news/partially-treated-sewage-released-in-the-james-river-at-lynchburg/article_04c5c396-281d-57c2-956f-cd4012107578.html)
4. Stuart, Courteney. July 3, 2012. Derecho dump: Lynchburg's raw sewage soils the James. The Hook. retrieved from <http://www.readthehook.com/104461/derecho-dumping-lynchburg-sewage-hits-james>



# Appendix H: Hazard Events

## Other Incidents

### Severe Winter Storm, 2015 February (4211)

#### Campbell, Lynchburg, Bedford County

In February, 2015, Lynchburg's temperature dropped to -11 degrees, a new, all time low. Around 6000 customers in Lynchburg, mostly in Appomattox County were without power for some time after the storm. Low temperatures following the storm shattered many water pipes. Some of the streets were covered in ice and heavy packed snow which slowed the traffic.



#### References

[http://www.newsadvance.com/news/local/lynchburg-cold-shatters-all-time-record-low/article\\_dd59d180-b904-11e4-ae67-7fb2f1cf7d4e.html](http://www.newsadvance.com/news/local/lynchburg-cold-shatters-all-time-record-low/article_dd59d180-b904-11e4-ae67-7fb2f1cf7d4e.html)

### EF0 tornado, 2017

#### Bedford County

According to the National Weather Service, a strong EF0 tornado touched down in Bedford County in April, 2017. The tornado traveled 0.66 miles and had a maximum path width of 100 yards and wind speed of 105 mph. It uprooted some trees in the area and caused minor structural damage to some houses.

1. <http://wset.com/news/local/nws-confirms-ef-1-tornado-hit-bedford-co>
2. <https://www.wsls.com/weather/tornado-touched-down-in-bedford-county-early-friday-morning>
3. <http://www.wdbj7.com/content/news/National-Weather-Service-EF-0-tornado-touched-down-in-Bedford-421505524.html>



# Appendix H: Hazard Events

## Flash Floods and Mudslides, 2015

### (Lynchburg)

Heavy rains in September 2015 caused minor flooding, landslides, and downed trees in Lynchburg (Cioffi, 2015). A number of streets (Florida and Campbell Avenue) were blocked after heavy flooding (Abdi, 2015)

1. Cioffi, Chris., Walsh, Tobi. September 29, 2015. Flash flood watch remains in effect as rain soaks Lynchburg area, causing minor flooding and mudslides. The News and Advance. retrieved from [http://www.newsadvance.com/news/local/flash-flood-watch-remains-in-effect-as-rain-soaks-lynchburg/article\\_5edbee8a-6690-11e5-b378-cfb8760985fb.html](http://www.newsadvance.com/news/local/flash-flood-watch-remains-in-effect-as-rain-soaks-lynchburg/article_5edbee8a-6690-11e5-b378-cfb8760985fb.html)
2. Abdi, Mona. September 29, 2015. Heavy Flooding Forces Crews to Close Down streets in Lynchburg. retrieved from <http://wset.com/news/local/heavy-flooding-forces-crews-to-close-down-streets-in-lynchburg>

## Hazmat Spill, 2017

### (Tri Tech lab, Lynchburg)

A hazmat incident involving an Isopropyl alcohol was reported in February, 2017 in Lynchburg.

1. Ann Ashley. February 8, 2017. Emergency crews responding to hazard material incident at Tri Tech Lab. retrieved from <http://wset.com/news/local/emergency-crews-responding-to-hazard-material-incident-at-tri-tech-lab>

## Flooding, 2017

### Bedford County

One of the connecting roads washed away because of heavy rains in September, 2017.

1. <http://www.wdbj7.com/content/news/Bedford-County-families-access-road-still-washed-out-from-September-flooding-409441915.html>
2. <http://www.wdbj7.com/content/news/Water-flooding-into-roadway-in-Bedford-County-482981431.html>



# Appendix H: Hazard Events

## Droughts

Drought event 1998-2019

ZONE	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
CAMPBELL	10/1/1998	400000	
APPOMATTOX	10/1/1998	300000	
BEDFORD	10/1/1998	400000	
AMHERST	10/1/1998	300000	
APPOMATTOX	11/1/1998	0	
CAMPBELL/ LYNCHBURG	11/1/1998	40000	
BEDFORD/ BEDFORD	11/1/1998	0	
AMHERST	11/1/1998	0	
CAMPBELL	6/1/1999	0	
AMHERST	6/1/1999	0	
BEDFORD	6/1/1999	0	
APPOMATTOX	6/1/1999	0	
APPOMATTOX	7/1/1999	0	
AMHERST	7/1/1999	0	
BEDFORD	7/1/1999	0	
CAMPBELL	7/1/1999	0	
CAMPBELL/ LYNCHBURG	8/1/1999	0	
APPOMATTOX	8/1/1999	0	
BEDFORD/	8/1/1999	0	





# Appendix H: Hazard Events

ZONE	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
BEDFORD			
AMHERST	8/1/1999	0	
CAMPBELL	9/1/1999	0	
APPOMATTOX	9/1/1999	0	
BEDFORD	9/1/1999	0	
AMHERST	9/1/1999	0	
BEDFORD	9/1/2007	4000000	The southern tip of Bedford county reached D2 severe drought. Hay, corn and soy production was down 30 to 40 percent.
CAMPBELL	9/1/2007	8000000	Hay, grain, soy and tobacco production was down forty to fifty percent due to the drought. The southwest portion of Campbell county had the greatest losses.
CAMPBELL	10/1/2007	0	The county began the month under a Severe (D2) Drought. This level of severity continued until October 23rd when it was increased to an Extreme (D3) Drought. This level of severity continued until October 30th when it was downgraded to a Moderate (D1) Drought.
BEDFORD	10/1/2007	0	The county began the month in the Severe (D2) Category of drought. It maintained this level of severity until October 30th when the drought category was downgraded to the Abnormally Dry (D0) Category. Voluntary water restrictions were in place for Bedford County for most of the month.
AMHERST	10/2/2007	0	Drought conditions increased into the Severe (D2) Category on October 2nd and remained at that level of severity through October 30th before dropping into the Abnormally Dry (D0) Category. Apples were of poor size and there was no second hay planting. Mandatory water



# Appendix H: Hazard Events

ZONE	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
			restrictions were in place for Amherst County for most of the month.
APPOMATTOX	10/2/2007	0	The drought severity increased to the Severe (D2) Category on October 2nd. It remained at that intensity through October 23rd when it was upgraded to the Extreme (D3) Category. On October 30th, the intensity was downgraded to Abnormally Dry (D0) Category.
APPOMATTOX	1/29/2008	0	A Moderate (D2) drought existed over the eastern part of the county.
CAMPBELL	1/29/2008	0	A Moderate (D2) drought existed over the eastern part of the county.
APPOMATTOX	2/1/2008	0	Severe drought conditions continued for the entire month over the eastern portion of the county.
CAMPBELL	2/1/2008	0	Severe drought conditions continued for the entire month over the southeastern portion of the county.
CAMPBELL	3/1/2008	0	Severe (D2)drought status across southeastern portions of Campbell county improved to moderate (D1) drought and abnormally dry (D0) status.
APPOMATTOX	3/1/2008	0	Severe (D2)drought status across eastern portions of Appomattox county improved to moderate (D1) drought status.
BEDFORD	8/19/2008	0	Severe drought conditions returned to the southern one third of the county for the latter half of the month.
CAMPBELL	8/19/2008	0	Severe drought conditions returned to the county for the latter half of the month.
APPOMATTOX	8/19/2008	0	Severe drought conditions returned to most of the county for the latter half of the month.



## Appendix H: Hazard Events

ZONE	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
BEDFORD	10/1/2019	9000000	Severe drought (D2) was depicted across western Bedford County on the U.S. Drought Monitor from October 1 to October 22nd. An extremely dry and very warm September led to the worsening conditions in the county. The NWS COOP site at Bedford (BDFV2) recorded only 0.31 inches of rain in September. This was the 3rd driest September on record at this station with around 85 years of sporadic data back to 1893. Impacts to corn, soybeans, hay and pasture amounted to around \$9 million.



# Appendix H: Hazard Events

## Earthquake

### Significant Earthquakes in Virginia

<https://www.dmme.virginia.gov/DGMR/majorearthquakes.shtml>

**February 2, 1774.** The first documented earthquake in Virginia originated near Petersburg, where houses were displaced “considerably off their foundations.” The tremor rang church bells as far away as Winston-Salem, North Carolina. Estimated magnitude: 4.5.

**December 11, 1811, January 23 and February 7, 1812.** Effects from a series of monstrous earthquakes in New Madrid, Missouri, were felt strongly in Virginia, and details were reported in the Richmond and Norfolk newspapers.

**August 27, 1833.** An earthquake shook buildings and violently rattled windows in Lynchburg. It was described as “severe” in Charlottesville and fences shook near Louisa Courthouse. Near Richmond, two miners were killed in a panic caused by the tremor. Probably centered in Goochland County. Estimated magnitude: 4.5.

**April 29, 1852.** An earthquake centered in Grayson County or Wythe County threw down a chimney near Wytheville, shook off the tops of chimneys at Buckingham Courthouse, and shook houses in Staunton. This quake was felt over an area of approximately 175,000 square miles, including parts of Ohio, Pennsylvania and New York. Estimated magnitude: 4.9.

**November 2, 1852.** An earthquake that damaged chimneys at Buckingham Courthouse was also reported to be strong at Fredericksburg and Richmond. In Scottsville, every house was shaken, and water in the canal was “troubled” and boats tossed about. Estimated magnitude: 4.3.

**December 22 and 23, 1875.** This quake was centered west of Richmond, with the highest intensities at towns near the James River in Goochland and Powhatan Counties, and in Louisa County, and it was felt from Baltimore, Maryland, to Greensboro, North Carolina, and from the Atlantic westward to White Sulphur Springs, West Virginia. In Richmond, severe damage was sustained in the downtown business and residential areas adjacent to the James River or on islands in the river. Waves “suddenly rose several feet” at docks, causing boats to snap their moorings and drift downstream. Bricks fell from chimneys, plaster cracked, and windows shattered. The quake occurred just before midnight, and people “rushed into the streets in all sorts of clothing.” At Manakin, west of Richmond, shingles were shaken from a roof and many lamps and chimneys were broken. Several small aftershocks were reported through Jan. 2, 1876. Maximum Intensity: VII, estimated magnitude: 4.5.

**September 1, 1886.** Originating in Charleston, South Carolina, felt across the extent of the eastern seaboard, an area of over two million square miles, this was the most damaging seismic event in the U.S. prior to the 1906 San Francisco earthquake, an estimated magnitude of 7.3 on the Richter scale. In Charleston, over sixty people died, and structural damage occurred as far away as Richmond and Atlanta, where prisoners rioted in the penitentiary and the militia had to be called out to restore order. Throughout Virginia, chimneys were thrown down, windows shattered, and plaster cracked.



## Appendix H: Hazard Events

**May 3, 1897.** Centered at Radford, where a few chimneys were wrecked and plaster fell from walls, and chimneys were damaged at nearby Pulaski and Roanoke. Felt in most of southwest Virginia and as far south as Winston-Salem, North Carolina. Estimated magnitude 4.3. This was a prelude to The Big One.

**May 31, 1897.** This earthquake was the most intense and widespread in Virginia in historical times, with Modified Mercalli Intensity of VIII. Felt over an area of 280,000 square miles from Georgia to Pennsylvania and from the Atlantic Coast westward to Indiana and Kentucky, the area of maximum ground motion extended over an area from Lynchburg west to Bluefield, West Virginia, south to Bristol, Tennessee. The shock was felt most severely near Pearisburg in Giles County, where the ground rolled in an undulating motion, water in springs became muddy, and some springs ceased to flow, and a train was derailed. Walls of old brick houses were cracked and many chimneys were thrown down or badly damaged. Many chimneys also were shaken down or damaged at Bedford, Pulaski, Radford, Roanoke, and Bristol, Christiansburg, Dublin, Floyd, Lexington, Lynchburg, Rocky Mount, Salem, Tazewell, and Wytheville in Virginia, as well as Charlotte, Oxford, Raleigh, and Winston, North Carolina, Knoxville, Tennessee, and Bluefield, West Virginia. Aftershocks continued through June 6, 1897. Estimated magnitude: 5.8-5.9. This was the second largest earthquake in the eastern United States in the last 200 years.

**February 5, 1898.** Bricks were thrown from chimneys, furniture was shifted in a few houses, and residents rushed into the streets of Pulaski. Felt throughout southwest Virginia and south to Raleigh, North Carolina.

**February 11, 1907.** Near Arvon in Buckingham County, chimneys were cracked and a window was broken at a store at Buckingham. A “terrific” shock sent people rushing outdoors at Arvon and displaced furniture. Felt strongly from Powhatan to Albemarle County.

**April 9 and 10, 1918.** At Luray, in Page County, windows were broken and plaster was cracked severely. Ceilings of houses were cracked badly at Edinburg; windows were broken at Harrisonburg and Staunton, and Washington, D.C. (at Georgetown University). In addition, a new spring formed in Page County near Hamburg, almost in the middle of a road. A minor aftershock was reported in the area about five hours later. Also felt in Maryland, Pennsylvania, and West Virginia.

**September 5 and 6, 1919.** This earthquake affected mainly towns in Warren and Rappahannock Counties. At Arco, in the Blue Ridge Mountains south of Front Royal, chimneys were damaged, plaster fell from walls, and springs and streams were muddied. Reports from the adjacent northern part of Rappahannock County state that similar shocks were felt and that streams were “rendered turbid.” Also felt in parts of Maryland and West Virginia. Several aftershocks occurred.

**December 25 and 26, 1929.** A moderate tremor at Charlottesville shook bricks from chimneys in some places. Also felt in other parts of Albemarle County.

**April 23, 1959.** This earthquake was strongest in Giles County, at Eggleston and Pembroke. Residents there reported several damaged chimneys and articles shaken from shelves and walls. One chimney toppled at the Norfolk and Western Station in Eggleston. Also felt in West Virginia. Magnitude 3.8.

**November 20, 1969.** Centered along the State line near Elgood, West Virginia, and Rich Creek, Virginia, locally many windows including display windows were broken and plaster cracked. Magnitude 4.6.





## Appendix H: Hazard Events

**November 11, 1975.** Windows were broken in the Blacksburg area and plaster was cracked at Poplar Hill (south of Pearisburg, in Giles County). Also felt in Pulaski County.

**September 13, 1976.** Centered in Carroll County, bricks fell from chimneys and pictures fell from walls at Mount Airy, North Carolina. At the nearby town of Toast, North Carolina, cracks formed in masonry and plaster. The earthquake was observed in many towns in North Carolina and Virginia and in a few towns in South Carolina and West Virginia. Carroll County is one of the most persistent areas of activity in Virginia; since 1976, five small felt earthquakes have occurred near Hillsville.

**In 1981** a sequence of three earthquakes with magnitudes of 3.4, 3.2, and 2.9 occurred near Scottsville within an eight-minute period.

**August 17, 1984.** An earthquake centered near Cunningham in Fluvanna County had a magnitude of 4.0 and a maximum intensity of V and was felt over 12,000 square miles.

**In the winter of 1986-1987,** a series of eleven small magnitude (1.5-2.2) shallow earthquakes were strongly felt (maximum intensity V) in Richmond.

**December 9, 2003.** South of Goochland along the James River, about thirty miles west of Richmond, this was the largest earthquake recorded in Virginia since the widespread use of modern seismic equipment in the 1970's. It was a shallow earthquake, three miles deep, probably the result of a rupture of the Lakeside Fault, with a magnitude of 4.5 and a maximum intensity of VI, and it was felt strongly over most of the State. Although little or no structural damage occurred during the event, the U.S. Geological Survey reported that the trembles were felt in parts of North Carolina and Maryland. Shaking was such that State government buildings were evacuated and inspected for damage. It had been preceded May 5, 2003 by a 3.8 event whose epicenter was just a few kilometers away.

**May 6th, 2008.** A minor earthquake with an estimated magnitude of 2.0 occurred near Annandale, Virginia. Felt reports were primary received from people in Fairfax County, Virginia; the District of Columbia; and Montgomery County, Maryland.

**August 23rd, 2011.** Virginia and much of the East Coast experienced a widely-felt earthquake at 1:51 p.m. eastern daylight time on Tuesday, August 23, 2011. According to the U.S. Geological Survey, the epicenter of the quake was located near Cuckoo, in Louisa County. With a magnitude of 5.8, this is the largest Virginia earthquake recorded by seismometers. 26 aftershocks have been reported by the USGS and the area is currently being monitored by geophysicists from several leading science institutions.



# Appendix H: Hazard Events

## Extreme temperatures: cold / wind chill

Cold/Wind Chill event 1996 - 2019

ZONE	BEGIN DATE	CROP DAMAGE (\$)	DESCRIPTION
CAMPBELL	2/3/1996	0	
AMHERST	2/3/1996	0	
BEDFORD	2/3/1996	0	
APPOMATTOX	2/3/1996	0	
CAMPBELL	3/8/1996	12000	
BEDFORD	3/8/1996	12000	
APPOMATTOX	3/8/1996	10000	
AMHERST	3/8/1996	5000	
AMHERST	4/9/1997	200000	Temperatures in the 20s during the morning hours on the 9th damaged apple, peach, and grape crops in Amherst County.
AMHERST	4/10/1997	200000	Temperatures in the 20s during the morning hours on the 10th damaged apple, peach, and grape crops in Amherst County.
AMHERST	4/15/1997	50000	Temperatures in the 20s during the morning hours on the 15th damaged apple, peach, and grape crops in Amherst County.
AMHERST	4/16/1997	50000	Temperatures in the 20s during the morning hours on the 16th damaged apple, peach, and grape crops in Amherst County.
BEDFORD	1/7/2014	0	Wind chill temperatures were observed in the -20F to -22F range at several locations throughout the county during the early morning hours of January 7th, 2014.



## Appendix H: Hazard Events

ZONE	BEGIN DATE	CROP DAMAGE (\$)	DESCRIPTION
CENTRAL VIRGINIA BLUE RIDGE	2/14/2015	0	Combination of winds and temperatures measured at multiple AWOS resulted in wind chills of -25 degrees.
CENTRAL VIRGINIA BLUE RIDGE	12/15/2016	0	Wind chill values between -10 and -20 degrees were estimated based on observations nearby.
CENTRAL VIRGINIA BLUE RIDGE	3/14/2017	0	Wind chill values were estimated to be between 10 and 15 degrees below zero based on observations nearby.
CENTRAL VIRGINIA BLUE RIDGE	12/12/2017	0	Wind chills were estimated to be between minus 5 and minus 15 degrees based on observations nearby.
CENTRAL VIRGINIA BLUE RIDGE	12/27/2017	0	Wind chills were estimated to be between -5 and -15 degrees based on observations nearby.
CENTRAL VIRGINIA BLUE RIDGE	1/1/2018	0	Wind chills were estimated to be between -10 and -25 based on observations nearby.
CENTRAL VIRGINIA BLUE RIDGE	1/4/2018	0	Wind chill values were around -10 to -25 degrees.
CENTRAL VIRGINIA BLUE RIDGE	1/5/2018	0	Wind chills were around -20 to -30 degrees.
CENTRAL VIRGINIA BLUE RIDGE	1/21/2019	0	The combination of cold temperatures and strong winds produced wind chills as low as -25 degrees.
CENTRAL VIRGINIA BLUE RIDGE	1/30/2019	0	The combination of cold temperatures and strong winds produced wind chills as low as -25 degrees.
CENTRAL VIRGINIA BLUE RIDGE	3/6/2019	0	The combination of cold temperatures and strong winds produced wind chills as low as -10 degrees.



## Appendix H: Hazard Events

### Extreme temperatures: excessive heat

Excessive heat event in CVPDC in 2012

ZONE	BEGIN DATE	CROP DAMAGE (\$)	DESCRIPTION
BEDFORD	7/1/2012	0	<p>A 57-year old man died of a heart attack that may have been related to the heat. No autopsy was performed so no conclusive evidence exists as to the cause of death. This was the 4th consecutive day of record or near-record heat in the county.</p> <p>A ridge of high pressure dominated the central and eastern U.S. the last few days of June and into the 1st of July. Records too numerous to mention were broken and in some cases, smashed throughout the eastern half of the nation, many of them all-time records not simply date records. See June Storm Data for the June details in the Blacksburg/Roanoke CWA. July 1st was the last day of the record-setting heat wave that began around the 27th of June. Records from climate observing sites on July 1st showed 100F at Danville (tied highest for date, records since 1948); 97F at Roanoke (tied 3rd, records since 1912); 97F in Lynchburg (tied 2nd, records since 1893), 90F at Blacksburg (tied 3rd, records since 1952) and 90F at Bluefield (1st, records since 1959).</p>



# Appendix H: Hazard Events

## Flooding

Flash flood events 2010 - 2019

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	EVENT NARRATIVE
BEDFORD	1/25/2010	10000	Heavy rain in steep terrain help to cause a mudslide that covered the intersection of Route 221 and Brookhill Road. Damage values are estimated.
CAMPBELL	1/25/2010	10000	Flash flooding caused Stage Road to be impassable. Damage values are estimated.
CAMPBELL	1/25/2010	50000	Flash flood waters caused Rocky Road and Wisecarver Road to be impassable. Damage values are estimated.
CAMPBELL	1/25/2010	10000	Flash flooding caused Route 678 to be impassable. Damage values are estimated.
BEDFORD	1/25/2010	10000	Heavy rain caused flash flooding on a stream and a bridge on Lipscomb Road was flooded. Damage values are estimated.
AMHERST	1/25/2010	5000	Heavy rain caused a stream to leave its bank and a flash flood flowed over Buffalo Springs Turnpike. The road was then closed. Damage values are estimated.
AMHERST	1/25/2010	20000	Heavy rain prompted flash flooding on Horsley Creek and the flowing water went across Wagon Trail Road. The road was closed. Damage values are estimated.
APPOMATTOX	1/25/2010	5000	Heavy rain prompted a flash flood to occur across Highway 460. Damage values are estimated.
APPOMATTOX	1/25/2010	5000	Heavy rains helped generate a mudslide east of Concord. Damage values are estimated.
AMHERST	1/25/2010	100000	Heavy rains caused a culvert to collapse on Mansion Way. Damage values are estimated.





## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	EVENT NARRATIVE
AMHERST	1/25/2010	100000	Flash flooding caused a portion of Turkey Mountain Road to wash out. Damage values are estimated.
AMHERST	5/28/2010	0	Flash flooding occurred along Woodson Road as heavy rain caused streams to leave their banks. Damage values are estimated.
BEDFORD	7/9/2010	0	Johns Creek was reported to have water briefly out of its banks and caused roads to be closed.
BEDFORD	8/5/2010	0	Nichols Road bridge was closed due to high water.
BEDFORD	8/5/2010	0	Flooding from an unnamed creek caused Union Church Road to be closed.
BEDFORD	8/5/2010	0	Nininger Creek flooded over Five Forks Road, which was closed.
BEDFORD	8/5/2010	0	Evington Road was closed due to flood waters flowing over the road.
BEDFORD	8/5/2010	0	Heavy rains caused Nolans Drive to become impassable due to high water.
APPOMATTOX	8/16/2010	0	Stonewall Creek was reported out of its banks. A retired NWS employee reported 3.78 inches of rain.
APPOMATTOX	8/16/2010	0	Water was reported to be flowing across a road from a nearby creek.
LYNCHBURG	8/24/2010	0	City police reported that Sandusky Drive was closed between Rhonda Road and Greenwood Drive due to rapidly flowing water well over 6 inches in depth. A later report said the water from Burton Creek reached 2 feet of depth in the parking lot of Sandusky Park.
BEDFORD	9/30/2010	10000	Bethel Church Road was closed due to flash flooding. Damage values are estimated.
BEDFORD	9/30/2010	10000	Flash flooding occurred along a tributary of the North



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	EVENT NARRATIVE
			Fork of Goose Creek and prompted flooding of Crouch Road. Damage values are estimated.
BEDFORD	9/30/2010	10000	Flash flooding along the North Fork of Goose Creek prompted the flooding and closure of Beale Trail. Damage values are estimated.
BEDFORD	9/30/2010	100000	Flash flooding occurred along Stony Fork and waters washed out a portion of Route 608. Damage values are estimated.
BEDFORD	12/1/2010	10000	Flash flooding prompted the closure of Thaxton Mountain Road between Union Church Road and Rocky Ford Road. Damage values are estimated.
BEDFORD	12/1/2010	10000	Flash flooding prompted the closure of Foster Road between Quarles Road and Nester Road where it crosses Goose Creek. Damage values are estimated.
AMHERST	12/1/2010	10000	Flash flooding occurred along the Piney River. A four foot rise was observed in less than six hours with the river cresting at 6.32 feet. Flood stage is 6.00 feet. Damage values are estimated.
AMHERST	4/16/2011	0	Flooding was occurring along Buffalo Springs Turnpike.
BEDFORD	4/16/2011	0	Portions of Stewartsville Road from block 24 to 12300 was flooded. Also flooding was reported along Saunders Road.
BEDFORD	4/16/2011	0	Goose Creek was flooding Wilkerson Mill Road with water and debris in the roadway.
AMHERST	4/16/2011	5000	Heavy rains caused several creeks to flood over roadways. Franklin Creek flooded the Lexington Turnpike, Stonehouse Creek flooded Fancy Hill Road, Maple Run Creek flooded Flat Woods Road, Maple Run Creek flooded Maple Run Road and Woodson Road was flooded by the Piney River.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	EVENT NARRATIVE
CAMPBELL	4/16/2011	0	Heavy rains caused a creek to flood Collins Ferry Road.
BEDFORD	8/13/2011	0	Heavy rains of 3 to 5 inches in several hours caused road closures in several locations. The Bedford Cooperative observer had 4.77 inches ending at 8 AM on the 14th. Roads close due to flooding included Highway 43 from Fancy Farm Road north Peaks of Otter; the intersection of Forbes Mill road and Jopling Road; intersection of Woods Road and Peaks Road and the intersection of Glass Hill Road and Otterville Road.
APPOMATTOX	3/20/2012	0	The upper Falling River flooded a portion of Pumping Station Road.
APPOMATTOX	3/20/2012	0	The upper reaches of the Falling River was reported to be flooding a portion of Chilton Road.
APPOMATTOX	3/25/2012	0	Heavy rains caused small stream flooding with several roads closed in Appomattox County.
BEDFORD	5/14/2012	0	An unnamed stream came out of its banks and flooded Spinnaker Way and Harbour Trail, leaving behind debris on the roads. Over six inches of water was observed flowing over these roads. Numerous driveways and front lawns were flooded as well.
BEDFORD	1/30/2013	5000	A portion of Meadowlark Lane was washed out due to flash flooding.
AMHERST	5/7/2013	0	Heavy rain caused Maple Run Creek to overflow its banks and flood Flat Woods Road.
CAMPBELL	7/11/2013	0	Stage Road was reportedly flooded by Archer Creek after rainfall of 1.5 to 3 in several hours.
APPOMATTOX	7/11/2013	0	Heavy rainfall estimated at 1.5 to 3 on radar caused flooding on parts of Route 460 at Highway 24, closing the road.
LYNCHBURG	7/11/2013	0	Heavy rainfall across the City of Lynchburg produced



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	EVENT NARRATIVE
			pockets of urban and flash flooding in the city. Radar showed that up to 2 inches fell in less than an hour in most of the city but a report of 3.49 was received by local broadcast media. A creek near Lynchburg College flooded a road and at least six to seven other roads in the city were flooded including Sandusky Drive, Sussex Street, Florida Avenue, Greenwood Drive and McConville Road. Several basements were flooded and manhole covers blown off by the rapid runoff.
APPOMATTOX	7/20/2013	0	Little Wreck Island Creek was flooded and covered a bridge or road.
CAMPBELL	4/30/2014	0	The Campbell County 911 Center reported that Morris Church Road was flooded and closed approximately five miles west of Red House. This flooding appeared to be the result of Little Falling River or one of its tributaries overflowing their banks.
CAMPBELL	4/30/2014	0	The Campbell County 911 Center reported that Dog Creek Road was flooded and closed as a result of flood waters from Dog Creek just before it flows into the Roanoke River.
AMHERST	5/15/2014	0	Several inches of water was observed flowing over Gidsville Road.
CAMPBELL	6/20/2014	5000	Flash flooding resulted in the closure of US Route 29S. Damage values are estimated.
CAMPBELL	6/23/2016	0	Water was estimated to be 12 inches deep and flowing across Calohan Road (Route 685).
CAMPBELL	6/23/2016	0	Flash flooding due the heavy rainfall was reported along a portion of Timberlake Road near Forest. The nearby Lynchburg Airport ASOS (LYH) climate site reported 3.54 inches for June 23rd which was a new record for the date. The old record was 1.73 inches set in 1967. It was also the 2nd wettest June day on record at Lynchburg with data back to 1893.



# Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	EVENT NARRATIVE
BEDFORD	8/21/2017	0	A tributary of the South Fork of Little Otter Creek overflowed and closed a portion of Liberty Street near West Federal Street and Jeter Street at West Washington Street. Some minor flooding also occurred near the intersection of 4th Street and Bedford Avenue closing the road for a period.
BEDFORD	8/21/2017	0	Up to two feet of standing water was observed along Route 460 westbound near the intersection with Hulls Street.
BEDFORD	5/17/2018	5000	Up to two feet of rapidly flowing water was over the intersection of Hazelwood Terrace and Beagle Club Road along with a small debris flow and small tree pushed into the roadway. Spotter reported 4.32 inches of rain in less than 4 hours at the time of the report. Turner Branch Road in the Blue Ridge area was washed out and closed and a motorist was rescued from the flood waters.
BEDFORD	5/17/2018	0	Water 1 to 2 feet in depth reported flowing across Goose Creek Valley Road.
CAMPBELL	5/17/2018	0	Water was reported covering portions of Route 501 between Rustburg and Gladys.
AMHERST	5/27/2018	0	Beck Creek Road and Tent Mountains Farm Road were flooded and closed. A rescue was conducted for one man in a home surrounded by rising flood waters.
AMHERST	5/27/2018	0	Beck Creek Road and Tent Mountain Farm Road were flooded and closed. A man was rescued from his home along Beck Creek Road as water was rising around the structure.
LYNCHBURG	6/9/2018	0	Flash flooding was reported at several locations around Lynchburg including Sussex Avenue, Wards Ferry Road, Twin Oaks Drive and Greenwood Drive which was flooded by overflow from Blackwater Creek.
LYNCHBURG	8/2/2018	18000000	Extreme rainfall of 4 to 6 inches in several hours





## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	EVENT NARRATIVE
			produced widespread flash flooding in the City of Lynchburg. The first reports began around 515 PM local time (415 PM EST) and continued for several hours with numerous roads closed by water running over them, vehicles flooded, water rescues and several properties flooded or threatened. Several apartment complexes and nearby cars were flooded. The runoff into College Lake caused water to overflow the dam (which is also Lakeside Road) to a depth of at least 12 to 18 inches and into Blackwater Creek. The overtopping is considered a partial failure of the dam but a complete failure of the structure was possible. This resulted in a Flash Flood Warning for a dam failure and subsequent evacuation of about 120 homes in the downstream watershed of Blackwater Creek. According to local City officials flood damage exceeded \$18 million in roads, property and water control structure damages, the biggest to College Lake Dam.
CAMPBELL	8/2/2018	100000	Several reports of flash flooding from the Timberlake area of Campbell County. Sunburst Road was flooded and impassable with more than a foot of water over it. Three feet of was over Timberlake and Woodhaven Road with a vehicle trapped. Buffalo Creek was well out of its banks and flooding Route 460. A swift was rescue was reported in this area. In addition, water was observed flowing over the spillway of Timberlake Dam. In the aftermath up to eight roads in the county were reported with some type of structural damage. Two homes were also reported to have been damaged.
BEDFORD	8/2/2018	25000	There were several reports of roads washed out or overtopped in the Forest area including Spring Lake Road, Bethel Church Road, Terry Place and Goose Hollow Road.
CAMPBELL	9/1/2018	0	The Little Falling River overflowed Morris Church Road (Route 646) southwest of Red House. The road was closed by State Police.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	EVENT NARRATIVE
APPOMATTOX	9/1/2018	0	Rocks Church Road (SR 620) was closed by flooding near Suanee Creek Road.
CAMPBELL	9/22/2018	0	Riverbend Road in Altavista and Johnson Creek Road were flooded and closed.
BEDFORD	9/22/2018	25000	Water was reported flowing over Highway 122. A private bridge over the East Fork Beaverdam Creek was badly damaged from the flooded creek, shown in a video on local media.
CAMPBELL	10/11/2018	366000	Campbell County was included in a Presidential Major Disaster declaration due mainly to the severe flooding associated with Tropical Storm Michael. There were several reports of flash flooding on the afternoon of the 11th with roads closed and verified flood damages exceeded \$300 thousand.
LYNCHBURG	10/11/2018	20000	Heavy rains led to some flash flooding as to 2 to 3 inches fell in a short period. Lynchburg Airport ASOS (LYH) set a daily record rainfall for October 11th of 2.58 inches, with records back to 1893. The old record was 1.76 inches in 1990. Flooding was reported along a Ivy Creek with water flowing across Ivy Drive. City of Lynchburg officials activated the Emergency Action Plan for College Lake dam early Thursday as a result of the heavy rain but did not have to evacuate any residents or businesses downstream of the dam along Blackwater Creek. Several other roads were reported closed in Lynchburg including Greenwood Drive where it crosses Ivy Creek.
APPOMATTOX	10/11/2018	69000	Appomattox County was included in a Presidential Major Disaster declaration due mainly to the severe flooding associated with Tropical Storm Michael. Purdums Branch was several feet out of its banks and flooding apartments along Red House Road. In the town of Appomattox, a woman and boy were rescued after fast-moving water trapped the two in a creek behind their home on Church Street. A team of about 17 first responders with the Concord Appomattox Swiftwater



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	EVENT NARRATIVE
			Team responded to the rescue effort around 4:45 PM Local time. The two victims were quickly pulled from the waters without injury according to news reports.

### Flood events 2010 - 2019

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
AMHERST	9/30/2010	10000	Small stream flooding occurred along Higginbottom Creek, and Higginbottom Road was flooded and closed because of the water. Damage values are estimated.
AMHERST	9/30/2010	10000	Flooding occurred along Maple Run, and Flatwoods Road was flooded and closed. Damage values are estimated.
AMHERST	9/30/2010	10000	Flooding occurred along Mill Creek and flooded and closed Buffalo Springs Turnpike. Damage values are estimated.
BEDFORD	3/6/2011	100000	Heavy rain produced flooding along Beagle Club Road at the Hardy Trailer Park. The water was one foot deep. Damage values are estimated.
BEDFORD	3/6/2011	0	Heavy rains prompted flooding along State Route 676, Crosscreek Road, rendering it impassable.
BEDFORD	3/6/2011	0	Heavy rain prompted a creek to leave its banks and flood Lankford Mill Road. The flood water rendered the road impassable.
BEDFORD	9/6/2011	0	A prolonged period of heavy rain, totaling around five inches, prompted Bellamy Creek to flood Red Hill Road.
BEDFORD	9/6/2011	0	A prolonged period of heavy rain, totaling around five to six inches, caused the Big Otter River to flood



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
			Lankford Mill Road. The flooding affected mainly pastureland adjacent to the river and flowed over a few roads. These roads included Mill Road, Peaks Road, and Lankford Mill Road. Damage values are estimated.
BEDFORD	9/6/2011	10000	Prolonged heavy rain, totaling three to four inches, flooded Bells Mill Road. Fallen trees, branches and mud completely blocked a small bridge on Bells Mill Road. Damage values are estimated.
BEDFORD	5/14/2012	0	Sheep Creek was observed spilling out of its banks and overflowing a low water bridge on Jay Bird Lane.
LYNCHBURG	6/6/2013	5000	Prolonged heavy rain produced flooding in a few locations, and debris collected by the waters prompted some street closures. Specifically, Greenwood Drive was closed due to flooding, and Campbell Avenue and Grace Streets were closed due to debris in the road. Damage values are estimated.
CAMPBELL	7/26/2016	0	High water closed Lynbrook Road at the intersection of Lawyers Road just south of Lynchburg Airport where the record daily rainfall occurred.
BEDFORD	9/30/2016	0	About one foot of water was reported over Beagle Club Road (Route 635) near Hardy Road.
CAMPBELL	5/25/2017	0	The USGS gauge at Brookneal (BROV2) crested at 24.46 feet (28400 cfs) during the evening of the 25th. Minor flood stage is 23 feet. This was the highest level since January 2010 at this location.
AMHERST	2/11/2018	0	Several roads were reported to be closed due to flooding in the county including Routes 648, 600, 624 and 604.
APPOMATTOX	2/11/2018	0	Several roads were reported closed due to flooding



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
			including Route 705, Route 666, Route 605.
CAMPBELL	5/19/2018	0	The Falling River near Naruna gauge crested on May 19th at 15.97 feet (Minor FS - 15 ft.). This was the highest stage at this gauging stations since July 3, 2003.
CAMPBELL	5/19/2018	0	The Roanoke (Staunton) River at Brookneal gauge crested at 24.19 feet (Minor FS - 23 ft.) around midday on the 19th.
AMHERST	12/28/2018	0	U.S. Route 60 was closed due to flooding at a bridge.
CAMPBELL	2/23/2019	0	The Roanoke River at Brookneal (BROV2) crested at 25.67 feet early on the 24th above the Minor flood stage of 23 feet. This was the highest stage at Brookneal since January 26, 2010 when the river reached 28.2 feet. Flooding was mainly in lowland fields and woods. According to USGS data however the peak discharge of 31500 cfs was only about a 2-year recurrence interval event (0.50 annual chance flood).





# Appendix H: Hazard Events

## Hailstorm

Hail event 2012-2019

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	MAGNITUDE	DESCRIPTION
CAMPBELL	2/24/2012	0	0.75	
BEDFORD	2/24/2012	0	0.88	
CAMPBELL	3/20/2012	0	0.88	
CAMPBELL	3/20/2012	0	1	
CAMPBELL	3/20/2012	0	1	
CAMPBELL	3/20/2012	0	0.75	
BEDFORD	3/20/2012	0	1	
BEDFORD	3/20/2012	0	0.88	
BEDFORD	3/24/2012	0	1	
BEDFORD	3/24/2012	0	1	
CAMPBELL	3/24/2012	750	1.75	The hail damaged siding, broke one window and several screens on a home.
CAMPBELL	3/24/2012	0	1	
CAMPBELL	3/24/2012	0	1.5	Hail lasted about 15 minutes.
APPOMATTOX	3/24/2012	0	1	
CAMPBELL	3/24/2012	0	0.88	



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	MAGNITUDE	DESCRIPTION
APPOMATTOX	3/24/2012	500	1	Gutters in a home were damaged.
APPOMATTOX	3/24/2012	0	1	
BEDFORD	5/2/2012	0	1	
BEDFORD	5/2/2012	0	1.75	
BEDFORD	5/2/2012	0	1	Quarter size hail was observed at the intersection of Routes 460 and 122.
BEDFORD	5/2/2012	0	1.25	
BEDFORD	5/2/2012	0	1	Dime to quarter size hail was observed at 1386 Kenmar Drive.
BEDFORD	5/3/2012	0	1.25	
AMHERST	5/22/2012	0	0.75	
AMHERST	5/22/2012	0	1	Quarter size hail was observed falling along Lowesville Road.
LYNCHBURG	5/22/2012	0	0.75	Dime to penny size hail was observed falling along Mayfield Drive.
BEDFORD	5/22/2012	0	1	Quarter size hail was observed falling along Highway 221 on the west side of the City of Lynchburg.
LYNCHBURG	5/22/2012	0	0.75	Penny size hail was observed falling along Lakeside Drive in the city of Lynchburg.
AMHERST	6/1/2012	0	2	Large hail ranged from one to two



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	MAGNITUDE	DESCRIPTION
				inches in diameter.
AMHERST	6/1/2012	0	1.75	Golfball size hail impacted roughly a one mile stretch of Gidsville Road.
AMHERST	6/1/2012	0	1.25	NSSL (National Severe Storms Laboratory) volunteers collected reports of half dollar size hail spread over a two mile swath in the Lowesville area.
AMHERST	6/1/2012	0	1.25	Half dollar hail was reported along Little Piney Road near Lowesville.
CAMPBELL	6/30/2012	0	0.75	
CAMPBELL	6/30/2012	0	0.88	Nickel size hail was reported at the intersection of English Tavern Road and Highway 29 South.
CAMPBELL	6/30/2012	0	1	Nickel to quarter size hail fell on Robinson Drive.
CAMPBELL	6/30/2012	0	1	Quarter size hail fell on Clarks Road.
BEDFORD	7/3/2012	0	1	
BEDFORD	7/3/2012	0	0.75	
BEDFORD	7/3/2012	0	1.5	
BEDFORD	7/3/2012	0	1	
APPOMATTOX	7/5/2012	0	1	



# Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	MAGNITUDE	DESCRIPTION
APPOMATTOX	7/9/2012	0	1	
AMHERST	6/13/2013	0	1	Quarter size hail covered the ground.
BEDFORD	6/13/2013	0	1	
BEDFORD	6/26/2013	0	0.75	
LYNCHBURG	5/27/2014	0	1	Quarter-size hail was observed on Wyndhurst Drive.
CAMPBELL	5/27/2014	0	0.75	
BEDFORD	5/28/2014	0	0.75	
CAMPBELL	6/11/2014	0	1	Quarter size hail fell on Conner Road.
BEDFORD	6/11/2014	0	1	Hail fell that ranged from dime to quarter size.
BEDFORD	6/16/2014	0	0.75	The report of penny size hail was relayed via Facebook.
BEDFORD	6/20/2014	0	1	
AMHERST	6/20/2014	0	0.88	
BEDFORD	7/3/2014	0	0.75	
AMHERST	7/3/2014	0	1	Hail to the size of quarters reported along Route 501.
BEDFORD	7/24/2014	0	0.88	
BEDFORD	4/8/2015	0	1	



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	MAGNITUDE	DESCRIPTION
CAMPBELL	4/8/2015	0	0.88	
AMHERST	5/11/2015	0	1	The public reported via Twitter quarter-sized hail approximately three miles west of Pleasant View.
AMHERST	5/11/2015	0	0.88	The public provided a report via Facebook of nickel-sized hail in the Pedlar Mills area or about three miles northeast of Naola.
AMHERST	5/11/2015	0	0.88	A storm spotter observed nickel-sized hail approximately five miles southwest of Amherst.
CAMPBELL	5/11/2015	0	1	A storm spotter observed quarter-sized hail approximately five miles southeast of Lynchburg.
CAMPBELL	5/11/2015	0	1	The public observed quarter-sized hail in Concord.
BEDFORD	6/1/2015	0	0.75	
AMHERST	6/1/2015	0	0.75	
BEDFORD	6/1/2015	0	1	Dime to quarter-size hail was observed on Camp Jaycee Road.
BEDFORD	6/17/2015	0	0.88	Dime to nickel-size hail was observed at Staunton River High School.
BEDFORD	7/13/2015	0	1	Quarter size hail fell on Planters Drive.
AMHERST	7/27/2015	0	0.88	Nickel hail fell at the intersection of Woodson Road and Lowesville Road.





## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	MAGNITUDE	DESCRIPTION
BEDFORD	8/4/2015	0	1	A SkyWarn spotter observed quarter-sized hail just north-northwest of Big Island.
AMHERST	8/4/2015	0	1	The public provided a report of quarter-sized hail via Twitter just north of Big Island.
CAMPBELL	8/4/2015	0	1	Several SkyWarn Spotters observed quarter-sized hail along Wards Road in Altavista, VA.
CAMPBELL	9/4/2015	0	1	
BEDFORD	9/4/2015	0	1	
BEDFORD	9/4/2015	0	1	
LYNCHBURG	5/1/2016	0	1	Quarter sized hail lasted for 10 minutes between 1047 PM EDT and 1057 PM EDT along Campbell Avenue based on radar estimates.
CAMPBELL	5/1/2016	0	1	Hail fell along Kimball Road in the community of Concord, VA.
AMHERST	5/2/2016	0	1	
BEDFORD	5/10/2016	0	1	
CAMPBELL	6/23/2016	0	0.88	
BEDFORD	6/23/2016	0	1	
LYNCHBURG	6/23/2016	0	1	



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	MAGNITUDE	DESCRIPTION
BEDFORD	6/23/2016	0	1.75	Multiple reports of golf ball sized hail near Forest.
LYNCHBURG	6/23/2016	0	1.75	
CAMPBELL	6/23/2016	0	1.5	Spotters reported hail ranging from quarter to ping pong ball size in Rustburg.
BEDFORD	6/23/2016	0	2.75	Multiple reports of hail ranging from quarter to baseball sized were reported. Some cars were damaged.
BEDFORD	7/19/2016	0	0.75	
BEDFORD	7/19/2016	0	1	
CAMPBELL	9/27/2016	0	1	
CAMPBELL	9/27/2016	0	1	
BEDFORD	9/28/2016	0	1.75	
BEDFORD	9/28/2016	0	1.5	Hail from the storm fell for several minutes.
AMHERST	9/28/2016	0	1	
BEDFORD	9/28/2016	0	1	
CAMPBELL	4/22/2017	0	1	
CAMPBELL	5/10/2017	0	0.75	
CAMPBELL	5/10/2017	0	1	



# Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	MAGNITUDE	DESCRIPTION
CAMPBELL	5/10/2017	0	1.25	
CAMPBELL	5/10/2017	0	0.88	
BEDFORD	5/19/2017	0	1.25	
BEDFORD	5/19/2017	0	1.75	
BEDFORD	6/4/2017	0	1	
BEDFORD	7/18/2017	0	1	
BEDFORD	5/10/2018	0	0.88	
BEDFORD	5/10/2018	0	0.75	
AMHERST	5/10/2018	0	1	
AMHERST	5/10/2018	0	1	
AMHERST	6/10/2018	0	0.75	
BEDFORD	7/11/2018	0	1	Quarter size hail fell at the Moneta Post Office.
APPOMATTOX	7/25/2018	0	0.75	Penny-size hail fell on State Route 636.
AMHERST	8/12/2018	0	1.25	Hail up to the size of half dollar coins fell in Madison Heights.
AMHERST	8/13/2018	0	0.75	Hail up to the size of pennies fell about five miles east of Alto.
BEDFORD	8/13/2018	0	0.88	Hail up to the size of nickels fell about two miles west-northwest of



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	MAGNITUDE	DESCRIPTION
				Stewartsville.
BEDFORD	8/13/2018	0	1	Hail up to the size of quarters fell on Gravel Hill Road.
AMHERST	8/13/2018	0	0.88	Hail up to the size of nickels fell on Grandmas Hill Road.
BEDFORD	8/13/2018	0	0.88	Hail up to the size of nickels fell in the town of Hardy.
BEDFORD	8/13/2018	0	0.88	Hail up to the size of nickels fell about four miles south-southeast of Stewartsville.
BEDFORD	8/13/2018	0	0.75	Hail up to the size of pennies fell about one mile west-southwest of Bedford.
AMHERST	8/30/2018	0	0.75	Hail up to the size of pennies fell in Madison Heights.
AMHERST	5/2/2019	0	1	Hail up to the size of quarters fell at the Lee and Moss grocery store along Wright Shop Road.
BEDFORD	5/29/2019	0	0.88	A couple mesoscale convective systems within a hot and humid air mass brought lines of severe thunderstorms during the afternoon and evening hours. The storms produced hail up to the size of half dollar coins and produced damaging winds that blew down numerous trees and power lines. At least 4,000 people lost power due to trees falling on to power lines, and a few structures also suffered damage.



## Appendix H: Hazard Events

### Severe thunderstorm, heavy rain, and lightning

*Storm Events Database NCEI data - thunderstorm wind 2012-2019*

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
AMHERST	2/24/2012	50	1000	Thunderstorm winds blew two large trees down in the town of Amherst. Damage values are estimated.
AMHERST	6/1/2012	65	20000	Thunderstorm winds blew thirty to forty trees down in a wooded area near Woodson Road. Damage values are estimated.
CAMPBELL	6/1/2012	50	500	Thunderstorm winds blew a tree down on Lynnbroad Road. Damage values are estimated.
CAMPBELL	6/1/2012	50	500	Thunderstorm winds blew a tree down on Sunnymead Road. Damage values are estimated.
LYNCHBURG	6/1/2012	60	5000	Thunderstorm winds downed power lines at Fort Avenue and Timberlake Road. Damage values are estimated.
BEDFORD	6/1/2012	55	7500	Thunderstorm winds blew multiple trees down. Damage values are estimated.
BEDFORD	6/1/2012	55	1500	Thunderstorm winds blew trees down on Red Hill School Road. Damage values are estimated.
BEDFORD	6/1/2012	57	0	
CAMPBELL	6/12/2012	60	3000	Thunderstorm winds blew shingles off a roof. Damage values are estimated.
APPOMATTOX	6/12/2012	55	500	Thunderstorm winds blew a tree down on Oakville Road. Damage values are estimated.





## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
CAMPBELL	6/12/2012	50	500	Thunderstorm winds blew a tree down on Bear Creek Road. Damage values are estimated.
CAMPBELL	6/12/2012	50	1000	Thunderstorm winds downed trees near Hat Creek. One of the trees fell along Irvindale Road, the other along Hat Creek Road. Damage values are estimated.
CAMPBELL	6/12/2012	55	7000	Thunderstorm winds help to bring trees and power lines down. Damage values are estimated.
CAMPBELL	6/21/2012	55	5500	Thunderstorm winds blew down one 10-inch maple tree and blew the tops off several large oak trees. Damage values are estimated.
LYNCHBURG	6/21/2012	55	7500	Thunderstorm winds downed multiple trees near Enterprise Drive. Damage values are estimated.
LYNCHBURG	6/21/2012	55	1500	Thunderstorm winds blew trees down near the corner of the Lynchburg Expressway and Lakeside Drive. Damage values are estimated.
LYNCHBURG	6/21/2012	55	2000	Thunderstorm winds blew trees down within the City of Lynchburg between the 300 block of Rivermont Avenue and 10th Street. Damage values are estimated.
CAMPBELL	6/21/2012	53	0	
BEDFORD	6/22/2012	50	1500	Thunderstorm winds blew trees down on Goose Creek Valley Road. Damage values are estimated.
AMHERST	6/22/2012	55	1500	Thunderstorm winds blew trees down on Route 635, North Fork of Buffalo River



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				Road. Damage values are estimated.
BEDFORD	6/29/2012	57	500000	Thunderstorm winds blew hundreds of trees down across the county. Some of these trees brought down power lines and also fell onto houses. A wind gust of 66 MPH was measured in Goode. Damage values are estimated.
AMHERST	6/29/2012	60	200000	Thunderstorm winds blew numerous trees down across the county. Many roads were blocked due to the downed trees. Damage values are estimated.
BEDFORD	6/29/2012	65	100000	Thunderstorm winds blew trees down. Some of these falling trees brought down power lines. Damage values are estimated.
CAMPBELL	6/29/2012	65	250000	Thunderstorm winds blew down hundreds of trees. The greatest concentration was over the northern half of the county. Damage values are estimated.
LYNCHBURG	6/29/2012	65	7120000	Thunderstorm winds blew down over 1,000 trees across the City of Lynchburg. Many power lines also came down as a direct result of the wind or trees and limbs falling on them. The winds damaged eight homes to the point of being deemed uninhabitable or destroyed. Damage values are estimated.
APPOMATTOX	6/29/2012	65	150000	Thunderstorm winds blew down around 100 trees across the county. Many of those trees brought down power lines. Damage values are estimated.
CAMPBELL	7/3/2012	50	5000	Power lines were reported down on Crestside Drive.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
BEDFORD	7/3/2012	50	300	A tree was reported blown down across intersection of Brookhill and Cifax Roads.
CAMPBELL	7/3/2012	50	1000	Tree limbs were blown down onto power lines on Doewood Place.
CAMPBELL	7/3/2012	55	10000	Trees and powerlines were down along Brookneal Highway in southern Campbell County.
CAMPBELL	7/3/2012	50	5000	Power lines were down on Pigeon Run Road.
CAMPBELL	7/3/2012	50	5000	A tree fell across powerlines along Mollies Creek Road.
BEDFORD	7/8/2012	50	4000	Power lines were blown down by thunderstorm winds on Parker Road.
BEDFORD	7/8/2012	50	4000	Three trees down in reported down in Chamblissburg, the tree diameters were 8-10 inches. Also, power lines were down on Route 24.
APPOMATTOX	7/9/2012	50	600	Trees were blown down on Red House Road.
AMHERST	7/23/2012	50	300	A tree was blown down on Poorhouse Farm Road.
AMHERST	7/23/2012	50	300	Thunderstorm winds blew down a tree on Cherry Hill Road.
BEDFORD	7/27/2012	50	600	Two trees were blown down on Lee Jackson Highway near Shortcut Road.
LYNCHBURG	7/27/2012	55	8000	Numerous trees, limbs and wires brought down by winds throughout Lynchburg. The siding off a building on Park Avenue was also ripped off.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
AMHERST	7/27/2012	50	600	Two trees were down at Lynchburg reservoir about 3/4 mile upstream of Pedlar Dam.
AMHERST	7/27/2012	55	10000	Numerous trees, limbs and wires down throughout the town of Amherst. A large portion of town was left without power. Damage extended east along the Route 60 corridor for about 10 miles with several reports of trees or numerous large tree limbs blown down.
AMHERST	7/27/2012	55	5000	Thunderstorm winds brought down several trees.
AMHERST	7/27/2012	50	0	Numerous large tree limbs blown down along Old Galilee Road.
BEDFORD	1/30/2013	54	0	This wind gust was measured with home weather station equipment.
AMHERST	1/30/2013	52	2000	A few trees were blown down by thunderstorm winds along the Buffalo Springs Turnpike.
BEDFORD	1/30/2013	55	5000	Thunderstorm winds blew down several trees in Huddleston.
AMHERST	3/16/2013	50	5000	Thunderstorm winds brought down several trees off Riverview Road and torn down fencing.
BEDFORD	4/19/2013	50	5000	The Bedford County 911 Center reported that a number of trees were down near the intersection of Falling Creek Road and Glenwood Drive just northeast of Huddleston. Another tree was down along Elk Lake Lane just west of Forest.
BEDFORD	4/19/2013	52	15000	Southwest Virginia Broadcast Media



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				reported that from 30 to 40 trees were blown down approximately five miles northwest of Evington. The Bedford County 911 Center reported that another tree was down near the intersection of Virginia Route 24 and New London Road., also just northwest of Evington.
LYNCHBURG	4/19/2013	50	3000	The Lynchburg City 911 Center reported that one tree was down across the road at the intersection of Link Road and Hurdle Hill Road, a tree and powerline were down near the 2500 block of Mayflower Drive, and another power/phone line was down at the intersevation of 12th and Kemper Streets, all within the City of Lynchburg.
CAMPBELL	4/19/2013	50	5000	A trained spotter reported that one tree was blown down onto a home on Frazier Road just north of Alta Vista and another tree was down along Lynch Mill Road.
APPOMATTOX	4/19/2013	56	50000	WSET Television of Lynchburg, Virginia and a trained storm spotter reported that nearly two dozen trees and several power lines were blown down down around Appomattox, mainly on the west and north side of the city. A considerable amount of damage was noted on High Street in Appomattox, just north of downtown Appomattox. Some homes on Country Club road were damaged from downed trees. The damage on Country Club Street alone was estimated to be near \$10,000. Although to some the damage appeared to have been caused by a tornado, it was determined that the damage was a result of strong thunderstorm straight-line winds, not a tornado.





## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
BEDFORD	5/11/2013	52	1500	A few trees were blown down by thunderstorm winds on Dickerson Mill Road.
BEDFORD	6/10/2013	50	500	Thunderstorm winds blew one large tree down across Route 122 near Moneta. Damage values are estimated.
BEDFORD	6/10/2013	50	500	Thunderstorm winds blew one tree down on Rock Cliff Road. Damage values are estimated.
BEDFORD	6/13/2013	50	1000	Thunderstorm winds along a squall line downed several large tree limbs. Damage values are estimated.
BEDFORD	6/13/2013	55	20000	Thunderstorms wind associated with a squall line blew down numerous trees in and near the Stewartsville area. Damage values are estimated.
AMHERST	6/13/2013	50	1000	Thunderstorm winds along a squall line uprooted two trees in the 400 block of South Five Forks Road. Damage values are estimated.
CAMPBELL	6/13/2013	50	200000	Thunderstorms produced damaging winds along a squall line that moved through the City of Lynchburg and Campbell County. Numerous trees and tree limbs were blown down throughout this region along with some power lines. Specific examples include numerous trees down in Timberlake, numerous trees and power lines down in and around the City of Lynchburg, numerous oak trees blown down in Altavista, some trees down and trees uprooted near Concord.
BEDFORD	6/13/2013	55	150000	Thunderstorms along a squall line moved



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				through Bedford County and the City of Bedford. The associated damaging winds blew down numerous trees and tree limbs. A number of these were reported near Goode and Evington VA, as well as in the City of Bedford. Also in the City of Bedford, a tractor trailer was blown over. Damage values are estimated.
BEDFORD	6/13/2013	55	5000	Thunderstorm winds from a squall line brought trees and power lines down from Thomasson Mill Road southeast of Stewartsville through Smith Mountain Lake and to Planters Drive near Huddleston. Damage values are estimated.
CAMPBELL	6/13/2013	50	10000	Thunderstorms along an associated squall line produced winds that downed and uprooted numerous trees. Dime size hail also occurred. Damage values are estimated.
BEDFORD	6/26/2013	55	22000	Thunderstorm winds blew down trees and tree limbs in the Stewartsville to Goodview area of the county. Some power lines also came down as a result of the falling trees. Damage values are estimated.
BEDFORD	6/26/2013	50	1500	Thunderstorm winds blew three trees down on Perrowville Road near the Ivy Hill/Candlestick Park area. Damage values are estimated.
LYNCHBURG	6/26/2013	50	3000	Thunderstorm winds blew a few trees down in the City of Lynchburg. Damage values are estimated.
BEDFORD	7/3/2013	70	2000	A thunderstorm produced microburst/straight line winds that caused tree and some structure damage.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
APPOMATTOX	7/20/2013	50	500	One tree was blown down by thunderstorm winds at the intersection of Route 608 and Route 613 that brought down a light pole. A second tree was reported down along Stonewall Road.
AMHERST	7/20/2013	50	3000	Three telephone poles were knocked down along Hillcrest Circle.
APPOMATTOX	7/24/2013	50	900	Three separate single tree down reports were received.
APPOMATTOX	7/24/2013	50	400	Thunderstorm winds blew down a tree across Old Courthouse Road.
CAMPBELL	9/21/2013	50	1000	Two trees were blown down on Leesville Road just north of the Town Fork Road.
BEDFORD	5/28/2014	55	5000	Several trees were blown down across the Town of Bedford, with one tree falling onto power lines.
BEDFORD	6/10/2014	50	2000	Thunderstorm winds blew several large limbs down near Peaks of Otter Lodge. Damage values are estimated.
AMHERST	6/11/2014	50	1000	Thunderstorm winds blew two trees down along Route 130, one near Mt. Tabor Road and another near Buffalo Springs Turnpike. Damage values are estimated.
CAMPBELL	6/11/2014	60	10000	Thunderstorm winds blew trees down between the area of New London and Timberlake. Damage values are estimated.
LYNCHBURG	6/11/2014	60	500000	Thunderstorm winds toppled a crane at Liberty University. Damage values are estimated.
CAMPBELL	6/11/2014	50	3000	Thunderstorm winds blew trees down in



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				Gladys. Damage values are estimated.
BEDFORD	6/11/2014	55	10000	Thunderstorm winds blew several trees down. Damage values are estimated.
AMHERST	6/11/2014	55	7500	Thunderstorm winds blew down multiple trees along Reservoir Road leading to Pedlar Dam. Damage values are estimated.
BEDFORD	6/12/2014	50	2000	Thunderstorm winds blew large tree limbs down. Damage values are estimated.
BEDFORD	6/18/2014	50	3000	Thunderstorm winds blew trees down. Damage values are estimated.
CAMPBELL	6/20/2014	55	3000	Thunderstorm winds blew trees down along Mollies Creek Road. Damage values are estimated.
CAMPBELL	6/20/2014	55	12000	Thunderstorm winds blew a couple dozen trees down near Brookneal. Multiple trees were blown down near Swinging Bridge Road, and others were blown down along Highway 40, blocking the traffic flow both ways. Damage values are estimated.
CAMPBELL	6/20/2014	55	8000	Thunderstorm winds blew down powerlines near a mobile home. The sparks set trees on fire. Damage values are estimated.
BEDFORD	6/20/2014	55	1000	Thunderstorm winds blew a couple of trees down near the intersection of Goode and Goode Station Road. Damage values are estimated.
APPOMATTOX	6/21/2014	50	500	Thunderstorm winds blew a tree down on Watt Abbitt Road. Damage values are estimated.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
AMHERST	7/3/2014	50	500	Large tree limbs were reported blown down by thunderstorm winds south of MM 49.3 on the Blue Ridge Parkway.
APPOMATTOX	7/8/2014	50	7000	Trees were reported down in several locations. Trees were reported down on Police Tower Road, Reedy Spring Road, Paradise Road, and Stonewall Road.
CAMPBELL	7/8/2014	50	1500	Thunderstorm winds blew down a power line in Concord. A tree was also blown down northeast of Concord.
APPOMATTOX	7/8/2014	50	500	Thunderstorm winds blew down a tree on Holliday Lake Road.
BEDFORD	7/9/2014	50	1000	Two trees were knocked down at intersection of Wyatts Way and Tucker Terrace.
CAMPBELL	7/9/2014	60	50000	About 100 trees were blown down due to straight-line winds along with two barn roofs blown off and a barn collapsed. Six more trees were reported down at intersection of Leesville Road and Ridge Road.
CAMPBELL	7/9/2014	50	7000	Thunderstorm winds blew the siding and shingles off a home. One tree was blown down on Wards Road, and multiple trees were blown down on Gough Road near the intersection of route 42.
BEDFORD	7/24/2014	50	10000	A report was made of numerous large trees blown down by thunderstorm winds at Peak of Otter Lodge and along Highway 43.
AMHERST	8/21/2014	50	500	The Amherst County 911 Center reported that a tree was down blocking Ambrose-Rucker Road, approximately one mile





# Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				north-northwest of Elon.
CAMPBELL	8/21/2014	50	500	The Campbell County 911 Center reported that a tree was down blocking Bethany Road, approximately one mile east-southeast of Rustburg.
AMHERST	5/11/2015	50	500	The Amherst County 911 Center reported that a tree was blown down by thunderstorm winds on Kings Road, approximately two miles north of Lynchburg.
AMHERST	5/11/2015	50	500	The Amherst County 911 Center reported that a tree was blown down by thunderstorm winds on Campbell Street or approximately two miles east-northeast of Lynchburg.
CAMPBELL	5/11/2015	55	15000	The Campbell County Emergency Management Director, along with trained spotters and the public, reported that several trees were down in the Timberlake area of northern Campbell county, or just south of Lynchburg. One tree was uprooted onto a car near the intersection of Horseman Drive and Sleepy Hollow Road. Another tree was down on Timberlake Drive, and two trees were down near the Waterlick Shopping Center.
LYNCHBURG	6/13/2015	50	1000	A tree was blown down onto cable lines on Greenwood Drive.
CAMPBELL	6/13/2015	50	2000	A tree was blown down onto a car, breaking the windshield, on Depot Road.
BEDFORD	6/14/2015	50	500	One tree was blown down along Highway 460 in the vicinity of the community of Montvale.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
BEDFORD	6/14/2015	50	500	One tree was blown down near the intersection of Highway 460 and Irving Road.
BEDFORD	6/14/2015	50	500	One tree was blown down along the W Lynchburg Salem Turnpike.
AMHERST	6/18/2015	55	3000	Several trees were blown down along U.S. Highway 29 near Falconerville.
AMHERST	6/18/2015	55	15000	Trees were reported blown down along Elon Road, Oak Ridge Court, Kenmore Road and on River Road. A tree was blown down onto a home on Odins Bow Road. A tree was blown down onto a powerline on Orchard Drive.
APPOMATTOX	6/18/2015	50	500	A tree was blown down along Oakville Road.
BEDFORD	6/18/2015	50	500	A tree was blown down along Elkton Farm Road in the community of Forest.
APPOMATTOX	6/18/2015	55	5000	Eight to ten trees were blown down along Wagon Wheel Road.
APPOMATTOX	6/18/2015	50	500	A tree was blown down at Holliday Lake State Park.
BEDFORD	6/18/2015	50	1500	Several large tree limbs were blown down along Clover Creek Road.
CAMPBELL	6/20/2015	50	1500	A tree was blown down on Gladys Road and two trees were blown down on Long Island Road.
LYNCHBURG	6/27/2015	50	500	A few tree limbs were blown down onto power lines along Trents Ferry Road.
AMHERST	6/30/2015	50	1000	Two trees were blown down along Route



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				60.
BEDFORD	6/30/2015	50	500	A tree was blown down along Route 704.
BEDFORD	6/30/2015	50	1000	Strong thunderstorm winds blew down two trees in the Huddleston area, including one along Smith Mountain Lake Parkway.
CAMPBELL	7/13/2015	50	1000	Thunderstorm wind blew a couple of trees down in the Sunnymead area. Damage values are estimated.
CAMPBELL	7/13/2015	50	1000	Thunderstorm winds blew two trees down along Sunnymead Road near Rustburg, VA. Damage values are estimated.
CAMPBELL	7/13/2015	50	1000	Thunderstorm winds blew two trees down along Route 501 South in Gladys, VA. Damage values are estimated.
CAMPBELL	7/13/2015	50	500	Thunderstorm winds blew a tree down along Oxford Furnace Road west of Concord, VA. Damage values are estimated.
APPOMATTOX	7/14/2015	50	700	Thunderstorm winds blew a tree and large limbs down. The tree fell on Holly Brook Drive. Damage values are estimated.
BEDFORD	7/14/2015	50	2000	Thunderstorm wind blew four trees down along the south side of Bedford. Joppa Mill Road, Casey Lake Road, Moneta Road, and Broken Bow Road each had a tree fall upon it. Damage values are estimated.
AMHERST	8/4/2015	50	500	The Amherst County 911 Center reported that a tree was down along Lowesville Road approximately five miles northwest of Amherst.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
AMHERST	8/4/2015	55	3000	The Amherst County 911 Center reported that several trees were down along Turkey Mountain Road approximately five miles north of Amherst.
AMHERST	8/4/2015	56	5000	The Amherst County 911 Center reported that multiple trees were down along Patrick Henry Way approximately two miles north-northeast of Clifford.
CAMPBELL	8/11/2015	50	500	The Campbell County 911 Center reported that a tree was down on Red House Road near its intersection with Rhonda Road, blocking both lanes of the road. This occurred approximately four miles northeast of Gladys.
CAMPBELL	8/11/2015	50	500	The Campbell County 911 Center reported that a tree was down blocking Lambs Church Road approximately three miles north of Hodges.
BEDFORD	2/24/2016	50	5000	A small barn was severely damaged by thunderstorm winds.
APPOMATTOX	4/7/2016	50	2000	Several large tree limbs were blown down on Winery Lane. Damage values are estimated.
AMHERST	5/2/2016	52	2000	Thunderstorm winds resulted in the downing of multiple trees along Route 501 near the Rockbridge and Amherst County Line.
BEDFORD	5/12/2016	50	500	Thunderstorm winds downed large tree limbs in this area.
APPOMATTOX	6/2/2016	52	500	Thunderstorm winds blew down one tree down along Route 60 near Bent Creek.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
BEDFORD	6/4/2016	55	4000	Thunderstorm winds knocked multiple trees down on Quarterwood Road.
AMHERST	6/4/2016	50	500	Thunderstorm winds brought a tree down on Route 60 near Moss Rock Road.
BEDFORD	6/4/2016	55	4000	Thunderstorm wind knocked down multiple trees along Goode Station Road near Goode.
BEDFORD	6/4/2016	55	5000	Thunderstorm wind knocked multiple trees down in the community of Forest.
AMHERST	6/16/2016	60	10000	Thunderstorm winds blew over a barn on Green Hill Road.
LYNCHBURG	6/16/2016	50	1000	Reports of two trees down from thunderstorm winds at Graves Mill Road and Breezewood Drive.
CAMPBELL	6/16/2016	65	100000	Over 50 trees in the county were blown over by thunderstorm winds. Most of the damage was near the town of Forest. Trees were blown onto 7 to 10 houses along Timberlake Drive and some people were trapped in their homes.
CAMPBELL	6/16/2016	50	1000	Thunderstorm winds blew down two trees. One tree was blown down at the intersection of Greenview and Portico streets. The second tree fell at the intersection of Wexford and Leeville Road.
CAMPBELL	6/16/2016	55	1000	Thunderstorm winds blew trees over on Mason Mill Road.
CAMPBELL	6/16/2016	50	500	Thunderstorm winds blew off several large tree limbs.
CAMPBELL	6/16/2016	55	2000	Thunderstorm winds knocked trees down





## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				onto Allen Road.
CAMPBELL	6/23/2016	55	5000	Thunderstorm winds blew down several large trees near Yellow Branch Elementary School.
BEDFORD	6/23/2016	52	1000	Thunderstorm winds blew trees down on Big Island Highway.
CAMPBELL	6/23/2016	50	500	Thunderstorm winds brought down a tree on Clarks Road.
LYNCHBURG	6/27/2016	50	500	Thunderstorm winds blew down a tree two miles west of Lynchburg.
LYNCHBURG	6/27/2016	50	500	One tree was knocked down by thunderstorm winds at the intersection of Lexington Drive and Inglewood Road.
CAMPBELL	7/4/2016	50	1000	Two large oak trees were blown down by thunderstorm winds along Bishop Creek Road near the community of Altavista.
CAMPBELL	7/4/2016	50	500	A tree was blown down by thunderstorm winds near the intersection of Hat Creek Road and White Tail Road.
BEDFORD	7/8/2016	50	500	One tree that was two feet in diameter was blown down by thunderstorm winds, blocking part of Turner Branch Road.
LYNCHBURG	7/13/2016	50	2000	Thunderstorm winds blew down one tree on the 501 Expressway, while another tree fell down on an attached garage east of Forest, but causing no major damage.
CAMPBELL	7/14/2016	50	1000	Thunderstorm winds brought down two trees.
LYNCHBURG	7/26/2016	50	1500	Trees were blown down by thunderstorm



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				winds along Hollins Mill, Overbrook and Langhorne Roads.
CAMPBELL	7/26/2016	50	20000	A tree was blown down by thunderstorm winds onto a house on Spring Oaks Drive.
CAMPBELL	7/26/2016	50	20000	A tree was blown down by thunderstorm winds onto a house along Eastbrook Road.
CAMPBELL	7/26/2016	50	500	One tree was blown down by thunderstorm winds on Epsons Road.
CAMPBELL	7/26/2016	50	500	One tree was blown down by thunderstorm winds on Mount Calvary Road.
BEDFORD	7/28/2016	50	5000	A large tree was blown down by thunderstorm winds onto a garage.
LYNCHBURG	7/28/2016	50	1500	A large tree was blown down by thunderstorm winds across a power line along Forrest Brook Road.
LYNCHBURG	7/28/2016	50	500	A large tree was blown down by thunderstorm winds at the intersection of Park Avenue and Fort Avenue.
AMHERST	7/28/2016	50	5000	Several trees and powerlines were blown down by thunderstorm winds along Riverville Road.
AMHERST	7/28/2016	50	500	A large tree was blown down by thunderstorm winds along Riverville Road.
BEDFORD	7/28/2016	50	1000	Thunderstorm winds brought down a large tree at the intersection of Feldspar Road and Morgans Church Road. Another tree was blown down along White House Road.
BEDFORD	7/28/2016	50	500	A large tree was blown down by



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				thunderstorm winds along Route 460 near Johnson School Road.
BEDFORD	7/28/2016	50	500	A large tree was blown down by thunderstorm winds along Lizard Ridge Road.
LYNCHBURG	7/28/2016	50	500	A large tree was blown down by thunderstorm winds on Route 501.
CAMPBELL	7/28/2016	50	500	A large tree was blown down by thunderstorm winds across Dearborn Road.
APPOMATTOX	7/28/2016	50	500	A large tree was blown down by thunderstorm winds along Route 635.
APPOMATTOX	7/30/2016	50	1500	Two trees were blown down by thunderstorm winds along Route 615. Another tree was blown down on Watt Abbitt Road.
APPOMATTOX	7/30/2016	50	500	A large tree was blown down by thunderstorm winds along Liberty Chapel Road.
BEDFORD	8/6/2016	50	1500	Thunderstorm winds blew three trees down along Bethel Church Road. Damage values are estimated.
CAMPBELL	8/6/2016	50	500	Thunderstorm winds blew a tree was blown down along Turkey Foot Road. Damage values are estimated.
BEDFORD	8/6/2016	50	7500	Thunderstorm winds blew multiple trees down along Bishop Creek Road. Damage values are estimated.
AMHERST	8/14/2016	50	2000	Thunderstorm winds blew four trees down along Highway 29 near the intersection



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				with U.S. 60. Damage values are estimated.
BEDFORD	8/17/2016	55	1500	Thunderstorm winds blew three trees down southeast of Montvale. The downed trees were located in the the following locations: the 6400 block of Quarterwood Road, the 2700 block of Quarles Road, and the 3400 block of Quarles Road. Damage values are estimated.
BEDFORD	8/17/2016	50	500	Thunderstorm winds blew one tree down along Holcomb Rock Road. Damage values are estimated.
AMHERST	8/17/2016	50	500	Thunderstorm winds blew one tree down along Lexington Parkway. Damage values are estimated.
BEDFORD	9/28/2016	60	5000	Thunderstorm winds resulted in numerous trees down along Holcomb Rock Road.
LYNCHBURG	9/28/2016	50	2000	Thunderstorm winds brought a power Line down on Rivermont Avenue.
AMHERST	9/28/2016	50	500	Several large tree limbs were blown down by thunderstorm winds.
BEDFORD	9/29/2016	50	500	Thunderstorm winds toppled a tree along Porters Mountain Road near Blue Ridge.
BEDFORD	9/29/2016	50	500	Thunderstorm winds downed a tree along Breezy Ridge Road.
CAMPBELL	2/25/2017	50	1000	Thunderstorm winds split part of a tree near Lynchburg which then damaged a chain link fence.
AMHERST	2/25/2017	50	500	Thunderstorm winds brought down several large tree limbs on Indian Valley Road.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
BEDFORD	3/1/2017	50	200	Thunderstorm winds snapped an 18-inch diameter branch off of a tree.
APPOMATTOX	3/1/2017	55	5000	Multiple trees were blown down across western Appomattox County, including trees along Beckham Road and along Vermillion Road.
CAMPBELL	3/1/2017	50	15000	Four trees and several power lines were blown down by thunderstorm winds across western portions of Campbell County.
APPOMATTOX	5/1/2017	50	2000	Thunderstorm winds downed three to four trees along Richmond Highway near Pamplin.
CAMPBELL	5/1/2017	50	500	Thunderstorm winds downed a tree along Bethany Road.
BEDFORD	5/5/2017	50	500	Thunderstorm winds downed a tree near the intersection of Smith Mountain Lake Parkway and Carters Mill Road.
AMHERST	5/5/2017	55	5000	Thunderstorm winds downed several trees along Boxwood Farm Road.
APPOMATTOX	5/5/2017	50	500	Thunderstorm winds downed a tree on Cub Creek Road.
APPOMATTOX	5/5/2017	50	500	Thunderstorm winds downed a tree along Rock Church Road.
APPOMATTOX	5/10/2017	50	1000	Thunderstorm winds downed two trees on Police Tower Road.
CAMPBELL	5/10/2017	50	500	Thunderstorm winds downed a tree near the intersection of Wheeler and Plumb Branch Roads.
BEDFORD	5/19/2017	50	500	Thunderstorm winds resulted in a downed





## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				tree across Falling Creek Road.
CAMPBELL	5/19/2017	50	2500	Thunderstorm winds downed a tree on a vehicle near the intersection of Marysville Road and East Ferry Road.
CAMPBELL	5/19/2017	50	2000	Thunderstorm winds brought down a tree on a car at the intersection of East Ferry Road and Marysville Road.
CAMPBELL	5/19/2017	50	500	Thunderstorm winds brought down a tree on Red House Road.
BEDFORD	6/4/2017	50	500	Thunderstorm wind gusts knocked down a tree.
BEDFORD	6/4/2017	50	500	Thunderstorm wind gusts caused a large limb to fall and block Smith Mountain Lake Parkway.
BEDFORD	6/15/2017	50	500	Thunderstorm wind gusts caused a tree to fall down on Jordon Town Road.
AMHERST	6/15/2017	50	1000	Several small to large limbs were reported down due to thunderstorm wind gusts between Elon and Madison Heights.
BEDFORD	6/19/2017	55	5000	The county sheriff reported that several trees were blown down by thunderstorm winds along the Lee Jackson Highway between the communities of Big Island and Coleman Falls.
AMHERST	6/19/2017	50	500	A tree was blown down by thunderstorm winds along Highway 130.
AMHERST	6/19/2017	50	500	A large tree was blown down by thunderstorm winds along Highway 60.
CAMPBELL	7/4/2017	50	1000	Two trees were blown down and a crop of



# Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				corn damaged along Bear Creek Road.
CAMPBELL	7/6/2017	50	500	One tree was blown down by thunderstorm winds along Timberlake Drive.
CAMPBELL	7/6/2017	50	1000	One tree was blown down by thunderstorm winds along Beaver Creek Crossing and another was blown down along Camp Hydaway Road.
CAMPBELL	7/6/2017	50	500	One tree was blown down by thunderstorm winds along Toll Gate Road.
BEDFORD	7/18/2017	50	3000	Multiple trees were blown down by thunderstorm winds along Tolers Ferry Road.
BEDFORD	7/22/2017	50	3000	Thunderstorm winds blew a tree down onto a power line near the intersection of Goode Station Road and Forest Road.
LYNCHBURG	7/22/2017	50	500	One tree was blown down by thunderstorm winds along the 200 block of Buckingham Road in the Timberlake area.
LYNCHBURG	7/22/2017	50	1000	Two large trees were blown down by thunderstorm winds near the intersection of Wigginton and Chadwick Roads.
LYNCHBURG	7/22/2017	50	1000	Thunderstorm winds blew a tree down near the intersection of Link Road and Boonsboro Road. Another tree was blown down along the 2200 block of Taylor Farm Road.
BEDFORD	8/21/2017	50	1000	Thunderstorm outflow winds, along with heavy water loading from torrential rains, brought down two trees within the community of Forest, VA. Damage values



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				are estimated.
CAMPBELL	10/23/2017	50	500	Thunderstorm winds knocked down a tree on Sandusky Drive in Lynchburg.
BEDFORD	10/23/2017	50	500	Thunderstorm winds knocked down one tree along the Lee Jackson Highway.
BEDFORD	4/15/2018	50	200	Large tree limbs were blown down by thunderstorm winds.
BEDFORD	4/15/2018	50	10000	Debris from a cattle barn was blown on to Meadors Spur Road.
CAMPBELL	4/15/2018	50	1000	One tree was blown down along Whipping Creek Road, and another tree was blown down along the Brookneal Highway.
CAMPBELL	5/10/2018	50	1500	Thunderstorm winds brought down a few trees on East Ferry Road.
BEDFORD	5/22/2018	55	5000	Thunderstorm winds blew down multiple trees and mangled fences on Dickerson Mill Road in Moneta.
CAMPBELL	5/22/2018	50	1000	Thunderstorm winds brought down trees on Dog Creek Road.
AMHERST	6/9/2018	50	2000	A few trees were blown down by severe thunderstorm winds across the community of Amherst.
AMHERST	6/9/2018	50	1000	Several large limbs were blown down out of trees by severe thunderstorm winds.
LYNCHBURG	6/9/2018	50	500	A tree was blown down along John Scott Drive by severe thunderstorm winds.
LYNCHBURG	6/9/2018	50	500	A tree was blown down in the Blue Ridge Farms Neighborhood by severe



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				thunderstorm winds.
LYNCHBURG	6/9/2018	50	500	A tree was blown down by thunderstorm winds along Landover Place.
LYNCHBURG	6/9/2018	50	500	A tree was blown down by thunderstorm winds along the entrance ramp to Highway 501 from Fort Avenue.
AMHERST	6/10/2018	60	45000	Considerable damage occurred to a residential farm property due to thunderstorm winds. A large barn was completely destroyed, with debris scattered a significant distance away. Numerous trees in the nearby area were damaged or blown down by the thunderstorm winds.
AMHERST	6/10/2018	50	1000	A large tree was blown down by thunderstorm winds along Lowesville Road while another tree was blown down at Stonehouse Lake.
CAMPBELL	6/20/2018	50	1000	One tree and a piece of fencing was blown down by thunderstorm winds along Whitehall Road.
CAMPBELL	6/22/2018	50	20000	A tree was blown down onto a house by thunderstorm winds along Independence Circle.
BEDFORD	6/22/2018	50	500	One tree was blown down by thunderstorm winds near the intersection of Shadwell Drive and Hawkins Mill Road.
CAMPBELL	6/22/2018	50	500	One tree was blown down by thunderstorm winds near the intersection of Cabin Field Road and Stage Road.
AMHERST	7/6/2018	50	1500	Thunderstorm winds blew three trees



# Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				down. Damage values are estimated.
BEDFORD	7/11/2018	50	6500	Thunderstorm winds blew down one large tree at the Moneta Post Office, with numerous large tree limbs down in the same immediate area. The tree damage resulted in downed power line and loss of power to the general area. Damage values are estimated.
AMHERST	7/16/2018	50	1500	Thunderstorm winds downed a tree and other large branches in the 200 block of Abbitts Drive near Lynchburg, VA. Damage values are estimated.
AMHERST	7/16/2018	50	10000	Thunderstorm winds blew several trees down on, and around, a house in the 200 block along Dixie Airport Road. Damage values are estimated.
CAMPBELL	8/1/2018	50	5500	Thunderstorm winds blew down one tree and one power line on Juniper Cliff Road in Brookneal.
CAMPBELL	8/2/2018	50	6000	Thunderstorm winds blew down two trees on to power lines in the Windcrest Manor area along Timberlake Drive.
CAMPBELL	8/12/2018	50	1000	Thunderstorm winds blew down one tree near the intersection of Three Creeks Road and Lewis Ford Road and a second tree near the intersection of Route 501 and Swinging Bridge Road.
AMHERST	8/12/2018	50	11000	Thunderstorm winds blew down multiple trees and power lines along Dixie Airport Road in Madison Heights.
BEDFORD	8/13/2018	50	200	Thunderstorm winds blew down two large tree branches about six miles east of





## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				Stewartsville.
AMHERST	8/30/2018	50	500	Thunderstorm winds blew down one tree about three miles south of Falconerville.
AMHERST	8/30/2018	50	500	Thunderstorm winds blew down one tree about two miles east-southeast of Falconerville.
CAMPBELL	9/1/2018	70	25000	Thunderstorm winds caused substantial damage along Dearing Ford Road in Lynch Station. Numerous trees were brought down and the steeple was blown off of the Bethany Ebenezer United Methodist Church.
BEDFORD	4/8/2019	50	2000	Thunderstorm winds blew two mature pine trees down onto a power line near Little Echo Lane. Damage values are estimated.
APPOMATTOX	4/14/2019	50	500	Thunderstorm winds blew a tree down near the intersection of Old Courthouse Road and Holiday Lake Road. Damage values are estimated.
APPOMATTOX	4/14/2019	50	500	Thunderstorm winds blew a tree down on Red House Road. Damage values are estimated.
CAMPBELL	4/15/2019	50	500	Thunderstorm winds blew one tree down along Colonial Highway close to the Campbell - Bedford County line. Damage values are estimated.
CAMPBELL	4/15/2019	50	500	Thunderstorm winds blew a tree down on Tardy Mountain Road close to the intersection of Oliver Road. Damage values are estimate.
CAMPBELL	4/15/2019	50	200	Thunderstorm winds blew a large limb off a



# Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				tree near the intersection of Brookneal Highway and Colonial Highway. Damage values are estimated.
CAMPBELL	4/15/2019	50	500	Thunderstorm winds blew a tree down near the intersection of Spring Mill Road and Mud Street. Damage values are estimated.
BEDFORD	4/15/2019	50	10000	Thunderstorm winds blew a carport off its foundation. The carport subsequently impacting a neighboring church building, damaging this second structure. Damage values are estimated.
BEDFORD	4/19/2019	60	15000	Thunderstorm winds blew multiple trees down, and a carport was destroyed near the intersection of Routes 460 and 831. Damage values are estimated.
APPOMATTOX	4/19/2019	50	4000	Thunderstorm winds blew numerous large tree limbs down at Appomattox Court House National Historical Park. Damage values are estimated.
AMHERST	5/29/2019	50	1500	Thunderstorm winds blew down multiple trees near the intersection of Route 60 and Pedlar River Road.
AMHERST	5/29/2019	55	20000	Thunderstorm winds blew down widespread trees along Lowesville Road and Indian Creek Road. One of those trees fell on a business.
BEDFORD	5/29/2019	55	10000	Thunderstorm winds blew down one tree on to a trailer along Bruno Drive, blew down multiple trees near the intersection of Sandy Level Road and Goodview Town Road, and shattered windows to a residence on Emmaus Church Road.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
BEDFORD	5/29/2019	50	500	Thunderstorm winds blew down one tree on Joppa Mill Road about six miles north-northeast of Moneta.
CAMPBELL	5/29/2019	55	20000	Thunderstorm winds snapped several trees and large branches on Mt. Calvary Road. In addition, the winds blew a few shingles off at least one home, blew down a carport, and destroyed a shed.
CAMPBELL	5/29/2019	55	3500	Thunderstorm winds blew down seven trees along Blue Mist Road about two miles north-northwest of Brookneal.
BEDFORD	5/31/2019	55	15000	Thunderstorm winds blew down numerous trees and tree limbs along Waters Edge Lane near Smith Mountain Lake. One of the trees uprooted and broke a window of a home as it fell.
CAMPBELL	5/31/2019	55	30000	Thunderstorm winds blew down a couple of trees in Altavista. The winds also blew down numerous tents and a few portable toilets at a large festival in English Park. Two people suffered minor injuries at the festival.
BEDFORD	6/2/2019	55	20000	Several trees were blown down by straightline thunderstorm winds across eastern Bedford County, including trees down on Jordantown Road, Hardy Road and Beagle Club Drive.
CAMPBELL	6/18/2019	50	500	Thunderstorm winds blew down a tree along Swinging Bridge Road near Brookneal Highway.
BEDFORD	6/24/2019	50	500	Thunderstorm winds blew down a tree along Big Island Highway near Coltons Mill Road.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
BEDFORD	6/29/2019	50	10000	A tree was blown down by thunderstorm winds onto a house along the 5000 block of Lynchburg Salem Turnpike in the community of Thaxton.
BEDFORD	6/29/2019	50	12000	Thunderstorm winds blew down a tree and the wall of a building that was under construction.
BEDFORD	7/2/2019	60	10000	Several trees and a large branch were blown down by thunderstorm winds along Blankenship Road about one mile east of Stewartsville. One tree brought down a power line when it fell. The winds also blew the roof off of a storage shed along Regency Drive.
AMHERST	7/11/2019	55	3000	A few trees and utility poles were snapped by thunderstorm winds along Stallings Lane.
AMHERST	7/11/2019	50	500	A tree was blown down by thunderstorm winds on Virginia Highway 130.
CAMPBELL	7/11/2019	50	1500	Thunderstorm winds downed a couple trees, as well as snapped large limbs along Lewis Ford Road.
BEDFORD	7/21/2019	60	30000	Thunderstorm winds downed numerous trees, several utility poles and street signs. The sides of a mobile home were also torn off by the thunderstorm winds.
LYNCHBURG	7/21/2019	55	21000	Approximately 20 trees were blown down by thunderstorm winds in the Lynchburg area. Several of the trees fell onto power lines, bringing them down. One tree fell on a chain link fence, destroying the fence.
APPOMATTOX	7/21/2019	55	2500	A few trees were blown down by



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				thunderstorm winds along Route 460.
APPOMATTOX	7/21/2019	55	2500	A few trees were blown down by thunderstorm winds on Oakville Road.
AMHERST	7/21/2019	50	500	A tree was blown down by thunderstorm winds near the intersection of Elon Road and River Road.
AMHERST	7/21/2019	50	500	A large tree was blown down by thunderstorm winds.
BEDFORD	7/22/2019	55	3000	Approximately half a dozen trees were blown down by thunderstorm winds around Moneta.
BEDFORD	7/22/2019	55	6000	Approximately a half dozen trees were downed by thunderstorm winds in the Coleman Falls and Big Island area. A couple trees brought down power lines when they fell.
AMHERST	7/22/2019	50	7000	A couple trees were blown down onto two separate houses by thunderstorm winds on Yahweh Drive.
AMHERST	8/1/2019	55	22500	A few trees were blown down by severe thunderstorm winds along Cedar Gate Road and High Peak Road. In addition, a barn was destroyed and a car was flipped over in this area.
LYNCHBURG	8/1/2019	50	5000	A few trees and power lines blown down by severe thunderstorm winds in Lynchburg City.
CAMPBELL	8/1/2019	55	2500	Several tree tops were snapped off by severe thunderstorm winds.
BEDFORD	8/9/2019	60	15000	Local news reported that considerable





## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				damage occurred in Moneta near the Spring Valley Farm. A roof was ripped off of a barn and caused damage to a nearby structure. A horse in a field was also killed by debris from the barn.
AMHERST	8/15/2019	50	1000	A tree and several branches were blown down by severe thunderstorm winds on Route 130.
APPOMATTOX	8/19/2019	60	20000	A possible microburst blew down several trees, power lines, and power poles near the intersection of Fleshman Street and Annie Street. The thunderstorm winds also tore off a wooden roof at a baseball park on Park Lane.
BEDFORD	8/20/2019	50	500	A few large tree limbs were blown down by thunderstorm winds off Route 731.
AMHERST	8/20/2019	50	1000	One tree and a couple of large limbs were blown down by severe thunderstorm winds at Pedlar Dam.
APPOMATTOX	8/21/2019	50	500	Several tree limbs were blown down by by severe thunderstorm winds in the Pamplin area.
CAMPBELL	8/22/2019	50	500	One was tree blown down by severe thunderstorm winds on Rocky Road.
APPOMATTOX	8/23/2019	50	500	One large tree was blown down by severe thunderstorm winds on Phoebe Pond Road.
APPOMATTOX	8/23/2019	50	1000	A tree was blown down onto power lines by severe thunderstorm winds on Morning Star Road.
APPOMATTOX	9/9/2019	60	35000	Thunderstorm winds blew more than one



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
				dozen trees down in the Oakville area, particularly on Virginia Highway 26 between Oakville and Appomattox. Also, Highway 26 near Oakville was blocked going towards Nelson County. A garage in the 4000 Block of Oakville Road was damaged by thunderstorm winds. Finally, a large tree fell down on Oakville Road. Damage values are estimated.
APPOMATTOX	9/9/2019	50	1100	Thunderstorm winds blew large limbs and a tree down on Horseshoe Road. Damage values are estimated.
APPOMATTOX	9/9/2019	50	1000	Thunderstorm winds blew one tree down at Appomattox Middle School, and also one tree was blown down on Church Street. Damage values are estimated.
APPOMATTOX	9/9/2019	50	500	Thunderstorm winds blew a tree down on Route 604. Damage values are estimated.
CAMPBELL	9/9/2019	50	500	Thunderstorm winds blew one tree down in the 4000 block of Brookneal Highway. Damage values are estimated.
BEDFORD	9/11/2019	55	15000	Thunderstorm winds downed several trees, and power lines were brought down along Thrush Drive and Rocky Ford Road. Damage values are estimated.
CAMPBELL	9/11/2019	50	500	Thunderstorm winds blew a tree down on School Street in Alta Vista. Damage values are estimated.
BEDFORD	9/29/2019	50	400	Thunderstorm winds blew a couple of large limbs down along Coltons Mill Road near Big Island Highway. Damage values are estimated.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	MAGNITUDE	PROPERTY DAMAGE (\$)	DESCRIPTION
APPOMATTOX	9/29/2019	50	500	Thunderstorm winds blew a tree down on Paradise Road near the county line between Appomattox and Campbell Counties. Damage values are estimated.
CAMPBELL	9/29/2019	50	500	Thunderstorm winds blew a tree down near the intersection of Route 24 and Cardinal Lane. Damage values are estimated.
BEDFORD	10/31/2019	50	10500	Thunderstorm winds blew down multiple power lines and one tree about two miles west of Bedford.

### ***Storm Events Database NCEI data - heavy rainfall 2014-2019***

(There is no record for year 2012 and 2013)

JURISDICTION	BEGIN DATE	DESCRIPTION
CAMPBELL	7/24/2014	The official gage at Lynchburg Airport (LYH) measured 3.88 inches of rain in about 2.5 hours. It was the 2nd wettest daily total for this date and also 2nd for any July day with records dating back to 1893. The recurrence interval at the 3-hour duration for this rainfall was very close to 100-years or the 1 percent annual chance of occurrence.
BEDFORD	9/30/2016	A mudslide was reported across a portion of Route 460 near Johnson School Road.
BEDFORD	5/24/2017	The COOP observer at Big Island (BGIV2) measured 3.27 inches for 24-hours ending at 07:00 EST. This is the highest 1-day rainfall in the month of May at this site, the old record was 2.80 inches set May 30, 1971. Records date back to 1960 at this site.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	DESCRIPTION
AMHERST	6/15/2017	A storm spotter reported 3.50 inches of rain in about 2.5 hours.
CAMPBELL	2/10/2018	The COOP observer at Concord 4 SSW had a 24-hour total of 2.60 inches for the 24-hour period ending at 7 AM on the 11th. This was the highest daily rainfall total during the month of February at this location since records began in 1950. Minor flooding was reported in parts of the county.
BEDFORD	2/10/2018	The COOP observer at Bedford had a 24-hour total of 3.10 inches for the 24-hour period ending at 7 AM on the 11th. This was the highest daily rainfall total during the month of February at this location since records began in 1931. Minor flooding was reported in parts of the county.
APPOMATTOX	2/10/2018	The COOP observer at Appomattox had a 24-hour total of 2.73 inches for the 24-hour period ending at 7 AM on the 11th. This was the highest daily rainfall total during the month of February at this location since records began in 1938. An IFLOWS gage at Bent Creek (BECV2) recorded 5.13 inches for a storm total. Minor flooding was reported in parts of the county.
CAMPBELL	2/11/2018	The ASOS rain gauge at Lynchburg had a 24-hour total of 2.04 inches for the 24-hour period ending at 12 AM on the 12th. This was the 4th highest daily rainfall total during the month of February at this location since records began in 1893 and was a record for February 11th. The old record was 1.99 inches set in 1994. Minor flooding was reported around the county with some roads closed.
BEDFORD	5/17/2018	The CoCoRaHS observer at Vinton 2.6 E had 6.86 inches of rain for the 24-hours ending at 700 AM EST. This amount exceeds the 50-year recurrence interval (0.02 annual exceedance probability) for this location and duration.
LYNCHBURG	6/9/2018	Heavy rainfall of 2 to 3 inches in a few hours caused the partial collapse of a roof at a manufacturing plant in Lynchburg. About 35 employees were working inside the plant when the storm began but safely evacuated before the roof collapsed. The collapse opened up a hole in the roof of the rear of the building,



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	DESCRIPTION
		measuring about 75 foot by 100 foot. A broken water main and a partially opened roof resulted in about an inch of flooding inside the plant according to reports. A CoCoRaHS observer at Lynchburg 1.3 SSW measured 2.24 for the 24 hours ending 7AM local time and a nearby observer at Lynchburg 1.3 SSW had 2.21 inches.
LYNCHBURG	8/2/2018	A CoCoRaHS station at Lynchburg 2.5 NNW (VA-LYC-1) measured 6.00 inches for the 24-hour period ending at 800 AM EST on the 3rd. According to local mesonet stations and NWS radar most of the rain fell during intense storms over about a 3-hour period between 500 and 800 PM on August 2nd. For a 24-hour period this is roughly a 25-year rain event (.04 annual exceedance probability) but much more extreme (near 1000-year event) for the approximately 3-hour duration of the rain.
LYNCHBURG	8/2/2018	A CoCoRaHS station at Lynchburg 1.3 SSW (VA-BD-19) measured 6.05 inches for the 24-hour period ending at 330 AM EST on the 3rd. According to local mesonet stations and NWS radar most of the rain fell in intense storms during about a 3-hour period between 500 and 800 PM late afternoon and evening on August 2nd. For a 24-hour period this is roughly a 25-year rain event (.04 annual exceedance probability) but much more extreme (near 1000-year event) for the approximately 3-hour duration of the rain.
APPOMATTOX	9/1/2018	The COOP station at Appomattox, VA (APXV2) measured 2.92 inches for the 24-hour period ending 700 AM local time on September 2nd. This was the highest ever for the date (the old record was 1.30 inches in 1957) and the 11th highest ever in the month of September. Nearly continuous data back to 1938 exists at this location.
APPOMATTOX	9/1/2018	The COOP station at Appomattox (APXV2) measured 2.92 inches for the 24-hour period ending 700 AM local time on September 2nd. It was the highest rainfall for this date with records dating back to 1937.
BEDFORD	9/22/2018	The COOP site at Bedford (BEDV2) measured 3.95 inches for the





## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	DESCRIPTION
		24 hours ending at 700 AM local time on the 23rd. This was the 4th highest daily rainfall recorded at this station in the month of September with rainfall records from 1893-1902, 1931-2005 and 2017-present.
CAMPBELL	10/11/2018	The CoCoRaHS site at Brookneal 2.9 E (VA-CM-10) measured 4.90 inches for 24-hour period ending at 700 AM local time, October 12, 2018.
CAMPBELL	12/14/2018	The ASOS at Lynchburg Airport (LYH) recorded a daily record for December 15th of 1.11 inches for the 24 hours ending at midnight. The old record was 0.99 inches set in 1999. Climate records for Lynchburg date back to 1893.
BEDFORD	12/14/2018	The COOP station at Big Island (BGIV2) reported 1.67 inches for the 24-hours ending at 700 AM local time which was the highest on record for December 15th. The old record was 0.95 inches in 1977. Climate records at this station exist from 1960-1985 and 2000 to present.
AMHERST	12/14/2018	The COOP station at Pedlar Dam (PDLV2) reported 1.27 inches for the 24-hours ending at 700 AM local time which was the highest on record for December 15th. The old record was 1.21 inches in 1951. Nearly continuous climate records at this station began in 1937.
CAMPBELL	12/20/2018	The record rainfall of 1.63 inches was tied at Lynchburg, VA (LYH) for December 20, tying the record first set in 1905. Official climate records for Lynchburg date back to 1893.
BEDFORD	12/20/2018	The COOP station at Big Island (BGIV2) reported 2.76 inches of rain for the 24-hours ending at 700 AM local time which was the highest on record for December 21st. The old record was 2.29 inches in 1973. It was also the highest daily precipitation recorded in the month of December. The record was 2.35 inches set December 12, 2008. Climate records at this station exist from 1960-1985 and 2000 to present.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	DESCRIPTION
CAMPBELL	12/20/2018	The COOP station at Altavista (ALTV2) reported 2.16 inches of rain for the 24-hours ending at 700 AM local time which was the highest on record for December 21st. The old record was 2.10 inches in 1973. It was also the 3rd highest daily precipitation recorded in the month of December. The record is 3.40 inches set December 29, 1958. Climate records at this station date back to 1945.
BEDFORD	5/2/2019	Rainfall of 4.5 inches in about one hour was reported.
LYNCHBURG	8/1/2019	CoCoRaHS observer (VA-LYC-1) reported 3.50 inches in 24 hours, most of which fell in several hours during the evening of August 1st.
LYNCHBURG	8/1/2019	A CoCoRaHS observer (VA-LYC-4) in Lynchburg reported 4.10 inches in 2.5 hours that fell from 715 to 945 PM local time (EDT). According to the observer the creek behind their house was the highest seen in 32 years. Per NOAA Atlas 14, the 4.10 inches in 2.5 hours is roughly a 200-year rain event (.005 annual chance occurrence).
AMHERST	8/1/2019	A CoCoRaHS observer (VA-AH-5) reported 2.70 inches of rain in several hours with the heaviest falling in 45 minutes.

### Storm Events Database NCEI data - lightning 2014-2019

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
LYNCHBURG	6/21/2012	5000	A lightning strike cause a shed to catch fire. Timberlake Road was closed temporarily because of the fire. Damage values are estimated.
CAMPBELL	7/1/2012	250	A brush fire was caused by lightning on Tardy Mountain Road.
BEDFORD	5/7/2013	10000	Lightning damaged a home on the 1000 block of



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
			Glenwood Drive.
APPOMATTOX	7/24/2013	5000	Lightning strikes caused damage in two locations including a shed that was set on fire and at a private residence along Old Court House Lane.
LYNCHBURG	6/11/2014	250000	A lightning strike ignited a house fire at 509 Sussex St., Lynchburg, VA. Firefighters were able to quickly contain the flames, and there were no injuries to either the residents or the firefighters. The family of five were displaced due to the damage. Damage values are estimated.
AMHERST	8/21/2014	200000	The Lynchburg News and Advance along with the Amherst Fire and Rescue Department reported that lightning struck and sparked a fire at a home on Gun Mountain Drive near Amherst. The home was completely destroyed by the fire. Nine residents of the home were completely displaced as a result.
AMHERST	9/9/2015	50000	Lightning struck a HVAC business just northeast of the community of Madison Heights. Two 16 x 32 foot garage buildings housing the HVAC business were damaged, one of which burned to the ground and was completely destroyed. The other was partially destroyed.
CAMPBELL	6/21/2016	100	A home on St. Cloud Avenue in Lynchburg was struck by lightning blowing out a light fixture in the attic.
BEDFORD	6/23/2016	30000	Lightning caused a house on Wingfield Road in Goode to catch fire.
BEDFORD	6/23/2016	10000	Lightning caused a house on Patterson Mill Road near Bedford to catch fire.
LYNCHBURG	6/27/2016	100	Lightning struck a home on Grace Street, destroying a



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
			microwave oven.
LYNCHBURG	6/27/2016	1000	Lightning struck a power pole at the intersection of Lexington Drive and Inglewood Road.
BEDFORD	7/14/2016	0	A man was struck by lightning while walking along Highway 122. He later died from his injuries.
BEDFORD	7/26/2016	10000	A lightning strike set a two-car garage on fire.
CAMPBELL	7/26/2016	2000	A lightning strike took down two power lines.
CAMPBELL	7/26/2016	10000	A lightning strike caused major damage to the electrical components of a patrol vehicle for the Campbell County Sheriff's Office.
LYNCHBURG	7/26/2016	15000	A lightning strike caused a home to catch fire.
APPOMATTOX	5/10/2017	2500	A thunderstorm produced lightning which struck a house on Old Courthouse Road.
LYNCHBURG	7/6/2017	10000	Lightning struck a tree, causing it to fall onto a car along Edgewood Avenue.
BEDFORD	9/5/2017	5000	A lightning strike from a thunderstorm struck a tree on church property during the evening hours. Early the next morning, residual embers from the roots of the struck tree caused a small fire to occur within a nearby church building.
CAMPBELL	8/1/2018	5000	Lightning struck a residence on Riverview Drive in Altavista. Damage values are estimated.
CAMPBELL	8/12/2018	200	Lightning struck a tree along the 6500 block of Sugar Hill Road.



## Appendix H: Hazard Events

JURISDICTION	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
BEDFORD	8/5/2019	3000	Lightning struck a shed and caught it on fire. The shed was a total loss.
BEDFORD	8/6/2019	15000	Lightning struck a barn and caught it on fire. The barn was completely destroyed by the fire.
APPOMATTOX	8/19/2019	10000	Lightning from a thunderstorm struck a barn on Little Cub Road and ignited a fire that completely destroyed the barn.





# Appendix H: Hazard Events

## Severe winter storm

Winter storm event 2010-2019

JURISDICTION/ ZONE	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
BEDFORD	2/5/2010	70000	Light to moderate moved into the county during the early morning hours on the 5th. The snow turned to a mixture of rain, freezing rain, and sleet during the afternoon, before ending as snow late at night into the day on the 6th. Snowfall accumulations of 7 to 8 inches were reported across the county. Roadways became slick, with many reports of vehicles sliding off roads across the state. The heavy snow and ice also caused the roof of a large dock at a marina at Smith Mountain Lake to collapse. As many as 22 boats, many of which were large, were damaged in the collapse.
AMHERST	2/5/2010	0	Light to moderate moved into the county during the early morning hours on the 5th. The snow turned to a mixture of snow, freezing rain, and sleet during the afternoon, before ending as snow late at night into the day on the 6th. Most of the county saw between 6 and 9 inches of snow. Roadways became slick, with many reports of vehicles sliding off roads across the state.
APPOMATTOX	2/5/2010	0	Light to moderate moved into the county during the early morning hours on the 5th. The snow turned to a mixture of snow, freezing rain, and sleet during the afternoon, before ending as snow late at night into the day on the 6th. Snowfall amounts of 5 to 7 inches were common across the northern part of the county, with lower amounts near 3 inches across southern areas. Roadways became slick, with many reports of vehicles sliding off roads across the state.
CAMPBELL	2/5/2010	0	Light to moderate moved into the county during the early morning hours on the 5th. The snow turned to a mixture of snow, freezing rain, and sleet during the afternoon, before ending as snow late at night into the day on the 6th. Most of the county saw around 5 inches



## Appendix H: Hazard Events

JURISDICTION/ ZONE	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
			of snow. Roadways became slick, with many reports of vehicles sliding off roads across the state.
BEDFORD	12/16/2010	0	Snow amounts ranged from 3.0 inches near Goode to 4.0 inches at Big Island and Stewartsville. Some light sleet and freezing rain fell on the snow at the end of the event. Damage values are estimated.
AMHERST	12/16/2010	0	Snow amounts ranged from 3.5 inches near Naola to 5.0 inches at Lowesville. Some light sleet and freezing rain fell on top the snow at the conclusion of the event. Damage values are estimated.
CAMPBELL	12/16/2010	0	Snow amounts ranged from 2.0 inches at Timberlake to 3.5 inches at Brookneal. Some light sleet and freezing rain fell on top the ice. Damage values are estimated.
BEDFORD	2/19/2012	0	Snowfall totals across the county ranged from 6.0 inches in the City of Bedford to 7.4 inches near Forest.
CAMPBELL	2/19/2012	0	Snow totals across the county ranged from 5.0 inches in Rustburg to 7.7 inches in the City of Lynchburg.
AMHERST	2/19/2012	0	Snowfall totals across the county range from 6.0 inches near Elon to 7.0 inches in Amherst.
APPOMATTOX	2/19/2012	0	Snow all totals across the county ranged from 4.0 inches in Appomattox to 5.5 inches in Stonewall.
CAMPBELL	2/12/2014	50000	Snowfall totals ranged from around 9 inches across the southern part of the county to around 10 inches near Lynchburg. Freezing rain accretion occurred over the eastern part of the county where one tenth to a little over one-quarter of an inch was reported. Around 100 vehicle accidents took place and caused indirect damage as a result of the snow and ice covered roads. Damage values are estimated.
APPOMATTOX	2/12/2014	0	Snowfall amounts ranged from 8 to 10 inches across the county. Freezing rain accretion ranged from a few



# Appendix H: Hazard Events

JURISDICTION/ ZONE	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
			hundredths across the western part of the county to a little over a quarter inch in the east.
AMHERST	3/16/2014	0	Various sources reported snowfall totals of around 3 inches with about 0.3 inches of sleet and then .05 inches of freezing rain toward the end of the event.
BEDFORD	2/16/2015	0	The public observed 9.5 inches of snow in Forest, while trained spotters and the public provided numerous reports of snowfall ranging from 7.0 to 9.0 inches from Big Island, Huddleston, Goode, Bedford, and Thaxton.
CAMPBELL	2/16/2015	0	A spotter observed 9.0 inches of snow 4NNE of Rustburg, while other spotters measured 8.0 inches of snow near Timberlake, Bockock, and 3NNW of Gladys. WSET Television measured 7.2 inches at the Lynchburg Airport and 9.0 inches 1WSW of Lynchburg City.
APPOMATTOX	2/16/2015	0	A spotter measured 9.0 inches of snow at Stonewall while another spotter recorded 7.0 inches of snow 2NW of Oakville.
AMHERST	2/16/2015	0	The public measured 7.0 inches of snow 2W of Elon and a trained spotter measured 7.0 inches of snow 3SW of Lowesville.
CENTRAL VIRGINIA BLUE RIDGE	2/16/2015	0	Between 4.0 and 7.5 inches was reported by multiple sources in surrounding areas.
BEDFORD	2/21/2015	0	The public measured 9.5 inches of snow at Big Island, with several reports of 7.0 to 7.5 inches of snow measured by trained spotters around Bedford. Elsewhere across the county, snowfall amounts were mostly in the 4.0 to 6.0 inch range. In addition, an ice accumulation of 0.20 inch was measured by a spotter in Bedford. There were also several reports of sleet mixing in with the snow and ice.
CENTRAL	2/21/2015	0	Between 14.0 and 15.0 inches was reported in the



## Appendix H: Hazard Events

JURISDICTION/ ZONE	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
VIRGINIA BLUE RIDGE			surrounding areas.
AMHERST	2/21/2015	0	A spotter measured 11.0 inches of snow 2SW of Pera while a COOP Observer measured 10.1 inches of snow in Amherst. Elsewhere, snowfall amounts were mostly in the 5.0 to 6.0 inch range.
CAMPBELL	2/21/2015	0	The public measured 5.5 inches within the City of Lynchburg while the Campbell County Sheriff's Office measured 3.0 inches of snow near the Lynchburg Airport. Three inches of snow was also observed by a trained spotter at Concord. Elsewhere across the county, snowfall amounts were mostly less than 3.0 inches. However, ice accumulations ranged from 0.13 inch at WSET Television near Lynchburg to 0.30 inch at Altavista, as measured by a spotter.
CAMPBELL	2/25/2015	0	The public measured 7.0 inches of snow 2NNW of Altavista and 6.0 inches at Altavista. Spotters measured 6.0 inches of snow 4S of the Lynchburg Airport. Elsewhere, snowfall amounts of 4.0 to 5.0 inches were common as reported by spotters and WSET Television of Lynchburg.
BEDFORD	2/25/2015	0	A spotter measured 7.0 inches of snow at Huddleston. Elsewhere, as reported by spotters, the public, a COOP observer, and the county Fire Department, snowfall amounts ranged from 4.0 inches near Forrest to 3.0 inches of snow 2W of the D-Day Memorial.
AMHERST	2/26/2015	0	Trained spotters and the public measured snowfall amounts ranging from 5.0 inches at Madison Heights, 2NE of Madison Heights, and 4N Pleasant View to 3.0 inches 1SW of Falconverville.
APPOMATTOX	2/26/2015	0	Trained spotters measured snowfall ranging from 5.0 inches near Stonewall, 5NNW of Hixburg and near Appomattox to 4.0 inches near Evergreen.



## Appendix H: Hazard Events

JURISDICTION/ ZONE	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
CENTRAL VIRGINIA BLUE RIDGE	3/5/2015	0	Storm total snow between 5.0 and 8.0 inches was reported in surrounding areas.
BEDFORD	1/22/2016	0	Snowfall amounts between 8 and 12 inches were observed across several locations throughout the county. The highest accumulation report was recieved out of the Forest area, where 12.0 inches of snow was measured. A brief period of sleet was also reported during this storm.
CAMPBELL	1/22/2016	0	Snowfall amounts between 8 and 12 inches were observed across several locations throughout the county. The highest accumulation report was recieved out of the Rustburg area, where 12.0 inches of snow was measured. A brief period of sleet was also reported during this storm.
AMHERST	1/22/2016	0	Snowfall amounts between 9 and 11 inches were observed across several locations throughout the county. The highest accumulation report was recieved out of the Amherst area, where 11.0 inches of snow was measured. A brief period of sleet was also reported during this storm.
APPOMATTOX	1/22/2016	0	Snowfall amounts between 9 and 12 inches were observed across several locations throughout the county. The highest accumulation report was recieved out of the Appomattox area, where 11.2 inches of snow was measured. A brief period of sleet was also reported during this storm.
BEDFORD	2/14/2016	0	Snowfall amounts between 5 to 9 inches were observed across several locations in the county. The highest accumulation was in the town of Bedford where 11 inches was measured. Moderate post frontal winds combined with likely under reported icing contributed to more than 1,600 customers in the county losing power.
CAMPBELL	2/14/2016	0	Snowfall amounts between 3 to 8 inches were observed





## Appendix H: Hazard Events

JURISDICTION/ ZONE	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
			across several locations in the county. The highest accumulation was in the Concord area where 8 inches was measured. A report of a quarter of an inch of freezing rain was also reported in Rustburg. Strong winds after the storm caused 305 customers to lose power in the City of Lynchburg.
AMHERST	2/14/2016	0	Snowfall amounts between 5 to 8 inches were observed across several locations in the county. The highest accumulation was in the Oronco area where 7.6 inches was measured. Strong winds after the storm caused 268 power outages in the county.
APPOMATTOX	2/14/2016	0	Four to six inches of snow along with a quarter inch of ice accretion was reported across the county. This contributed to several accidents and disabled vehicles.   On Route 460 a car veered off the road and overturned. All 5 passengers were taken to the hospital for injuries; two adults, and three children.
CENTRAL VIRGINIA BLUE RIDGE	3/3/2016	0	A trained spotter reported a storm total of 5 inches.
BEDFORD	1/6/2017	0	Snowfall amounts between 5 and 9 inches were observed across several locations throughout the county. The highest accumulation report was received out of the Huddleston area, where 9.0 inches of snow was measured.
CAMPBELL	1/6/2017	0	Snowfall amounts between 6 and 8 inches were observed across several locations throughout the county. The highest accumulation report was received out of the Rustburg area, where 8.0 inches of snow was measured.
APPOMATTOX	1/6/2017	0	Snowfall amounts between 6 and 10 inches were observed across several locations throughout the county. The highest accumulation report was received out of the Appomattox area, where 9.3 inches of snow



## Appendix H: Hazard Events

JURISDICTION/ ZONE	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
			was measured.
AMHERST	1/6/2017	0	Snowfall amounts between 4 and 6 inches were observed across several locations throughout the county.
CAMPBELL	12/8/2017	10000	Snowfall amounts ranged from around two inches near Lynchburg to around four inches near Brookneal to around six inches near Gladys. Minor power outages occurred thanks to snow and ice weighted trees and limbs falling on power lines. Damage values are estimated.
APPOMATTOX	12/8/2017	0	Snowfall amounts ranged from around four inches near Evergreen to around five inches near Appomattox.
APPOMATTOX	1/17/2018	0	Snowfall amounts between 5 to 6 inches were observed across several locations in the county. The highest accumulation was near the city of Appomattox where 5.6 inches was measured. 118 traffic accidents were reported within the Appomattox division of the Virginia State Police which encompasses the City of Lynchburg, Campbell, Amherst and Appomattox counties. 105 of these accidents involved property damage and 13 involved injuries.
CAMPBELL	1/17/2018	0	Snowfall amounts between 4 to 6 inches were observed across several locations in the county. The highest accumulation was in the Evington area where 5.5 inches was measured. 118 traffic accidents were reported within the Appomattox division of the Virginia State Police which encompasses the City of Lynchburg, Campbell, Amherst and Appomattox counties. 105 of these accidents involved property damage and 13 involved injuries.
CENTRAL VIRGINIA BLUE RIDGE	3/12/2018	0	Snowfall totaled up to 6.5 at Wintergreen.



# Appendix H: Hazard Events

JURISDICTION/ ZONE	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
CENTRAL VIRGINIA BLUE RIDGE	3/20/2018	0	A wintry mix occurred on the 20th before a round of heavier snow developed on the morning of the 21st. Snowfall was estimated to be between 4 and 8 inches based on observations nearby.
AMHERST	3/20/2018	0	Snowfall amounts from across the county include 1.0 inch at Clifford, 3.0 inches two miles southeast of Forks of Buffalo, two miles west-southwest of New Glasgow, and one mile northeast of Madison Heights, 4.0 inches four miles north of Peasant View, 4.2 inches three miles west of Pleasant View, and 4.5 inches three miles north of Madison Heights.
BEDFORD	3/20/2018	0	Snowfall totals across the county include 2.2 inches five miles north of Bedford, 3.0 inches at Bedford, 3.3 inches at Forest, 3.6 inches two miles west-southwest of Boonsboro, 3.8 inches four miles south of Montvale, 4.0 inches five miles west-southwest of Sedalia and at Goodview, 4.2 inches at Stewartsville, 4.3 inches one mile north-northwest of Coleman Falls and four miles east-northeast of Moneta, 4.8 inches four miles south-southeast of Beford, 5.0 inches three miles east of Thaxton and four miles south-southeast of Thaxton, 5.5 inches six miles north-northeast of Thaxton, and 6.5 inches one mile northeast of Bedford.
CENTRAL VIRGINIA BLUE RIDGE	11/15/2018	0	Widespread ice accretion of around a half inch occurred along the higher elevations of the Central Virginia Blue Ridge. In addition, between 1 and 2 inches of snow and sleet accumulated.
BEDFORD	12/9/2018	0	Snowfall accumulations ranged from 10.5 inches at Bedford to 16.3 inches about two miles west-southwest of Chamblissburg.
AMHERST	12/9/2018	0	Snowfall accumulations ranged from 11.0 inches about three miles east-southeast of Amherst to 15.4 inches at Pedlar Dam.
APPOMATTOX	12/9/2018	0	Snowfall accumulations ranged from 11.0 inches about



## Appendix H: Hazard Events

JURISDICTION/ ZONE	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
			three miles west-northwest of Evergreen to 13.4 inches at Appomattox.
CAMPBELL	12/9/2018	0	Snowfall accumulations ranged from 11.0 inches about two miles east of Forest to 15.0 inches at Rustburg. Lynchburg received 11.7 inches of snow, which is the third highest storm total in the month of December since records began in 1893. It is also the earliest in the winter season that an amount this high has ever been recorded.
CENTRAL VIRGINIA BLUE RIDGE	12/9/2018	0	Snowfall amounts ranged from around 8 inches in the northern portion of the zone to upwards of 20 inches in the southern portion of the zone. A local maximum of 21.0 inches was measured near the Wintergreen Resort.
BEDFORD	1/12/2019	0	A winter storm brought mainly freezing rain to the county, where ice accumulations ranged from 0.2 to 0.33 inches thick. In addition, snow accumulations ranged from 2.0 to locally 5.0 inches.
CAMPBELL	1/12/2019	0	A winter storm brought mainly freezing rain to the county, where ice accumulations were as much as 0.25 inches thick. Snow amounts, which were mixed with sleet in some spots, were around 1.0 inch.
AMHERST	1/12/2019	0	Numerous reports of 3.0 to 4.0 inches of snow were observed by a variety of sources across the county. A few observers also witnessed very light amounts of sleet and icing from freezing rain.
APPOMATTOX	1/12/2019	0	A winter storm brought a combination of freezing rain, sleet and snow to the county. Ice accumulations from freezing rain were around 0.2 inches thick, while sleet accumulations were around 0.5 inches. Snow accumulations ranged from 1.8 to 2.0 inches.
BEDFORD	2/19/2019	0	A winter storm produced freezing rain, sleet and snow in Bedford county. Ice from freezing rain reached a thickness of 0.25 inches and sleet accumulated to a depth of 2 inches, while snow reports ranged from 1 to



## Appendix H: Hazard Events

JURISDICTION/ ZONE	BEGIN DATE	PROPERTY DAMAGE (\$)	DESCRIPTION
			4 inches across the county. Over 4,100 people in Bedford county were without power due to downed trees and power lines.
APPOMATTOX	2/20/2019	0	A winter storm created freezing rain and snow in Appomattox county. Ice from freezing rain reached a thickness of 0.25 inches, while snow reports ranged from 1 to 3 inches across the county.
AMHERST	2/20/2019	0	A winter storm produced sleet and snow in Amherst county. Sleet accumulation ranged from trace amounts to 0.5 inches, while snow reports ranged from 1.3 to 3.6 inches across the county. At one point during the storm, over 3,300 customers were without power in Amherst county.
CENTRAL VIRGINIA BLUE RIDGE	3/21/2019	0	Snowfall accumulations of 4 to 8 inches were reported, with 8.0 inches measured near Wintergreen Resort.





# Appendix H: Hazard Events

## Tornado

This table includes descriptions of major tornado events that have touched down in CVPDC. Events have been broken down by the date of occurrence and when available, by individual community descriptions. When no community specific description is available, the general description should be used as representing the entire planning area.

### *Historic Occurrences of Tornadoes in Central Virginia PDC (1950-2019)*

County	Date	F Scale	Property Damage (\$)	Description
Appomattox	2/1/1951	F1	2,500	
Amherst	5/15/1976		2,500	
Campbell	3/21/1984	F1	250,000	
Campbell	6/21/1989	F0	0	
Amherst	7/9/1990	F0	2,500	
Bedford	6/9/1996	F1	0	
Bedford	7/15/1996	F1	90,000	
Bedford	7/15/1996	F2	140,000	
Campbell	4/17/2000	F0	0	
Bedford	4/28/2002	F1	1,200,000	Destroyed 4 businesses and damaged 25 homes, 58 businesses, several dozen vehicles, and one church.
Bedford	4/28/2002	F2	3,000,000	Injured 1 person, destroyed 7 homes, 3 businesses, and about two dozen farm buildings. The tornado damaged about 129 other homes, 39 businesses, and a tractor trailer. Numerous trees were toppled.
Campbell	4/28/2002	F2	3,000,000	Injured 11 people, destroyed 15 homes, 3 businesses, and a church. The tornado damaged over 200 other homes, six businesses, two churches, 20 recreational vehicles, and several automobiles. Numerous trees were toppled, Some of the trees landed on homes, and two landed on vehicles.
Bedford	9/17/2004	F2	0	Damage to trees. A few homes suffered only



# Appendix H: Hazard Events

County	Date	F Scale	Property Damage (\$)	Description
				minor damage to shingles and roofs, mainly due to trees falling on them.
Campbell	9/17/2004	F1	0	Caused extensive tree damage.Minor damage to homes, mainly shingles and eaves.
Campbell	9/17/2004	F1	0	Large trees were snapped off or uprooted, but only minor damage occurred to sheds.
Appomattox	5/8/2008	EF1	25,000	Numerous trees were downed along and near the path of the tornado. Two houses were damaged, along with two other smaller structures. The damage from the tornado was observed within a larger area of straight-line wind damage.
Campbell	7/17/2009	EF0	20,000	The tornado downed and snapped numerous trees.
Campbell	2/24/2016	EF0	10,000	The tornado downed several trees.
Appomattox	2/24/2016	EF3	11,200,000	The fatality and all the injuries occurred in Evergreen, when the tornado was at its greatest intensity. Thirty structures were completely destroyed and 160 others were damaged, mostly in the Evergreen area. There were also 7 injuries and 1 fatality from this tornado. Numerous trees were snapped and uprooted.
Bedford	5/5/2017	EF0	15,000	It uprooted and snapped multiple large trees and produced damage to the roof and windows of a single dwelling.
Bedford	4/15/2018	EF1	200,000	This tornado caused significant damage to the roof of one home, and it also caused damage to an adjacent barn and outbuilding. About fifty mature trees were either snapped or uprooted.
Campbell	4/15/2018	EF1	100,000	A tornado touched down about five miles east-southeast of Rustburg near Carwile Road at 5:56 PM EST. Several trees were uprooted or snapped during the first moments, but the tornado intensified along New Chapel Road. A roof was blown off a garage, and a manufactured home was moved off its



## Appendix H: Hazard Events

County	Date	F Scale	Property Damage (\$)	Description
				foundation. In addition, a metal roof from a large shed was also peeled off by the tornado. The estimated maximum winds reached 90 MPH. By 5:59 PM EST, the tornado lifted just south of the intersection of New Chapel Road and Bethany Road.
Campbell	4/15/2018	EF2	6,100,000	The tornado uprooted trees, damaged multiple roofs from homes, damaged several businesses, and flipped several cars. A total of 28 buildings suffered damage, and five of those buildings were completely destroyed.
Lynchburg	4/15/2018	EF2	9,600,000	The tornado uprooted trees and caused notable damage to 332 private buildings, and 34 of those buildings were condemned due to the damage. It also damaged numerous power lines and transformers. Two people were injured.
Amherst	4/15/2018	EF3	4,300,000	A total of 166 homes suffered damage, and 22 of those homes were considered a total loss. A motor home was carried about thirty feet and tipped over. The hardest hit locations were along Nottaway Drive and Deerfield Drive. Seven people were injured and taken to the hospital from Elon. As the tornado continued north-northeastward out of Elon, it snapped or uprooted hundreds of trees and caused more minor roof damage to homes.
Amherst	4/15/2018	EF0	50,000	It tracked toward the northwest and lifted at 6:41 PM EST about four miles west-northwest of Lowesville. The tornado only uprooted trees during its time on the ground.
Bedford	5/19/2018	EF1	25,000	Approximately 50 trees were snapped or uprooted but no damage to any structures was noted.
Bedford	4/19/2019	EF1	75000	The tornado touched near Patterson Mill Road, about 2.5 miles north of Thaxton, VA. The tornado stayed on the ground for three



## Appendix H: Hazard Events

County	Date	F Scale	Property Damage (\$)	Description
				minutes, heading nearly due north, uprooting or snapping trees in its path, one of which crushed a storage shed. The tornado destroyed one outbuilding off Centennial Road before dissipating. Damage values are estimated.
Campbell	5/11/2019	EF1	65000	An EF-1 tornado touched down about 5.5 miles southwest of Red House at 3:35 PM EST on May 11, 2019. The tornado traveled 4.1 miles and grew up to 275 yards wide along its path. Winds inside the tornado reached 90-100 MPH, which caused minor damage to three homes and severely damaged or destroyed four outbuildings. In addition, the tornado overturned one modular home and uprooted or snapped numerous trees. By 3:46 PM EST, the tornado lifted about 1.5 miles southwest of Red House.

Source: Storm Events Database



# Appendix H: Hazard Events

## Hazardous materials incident

Table HazMat incidents in CVPDC (1990 - 2019)

Incident County	Date of Incident	Mode of Transportation	HazMat Code	Damages	Fatalities	Injuries	Incident Route
Bedford	2/26/1990	Highway	3	32	0	0	
Lynchburg	6/26/1990	Highway	8	0	0	0	3335 OLD FELLOWS RD
Campbell	6/28/1990	Highway	6.1	136	0	0	ROUTE 29
Lynchburg	7/20/1990	Rail	8	25	0	0	ROUTE 2
Lynchburg	8/1/1990	Rail	8	10	0	0	ROUTE 2
Campbell	9/17/1990	Highway	6.1	125	0	0	ROUTE 29 N
Lynchburg	1/24/1991	Highway	3	0	0	0	1 MILLERACE ST
Lynchburg	4/26/1991	Highway	3	0	0	0	MURRAY PLACE
Lynchburg	10/27/1991	Highway	3	450	0	0	MURRAY PLACE - TERMINAL LOCATI
Lynchburg	12/17/1991	Highway	3	50	0	0	NAVAL RESERVE RD
Lynchburg	2/19/1992	Highway	3	0	0	0	3335 OLD FELLOW ROAD
Bedford	6/30/1992	Highway	3	80	0	0	RT 24 AND O'NEIL





# Appendix H: Hazard Events

Incident County	Date of Incident	Mode of Transportation	HazMat Code	Damages	Fatalities	Injuries	Incident Route
							DRIVE
Lynchburg	8/14/1992	Highway	7	0	0	0	MT ATHOS ROAD
Lynchburg	8/24/1992	Highway	3	10	0	0	4640 MURRAY PLACE
Lynchburg	1/19/1993	Highway	8	5	0	0	4640 MURRAY PL
Lynchburg	3/9/1993	Rail	8	0	0	0	
Lynchburg	4/23/1993	Highway	3	5	0	0	4640 MURRAY PLACE
Lynchburg	5/24/1993	Highway	2.3	38650	0	0	9TH STREET
Lynchburg	6/10/1993	Highway	8	115	0	0	3600 CANDLERS MTN RD
Lynchburg	10/5/1993	Highway	8	0	0	0	4640 MURRAY PL
Appomattox	10/18/1993	Highway	8	125	0	0	200 12TH STREET
Lynchburg	1/18/1994	Highway	3	360	0	0	3106 ODD FELLOWS
Lynchburg	2/1/1994	Highway	3	375	0	0	3106 ODD FELLOWS ROAD
Lynchburg	2/15/1994	Highway	3	405	0	0	3106 ODD



# Appendix H: Hazard Events

Incident County	Date of Incident	Mode of Transportation	HazMat Code	Damages	Fatalities	Injuries	Incident Route
							FELLOW ROAD
Lynchburg	2/28/1994	Rail	2.2	0	0	0	
Lynchburg	3/20/1994	Highway	8	900	0	0	3106 ODD FELLOWS ROAD
Amherst	3/27/1994	Highway	2	15	0	0	ROUTE 29
Lynchburg	5/31/1994	Highway	3	0	0	0	MAYFLOWER DRIVE
Bedford	7/11/1994	Highway	3	0	0	0	UNKNOWN
Lynchburg	7/19/1994	Highway	3	50	0	0	4640 MURRAY PLACE
Bedford	9/16/1994	Highway	8	120	0	0	UNKNOWN
Campbell	11/8/1994	Highway	8	0	0	0	RT I-29 NORTH
Bedford	1/7/1995	Highway	3	56284	0	0	RT 122
Lynchburg	6/29/1995	Highway	2.1	913	0	0	109 HIGH VIEW PLACE
Bedford	8/11/1995	Highway	3	0	0	0	
Lynchburg	9/22/1995	Highway	4.1	25	0	0	TIMERLAKE RD
Lynchburg	10/31/1995	Highway	9	0	0	0	3301 MAYFLOWER



# Appendix H: Hazard Events

Incident County	Date of Incident	Mode of Transportation	HazMat Code	Damages	Fatalities	Injuries	Incident Route
							DRIVE
Lynchburg	11/9/1995	Highway	8	0	0	0	3301 MAYFLOWER DRIVE
Bedford	1/30/1996	Highway	9	2530	0	0	ROUTE 122
Lynchburg	2/15/1996	Rail	2.1	0	0	0	CONCORD TURNPIKE
Lynchburg	3/7/1996	Highway	8	25	0	0	WOODALL RD
Amherst	5/2/1996	Highway	9	0	0	0	
Lynchburg	5/9/1996	Highway	8	25	0	0	3335 ODD FELLOWS ROAD
Lynchburg	7/1/1996	Highway	9	0	0	0	3301 MAYFLOWER DR
Amherst	6/17/1997	Highway	3	20	0	0	ROUTE 29 NORTH
Bedford	7/11/1997	Highway	9	0	0	0	
Lynchburg	10/18/1997	Rail	2.2	0	0	0	5100 WOODALL ROAD
Lynchburg	2/2/1998	Highway	3	0	0	0	5235 WOODALL ROAD
Amherst	2/26/1998	Highway	8	0	0	0	RT 534
Lynchburg	3/31/1998	Rail	3	2713000	0	0	KEMPER



# Appendix H: Hazard Events

Incident County	Date of Incident	Mode of Transportation	HazMat Code	Damages	Fatalities	Injuries	Incident Route
							STREET
Bedford	7/31/1998	Highway	2	30	0	0	PEPPERS FERRY ROAD
Bedford	3/5/1999	Highway	3	2000	0	0	
Lynchburg	3/30/1999	Rail	3	0	0	0	5100 WOODALL RD
Bedford	7/14/1999	Highway	8	125	0	0	2B CORPORATE RD
Bedford	7/28/1999	Highway	8	0	0	1	
Lynchburg	1/27/2000	Highway	2	1000	0	0	ADAMS STREET UPPER BASIN
Bedford	1/19/2001	Highway	3	0	0	1	US501
Bedford	4/19/2001	Highway	8	0	0	0	
Lynchburg	5/31/2001	Rail	8	0	0	0	MP 172
Campbell	6/5/2001	Highway	3	820	0	0	HWY 29 S
Lynchburg	9/18/2001	Highway	2	300	0	0	CONCORD TURNPIKE
Appomattox	9/27/2001	Highway	3	0	0	0	US 460
Lynchburg	5/1/2002	Highway	7	0	0	0	2016 MT-ATHOS ROAD
Bedford	7/8/2002	Highway	3	543000	0	0	ROUTE 640 E



# Appendix H: Hazard Events

Incident County	Date of Incident	Mode of Transportation	HazMat Code	Damages	Fatalities	Injuries	Incident Route
Amherst	11/1/2002	Highway	8	375	0	0	118 ENTERPRISE DR
Lynchburg	4/2/2003	Highway	3	0	0	0	3301 MAYFLOWER DRIVE
Amherst	4/16/2003	Highway	8	365	0	0	118 ENTERPRISE DR
Campbell	5/13/2003	Highway	2.2	102030	0	0	RT 711
Lynchburg	6/16/2003	Highway	3	390	0	0	3416 CANDLER'S MTN RD
Lynchburg	11/17/2003	Highway	3	1050	0	0	
Lynchburg	12/10/2003	Highway	3	7695	0	0	200 S DURHAM ST
Lynchburg	6/25/2004	Highway	8	0	0	0	
Amherst	8/13/2004	Highway	8	375	0	0	118 ENTERPRISE DR
Lynchburg	1/16/2005	Rail	9	1000	0	0	5100 WOODALL ROAD MILEPOST 172
Lynchburg	1/31/2005	Highway	2.2	515	1	0	Route 800 just off route 460
Lynchburg	8/2/2005	Highway	3	525	0	0	20722





## Appendix H: Hazard Events

Incident County	Date of Incident	Mode of Transportation	HazMat Code	Damages	Fatalities	Injuries	Incident Route
							TIMBERLAKE RD STEEL
Lynchburg	10/24/2005	Highway	3	0	0	0	
Lynchburg	1/3/2006	Highway		0	0	0	5235 WOODALL RD
Bedford	1/12/2006	Highway	3	0	0	0	1070 OIL TERMINAL ROAD
Bedford	2/12/2006	Highway	3	0	0	0	1070 OIL TERMINAL ROAD
Lynchburg	4/14/2006	Highway	3	0	0	0	5235 WOODALL RD
Lynchburg	6/19/2006	Highway	3	0	0	0	5235 WOODALL RD
Lynchburg	12/18/2006	Highway	3	0	0	0	5235 WOODALL RD
Amherst	1/30/2007	Highway	8	0	0	0	118 ENTERPRISE DRIVE
Bedford	6/5/2008	Highway	3	0	0	0	1070 Oil Terminal Rd.
Lynchburg	11/21/2008	Highway	2	0	0	0	3301 MAYFLOWER DR



## Appendix H: Hazard Events

Incident County	Date of Incident	Mode of Transportation	HazMat Code	Damages	Fatalities	Injuries	Incident Route
Lynchburg	6/18/2009	Highway	2.1	0	0	0	5235 WOODALL RD
Amherst	1/2/2010	Highway	2.1	100000	0	0	ROUTE 60 WEST AMHERST VA
Bedford	5/26/2010	Highway	2	0	0	0	
Bedford	10/14/2010	Highway	3	582700	0	0	WILKERSON MILL ROAD AND RT 460
Lynchburg	4/12/2011	Highway	3	17000	0	0	1505 RUTHERFORD ST
Lynchburg	7/19/2011	Highway	2	0	0	0	3428 ODD FELLOWS RD
Lynchburg	3/23/2012	Rail	8	0	0	0	
Lynchburg	5/23/2012	Highway	2	0	0	0	3428 ODD FELLOWS ROAD
Bedford	5/28/2012	Highway	3	567000	0	0	
Lynchburg	2/8/2013	Highway	3	8500	0	0	
Lynchburg	7/18/2013	Highway	3	0	0	0	3428 ODD FELLOWS ROAD
Bedford	11/13/2013	Highway	3	2500	0	0	4180 Rocky Ford Rd



# Appendix H: Hazard Events

Incident County	Date of Incident	Mode of Transportation	HazMat Code	Damages	Fatalities	Injuries	Incident Route
Lynchburg	4/30/2014	Rail	3	2280000	0	0	
Lynchburg	3/15/2015	Rail	9	2500	0	0	
Lynchburg	6/24/2015	Highway	3	0	0	0	3428 ODD FELLOW ROAD
Lynchburg	6/30/2015	Highway	8	0	0	0	260 Fastener Dr
Lynchburg	12/4/2015	Highway	3	0	0	0	3428 ODD FELLOWS ROAD
Lynchburg	1/28/2016	Highway	8	2000	0	0	3428 ODD FELLOWS ROAD
Lynchburg	6/23/2016	Highway	3	4000	0	0	4630 Murray Place
Lynchburg	8/23/2016	Highway	3	3000	0	0	22290 TIMBERLAKE RD
Bedford	10/3/2016	Highway	9	7500	0	0	11080 East Lynchburg -Salem Tur
Bedford	5/24/2017	Highway	3	130188	0	0	10700 IL TERMINAL RD HWY 460W
Lynchburg	9/11/2017	Highway	3	4500	0	0	
Lynchburg	4/3/2018	Highway	6.1	2000	0	0	3428 ODD FELLOWS



## Appendix H: Hazard Events

Incident County	Date of Incident	Mode of Transportation	HazMat Code	Damages	Fatalities	Injuries	Incident Route
							ROAD
Lynchburg	4/23/2018	Highway	8	0	0	0	5235 WOODALL RD
Lynchburg	6/22/2018	Highway	5.1	0	0	0	5235 WOODALL RD
Lynchburg	7/10/2018	Highway	3	0	0	0	3428 ODD FELLOWS ROAD
Lynchburg	1/24/2019	Air	3	0	0	0	3321 ODD FELLOWS RD



# Appendix I: Mitigation Funding Sources

## Appendix I: Mitigation Funding Sources

Funding Opportunity	Agency	Name	More Information
PDM	FEMA	Predisaster Mitigation Program	<a href="https://www.fema.gov/pre-disaster-mitigation-grant-program">https://www.fema.gov/pre-disaster-mitigation-grant-program</a>
HMGP	FEMA	Hazard Mitigation Grant Program	<a href="https://www.fema.gov/hazard-mitigation-grant-program">https://www.fema.gov/hazard-mitigation-grant-program</a>
FMA	FEMA	Flood Mitigation Assistance Program	<a href="https://www.fema.gov/flood-mitigation-assistance-grant-program">https://www.fema.gov/flood-mitigation-assistance-grant-program</a>
RFC	FEMA	Repetitive Flood Claims Program	<a href="https://www.fema.gov/repetitive-flood-claims-grant-program-fact-sheet">https://www.fema.gov/repetitive-flood-claims-grant-program-fact-sheet</a>
BRIC	FEMA	Building Resilient Infrastructure and Communities Grant Program	<a href="https://www.fema.gov/drra-bric">https://www.fema.gov/drra-bric</a>
NDSP	FEMA/ DCR	Dam Safety, Flood Prevention and Protection Assistance Fund	<a href="https://www.fema.gov/national-dam-safety-program">https://www.fema.gov/national-dam-safety-program</a> , <a href="https://www.dcr.virginia.gov/dam-safety-and-floodplains/">https://www.dcr.virginia.gov/dam-safety-and-floodplains/</a>
HHPD	FEMA/ DCR	High Hazard Potential Dam Grants	<a href="https://www.dcr.virginia.gov/dam-safety-and-floodplains/dsfpm-grants">https://www.dcr.virginia.gov/dam-safety-and-floodplains/dsfpm-grants</a>
AFG	FEMA	Assistance to Firefighters Grant - Equipment and Training	<a href="https://www.fema.gov/assistance-firefighters-grant">https://www.fema.gov/assistance-firefighters-grant</a>
FP&S	FEMA	Fire Prevention and Safety Grant - Reduce injury and death among high-risk populations	<a href="https://www.fema.gov/fire-prevention-safety-grants">https://www.fema.gov/fire-prevention-safety-grants</a>
HSNTP and CTG	FEMA	Homeland Security National Training Program and Continuing Training Grants	<a href="https://www.grants.gov/web/grants/view-opportunity.html?oppld=327555">https://www.grants.gov/web/grants/view-opportunity.html?oppld=327555</a>
EMPG-S	FEMA	Emergency Management Performance	<a href="https://www.fema.gov/media-library/assets/documents/187029">https://www.fema.gov/media-library/assets/documents/187029</a>





# Appendix I: Mitigation Funding Sources

Funding Opportunity	Agency	Name	More Information
		Grant COVID-19 Supplemental	
SFCP	USACE	Small Flood Control Projects	<a href="https://www.mvp.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/587968/fact-sheet-09-small-flood-control-projects/">https://www.mvp.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/587968/fact-sheet-09-small-flood-control-projects/</a>
FPMS	USACE	Floodplain Management Services Program	<a href="https://www.nae.usace.army.mil/missions/public-services/flood-plain-management-services/">https://www.nae.usace.army.mil/missions/public-services/flood-plain-management-services/</a>
AERP	USACE	Aquatic Ecosystem Restoration Projects	<a href="https://www.nae.usace.army.mil/Missions/Public-Services/Continuing-Authorities-Program/Section-206/">https://www.nae.usace.army.mil/Missions/Public-Services/Continuing-Authorities-Program/Section-206/</a>
WRDA	USACE	Water Resources Development Act - Planning and Technical Assistance	<a href="https://www.nae.usace.army.mil/Missions/Public-Services/Planning-Assistance-to-States/">https://www.nae.usace.army.mil/Missions/Public-Services/Planning-Assistance-to-States/</a>
PHEP	CDC	Public Health Emergency Preparedness	<a href="https://www.cdc.gov/cpr/readiness/phep.htm">https://www.cdc.gov/cpr/readiness/phep.htm</a>
SAFECOM	DHS	Maintaining interoperable networks	<a href="https://www.cisa.gov/publication/emergency-communications-grant-guidance-documents">https://www.cisa.gov/publication/emergency-communications-grant-guidance-documents</a>
CESER	DOE	Energy Assurance Planning and Cybersecurity	<a href="https://www.energy.gov/ceser/state-and-local-energy-assurance-planning">https://www.energy.gov/ceser/state-and-local-energy-assurance-planning</a>
LWCF	DOI/DCR	Land and Water Conservation Fund Grants	<a href="https://www.dcr.virginia.gov/recreational-planning/lwcf">https://www.dcr.virginia.gov/recreational-planning/lwcf</a>
CESFP	DOJ	Coronavirus Emergency Supplemental Funding Program	<a href="https://bja.ojp.gov/funding/opportunities/bja-2020-18553?utm_medium=email&amp;utm_source=govdelivery">https://bja.ojp.gov/funding/opportunities/bja-2020-18553?utm_medium=email&amp;utm_source=govdelivery</a>
CRISI	DOT	Consolidated Rail Infrastructure and Safety Improvements	<a href="https://railroads.dot.gov/grants-loans/competitive-discretionary-grant-programs/consolidated-rail-infrastructure-and-safety-2">https://railroads.dot.gov/grants-loans/competitive-discretionary-grant-programs/consolidated-rail-infrastructure-and-safety-2</a>
DMTA	EDA	Disaster Mitigation and	<a href="https://www.eda.gov/funding-opportunities/">https://www.eda.gov/funding-opportunities/</a>



# Appendix I: Mitigation Funding Sources

Funding Opportunity	Agency	Name	More Information
		Technical Assistance Grants	
DWSRF	EPA/V DH	Drinking Water State Revolving Fund	<a href="https://www.epa.gov/dwsrf">https://www.epa.gov/dwsrf</a> , <a href="https://www.vdh.virginia.gov/drinking-water/financial-construction-assistance-programs/">https://www.vdh.virginia.gov/drinking-water/financial-construction-assistance-programs/</a>
CWSRF	EPA/DE Q	Clean Water State Revolving Fund	<a href="https://www.epa.gov/cwsrf">https://www.epa.gov/cwsrf</a> ; <a href="https://www.deq.virginia.gov/Programs/Water/CleanWaterFinancingAssistance/Wastewater.aspx">https://www.deq.virginia.gov/Programs/Water/CleanWaterFinancingAssistance/Wastewater.aspx</a>
AIP	FAA	Airport Improvement Program	<a href="https://www.faa.gov/airports/aip/2020_aip_grants/">https://www.faa.gov/airports/aip/2020_aip_grants/</a>
ECP	Farm Service Agency (FSA)	Emergency Conservation Program	<a href="https://www.fsa.usda.gov/programs-and-services/conservation-programs/emergency-conservation/index">https://www.fsa.usda.gov/programs-and-services/conservation-programs/emergency-conservation/index</a>
TAP	FSA	Tree Assistance Program	<a href="https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/tree-assistance-program/index">https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/tree-assistance-program/index</a>
HPP	HHS	Hospital Preparedness Program	<a href="https://www.phe.gov/Preparedness/planning/hpp/Pages/default.aspx">https://www.phe.gov/Preparedness/planning/hpp/Pages/default.aspx</a>
CDBG	HUD	Community Development Block Grant Program	<a href="https://www.hudexchange.info/programs/cdbg/">https://www.hudexchange.info/programs/cdbg/</a>
HDBE	National Science Foundation	Human, Disasters, and the Built Environment Grants	<a href="https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13353">https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13353</a>
WFPO	NRCS	Watershed and Flood Prevention Operations Program	<a href="https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/landscape/wfpo/?cid=nrcs143_008271">https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/landscape/wfpo/?cid=nrcs143_008271</a>
WSP	NRCS	Watershed Surveys and Planning	<a href="https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wsp/">https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wsp/</a>
WR	NRCS	Watershed Rehabilitation	<a href="https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wr/">https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wr/</a>



# Appendix I: Mitigation Funding Sources

Funding Opportunity	Agency	Name	More Information
		(Dam Rehabilitation)	
CFDLGP	Rural Development (RD)	Community Facilities Direct Loan and Grant Program	<a href="https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program">https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program</a>
SFHRLG	RD	Single Family Housing Repair and Loan Grants	<a href="https://www.rd.usda.gov/programs-services/single-family-housing-repair-loans-grants">https://www.rd.usda.gov/programs-services/single-family-housing-repair-loans-grants</a>
Community Facilities	USDA	Grants for essential community facilities in rural areas and towns up to 20,000 in population.	<a href="https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program">https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program</a>
HSGP	VDEM	Homeland Security Grant Program	<a href="https://www.vaemergency.gov/job/homeland-security-grant-program-hsgp/">https://www.vaemergency.gov/job/homeland-security-grant-program-hsgp/</a>



# Appendix J: Mitigation Progress

## Appendix J: Mitigation Progress

The Central Virginia PDC Hazard Mitigation Plan, while officially an update to the 2013 Region 2000 Hazard Mitigation Plan, was developed as though a first pre-disaster evaluation, planning, and strategy development process. The expanded stakeholder participation, Hazard Identification and Risk Assessment (HIRA), vulnerability analysis, locality and regional capability assessment, and establishment of regional and unique locality mitigation strategies tailored to local needs were all developed during this mitigation planning process and did not build upon the 2013 mitigation plan. Further, no designated or recorded implementation or maintenance actions had taken place regarding any element of the 2013 Mitigation Plan. Finally, this Hazard Mitigation Plan was developed through a broader stakeholder group, most of whom were not involved in the last mitigation process. As such, a detailed evaluation of the past plan was not incorporated in this Plan. It should be noted that confirmation with FEMA to account for this process was sought and received.

The Central Virginia PDC Hazard Mitigation 2020 Update incorporates a comprehensive Implementation and Maintenance program. This includes a process to monitor implementation activities, including integration into local and regional planning documents and departmental processes. The monitoring and capturing of mitigation activities will be accomplished through dedicated program meetings, at least two per year. A strategy matrix and review process will be used, and activities will be tracked utilizing the following evaluation format. Integration of this continued program monitoring will provide a ready format for any necessary amendments and review for the regional mitigation plan update.

Jurisdiction	Mitigation Goal(s) and Objective(s)	Mitigation Action	Complete?	Progress

Central Virginia Planning District  
Commission Hazard Mitigation Plan 2020

