APPENDIX H

LOCALITY VULNERABILITY SUMMARIES

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PURPOSE

This section provides a consolidated vulnerability summary for each of the 21 jurisdictions and four special districts participating in the Central Shenandoah Hazard Mitigation Plan. The following vulnerability summaries are synthesized from the hazard-specific analyses presented in Sections 4.1 through 4.12 of this chapter and from the community profile data presented in Chapter 3: Regional Setting. The jurisdictions and special districts are grouped by the four sub-areas used throughout this plan: Bath-Highland, Harrisonburg-Rockingham, Staunton-Augusta-Waynesboro, and Lexington-Rockbridge-Buena Vista.

The towns within each sub-area are addressed collectively following their respective county summaries. Because incorporated towns in Virginia are embedded within the county governments that surround them, their hazard exposure is fundamentally shaped by the same geographic, geologic, hydrologic, and climatological conditions that define county-level vulnerability. Where a town's vulnerability diverges meaningfully from its county — due to a disproportionate share of land in a flood zone, a specific critical facility at risk, a notable historical event, or a particular demographic or economic characteristic — that distinction is called out explicitly.

In most other respects, the hazard profiles described for each county apply to the towns within it. Town summaries are therefore organized around the hazards and characteristics that most differentiate their vulnerability, rather than repeating county-level analysis for each of the twelve hazard profiles individually. This approach reflects both the functional relationship between Virginia's towns and counties and the practical reality that town-level data — including flood insurance records, critical facility inventories, and demographic statistics — is often available only at the county or city level, limiting the precision with which town-specific vulnerability can be independently assessed.

Vulnerability is defined here as the susceptibility of a community's people, structures, systems, natural resources, cultural resources, and economic activities to damage or loss from an identified hazard. A community may be exposed to a hazard but not vulnerable if it has the capacity, resources, and infrastructure to withstand and recover from its impacts. Conversely, a community with limited resources, aging infrastructure, or a high concentration of residents with special needs may be highly vulnerable even to hazards of moderate probability. Both dimensions – exposure and capacity – are considered in the following summaries.

BATH-HIGHLAND SUBAREA

The Bath-Highland sub-area encompasses Bath County, Highland County, the Town of Monterey, and the Bath County Service Authority. These jurisdictions cover over 950 square miles of mountainous terrain in the Allegheny Highlands and comprise the least populated sub-area in the planning district. The combined 2023 population of approximately 6,481 residents reflects a significant decline from 2013, with Bath County losing 11.6% of its population and Highland County losing 2.2% over that decade (Table 3.1). Population projections through 2040 suggest continued decline: Bath County is projected to lose another 14.1% and Highland County another 6.2% by that year (Chart 3.1).

Both counties have median ages well above the regional average: Bath County's median age of 53 years and Highland County's median age of 51 years are the highest in the region (Chart 3.2). Approximately 40% of the sub-area's population is over age 60. These demographic characteristics create a concentrated vulnerability to temperature extremes, infectious disease, and infrastructure failures that disrupt heating, water, and medical supply systems.

The sub-area's economy is anchored by tourism (including the Omni Homestead Resort in Bath County), agriculture (primarily beef cattle), and public land recreation. Median household incomes are moderate ($61,709 in Bath County; $62,946 in Highland County), but economic opportunity is limited and Highland Counties is identified as an EDRC or potentially disadvantaged under FEMA Region 3 mapping (Map 3.5). Both counties are located within the National Radio Quiet Zone (NRQZ), which permanently restricts emergency radio communication frequencies. Over half of Bath County's land area and more than a quarter of Highland County's is in public ownership, including federal forests, wildlife management areas, and state parks. Well over three-quarters of residents in both counties depend on private wells for drinking water.

The sub-area contains 25 properties on the National Register of Historic Places in Bath County and 8 in Highland County, including 1 National Historic Landmark each: The Homestead (Bath) and Butler Cave-Breathing Cave (Highland). These resources are disproportionately vulnerable to wildfire, flooding, and infrastructure failures given their rural, often forested settings and the lack of modern fire protection systems in older historic structures.

BATH COUNTY

FLOODING | Bath County faces significant flood risks from the Cowpasture River and its tributaries. The County's mountainous terrain also creates elevated flash flood risk. Approximately 535 square miles of the County's land falls within the 100-year or 500-year flood zones as mapped by FEMA, and two critical facilities are located within the 100-year flood zone: one Water Systems facility and one Utility facility.

The potential consequences of a major flood event are substantial: the Basic Hazus analysis conducted for this plan (Map 4.1.9) estimates that the northwest and southeast areas of the County could experience economic losses exceeding $10 million in a 100-year flood event. It is important to note that all of Bath

County's FIRM data consists of Zone A (meaning no Base Flood Elevation data is available) which introduces the highest degree of flood risk uncertainty of any jurisdiction in the region. As a result, flood depths, insurance requirements, and regulatory standards for Bath County are based on less precise data, and the true number of residents and assets at risk from flooding may be different than current maps indicate.

TROPICAL STORM/HURRICANE | Bath County's vulnerability to tropical storms/hurricanes encompasses both the flood risk described above and the cascading effects of high winds, prolonged power outages, and communication failures. While the County's inland mountain location means it is rarely subject to direct storm-force winds, the secondary and indirect effects of tropical systems pose meaningful risk. The Commonwealth of Virginia's 2023 Hazard Mitigation Plan estimates $8,585 in annualized wind loss for Bath County based on a Hazus hurricane wind analysis (Table 4.2.3), a relatively modest figure that nonetheless reflects persistent, recurring exposure. More consequential than direct wind damage is the compounding effect of simultaneous infrastructure failures: when a tropical system disrupts roads, electric power, and communications at the same time, Bath County's small, aging, and geographically isolated population faces acute risk of extended isolation from emergency services, medical care, and essential supplies.

HIGH WINDS | Bath County experiences 0.7 to 2.1 strong wind events per year – a lower frequency than the other localities but with proportionally greater consequence given the county's remote location. The 2012 derecho produced the highest per-capita public assistance cost in the region for Bath County at $248.86 per person, reflecting the severe consequence of losing power and road access in a rural, isolated area with a limited tax base. Downed trees on the county's relatively sparse secondary road network can isolate communities for extended periods, and NRQZ restrictions limit communication alternatives during prolonged outages. The County’s entire population is vulnerable to service disruptions and compromised access due to high wind events.

WILDFIRE | Bath County has 95% of its structures with direct wildfire exposure (Table 4.4.9). The county's critical facility exposure is extensive for its population size. There are 8 Woodland Communities (Table 4.4.6) and 39 critical facilities (Table 4.4.5) in the wildland-urban interface, according to available datasets. Additional factors such as long emergency response times, limited local suppression capacity, and NRQZ communication restrictions compound wildfire vulnerability. The Homestead resort campus and multiple National Register properties in WUI areas (including the Reveille estate and historic schoolhouses) face irreversible loss risk. Furthermore, the county's forest-dominated land cover (Map 3.7) creates fuel conditions that can sustain large, difficult-to-contain wildfires.

DROUGHT | Bath County's 74.4% groundwater dependency creates severe drought vulnerability. When drought draws down the water table, private wells can fail, leaving households without water and with very limited access to alternatives. The county received a primary agricultural disaster designation in 2014, and its beef cattle operations face forage loss and water shortage during moderate to severe drought conditions. The county's sole water source for most residents has no municipal backup, making drought-related water supply failure a direct threat to public health – particularly for elderly residents who may have difficulty seeking alternative supplies. Bath County's declining population may reduce agricultural economic resilience over time, as fewer active farms share the risk of agricultural drought losses.

SINKHOLES | Approximately 40% of Bath County overlies karst terrain. The county's 81 documented springs (including nationally registered resources such as Warm Springs) are vulnerable to contamination from sinkhole activity and surface spills that enter the karst groundwater system. Critical facility exposure over carbonate bedrock includes 2 emergency/medical facilities, 5 public service facilities, 1 industrial facility, 1 major employer, 5 historic places, and 7 social centers. Two dams, Bath Alum Farm Dam and John Lawrence Dam, carry significant hazard potential ratings and are located in karst terrain, creating compound risk.

EXTREME TEMPERATURES | With 27.4% of its population aged 65 and over and a median age of 53 years, Bath County has among the highest concentrations of temperature-vulnerable elderly residents in the region. The county has recorded multiple Extreme Cold/Wind Chill events since 2015. Residents on private wells lose water supply when power fails during cold events, simultaneously leaving elderly, isolated residents without heat and water. Bath Community Hospital (25 beds, no ICU) cannot manage complex cases, meaning cold-related medical emergencies require transport to facilities in neighboring counties over roads that may be compromised by ice and snow.

SEVERE WINTER WEATHER | Bath County averages over 30 inches of snowfall annually – among the highest in the region – and has 171 VDOT-maintained bridges, 6% of which are in Poor condition (Table 4.8.3). The county's sparse secondary road network is critical to connectivity where many communities can be reached by only a single route. Winter weather events that close roads or damage bridges can isolate residents from emergency services and essential supplies for days. Bath Community Hospital's limited capacity means that a major winter event causing widespread injuries could quickly overwhelm local medical resources.

INFECTIOUS DISEASE OUTBREAK | Bath County's 27.4% elderly population, single critical access hospital (no ICU), geographic isolation, and near-universal lack of adequate broadband access create acute infectious disease vulnerability. The Omni Homestead Resort (a large congregate hospitality setting and the county's largest employer) proved highly vulnerable during COVID-19 when its closure created disproportionate economic impact, given the county's limited economic diversity. According to 2022 data, the county reported 1 COVID case per 4.6 people (Table 4.9.2). Additionally, telehealth – a critical alternative healthcare delivery mechanism during pandemics – is effectively unavailable for most residents due to broadband gaps (Table 4.11.1).

HAZARDOUS MATERIALS | Bath County has no TRI facilities but faces transportation corridor and agricultural chemical risk from the road networks that serve as its primary access routes. The county's karst topography means that a fuel or chemical spill on a remote mountain road could contaminate springs and groundwater serving multiple households with no alternative water supply. The Homestead resort and Bath's nationally recognized springs – several listed on the Virginia Landmarks Register and National Register – represent natural and cultural resources acutely vulnerable to groundwater contamination.

CRITICAL INFRASTRUCTURE FAILURE | Bath County's infrastructure vulnerability is among the most severe in the region. The county has 1,650 unserved broadband locations (2.6 people per unserved location); its NRQZ position restricts emergency radio frequencies; the Bath County Pumped Storage facility includes multiple High Hazard Potential Dams; and it averages one significant regional utility outage every 18 months. Extended utility outages leave most residents without water (private electric well pumps), heating, and

communication simultaneously. The county's declining population constrains its ability to fund resilience investments.

ACTIVE ASSAILANT | Bath County's active assailant risk is low probability, but high consequence given its remote location and limited emergency response capacity. Response times from law enforcement and trauma care are among the longest in the region. The Omni Homestead Resort – a major public venue with national visibility – and public lands attracting recreational visitors represent soft target environments in a jurisdiction with minimal security infrastructure.

HIGHLAND COUNTY

FLOODING | Highland County has the lowest modeled annual average flood loss in the region ($2.8 million) and the smallest proportion of land in flood hazard areas (1.9%), reflecting its mountainous topography and limited valley-floor development. However, the county's remoteness means that even modest floods can isolate communities from emergency services for extended periods. Flash flooding in the steep Allegheny Highland watersheds can be sudden and severe. Additionally, the county has 3 critical facilities, specifically social centers located within the 100-year flood zone.

The potential consequences of a major flood event are substantial: the Basic Hazus analysis conducted for this plan (Map 4.1.9) estimates that the County could experience economic losses exceeding $10 million in a 100-year flood event. It is important to note that all of Highland County's FIRM data consists of Zone A (meaning no Base Flood Elevation data is available) which introduces the highest degree of flood risk uncertainty of any jurisdiction in the region. As a result, flood depths, insurance requirements, and regulatory standards for the county are based on less precise data, and the true number of residents and assets at risk from flooding may be different than current maps indicate.

TROPICAL STORM/HURRICANE | Highland County's vulnerability to tropical storms encompasses both the flood risk described above and the cascading effects of high winds, prolonged power outages, and communication failures. The Commonwealth of Virginia's 2023 Hazard Mitigation Plan estimates $3,836 in annualized wind loss for Bath County based on a Hazus hurricane wind analysis (Table 4.2.3), representing meaningful per-capita exposure given the population of only 2,079. To compound the County’s vulnerability, the county's NRQZ position complicates radio frequency alternatives when communication infrastructure fails during tropical events, and its lack of a hospital means that tropical system injuries require transport over potentially compromised road networks.

HIGH WINDS | Highland County experiences 0.7 to 2.1strong wind events per year. Tornado records may underrepresent actual occurrences given the county's sparse population. The 2012 derecho caused $77.13 per-capita public assistance costs (Table 4.3.3), reflecting meaningful impact on a small community. Downed trees on the county's sparse road network can isolate communities for extended periods with no alternative routes. The County’s entire population is vulnerable to service disruptions and compromised access due to high wind events.

WILDFIRE | Highland County has the highest proportion of structures with direct wildfire exposure in the region at 97% (Table 4.4.9). The county's near-universal position within or adjacent to forested landscapes (reflected in Map 3.7's land cover data) creates conditions where any ignition can threaten structures. The county has 2 Woodland Communities and 17 critical facilities in WUI areas (4 emergency/medical, 4 public service, 2 water system, 5 historic places, and 7 social centers) (Table 4.4.5). Emergency response times are the longest in the region (Map 4.4.3), and NRQZ restrictions limit coordination with resources. National Register properties including the Mansion House, C.P. Jones House and Law Office, McDowell Presbyterian Church, and Crab Run Lane Truss Bridge are located in WUI areas and face irreversible loss risk.

DROUGHT | Highland County has the highest groundwater dependency in the region at 88.8% (Table 4.5.6). A severe multi-year drought could deprive nearly the entire county of its primary water source, with no municipal backup available. The county's beef cattle operations face forage loss and water shortage. The county received drought-related agricultural disaster designations in 2014 and 2019. As population declines, remaining farm operations face less economic capacity to weather multi-year drought impacts.

SINKHOLES | Approximately 50% of Highland County overlies karst terrain (mostly a mixture of carbonate and non-carbonate bedrock) and the county has 51 documented springs (Table 4.6.2). Groundwater contamination from sinkhole activity or surface spills poses a direct threat to the county's nearly universally well-dependent population. The county's sparse development means that sinkhole activity in populated areas, while infrequent, carries significant relative impact.

EXTREME TEMPERATURES | Highland County presents the most acute cold temperature vulnerability profile in the region. It records the highest cold wave frequency (0.8 to 1.8 events per year), the lowest average low temperatures, and the highest share of residents aged 65 and older at 34.3% — a population particularly susceptible to hypothermia and cold-related illness. Since 2015, the county has logged more Cold/Wind Chill events than any other jurisdiction in the region. Especially concerning is the convergence of exposure and isolation. Residents depend almost universally on private electric well pumps for water, and the county has no hospital within its borders. A prolonged cold wave that disables heating and water systems could leave elderly residents without either for days — with no nearby medical facility to absorb the resulting health crisis.

SEVERE WINTER WEATHER | Highland County averages over 30 inches of snowfall annually and has the highest RSI snow event frequency in the region. Its153 VDOT-maintained bridges, 7% of which are in Poor condition (Table 4.8.3), are critical connectors in a county where sparse roads provide the only access between communities. The county has no hospital, meaning winter injuries require transport to facilities in neighboring counties over roads that may be closed by snow and ice. The NRQZ limits communication during winter emergencies when other infrastructure is also degraded. Highland County's EDRC designation reflects its limited financial capacity to address these compounding infrastructure vulnerabilities.

INFECTIOUS DISEASE OUTBREAK | Highland County's combination of no hospital, 34.3% elderly population, 88.8% private well dependency, near-universal lack of adequate broadband, and extreme geographic isolation creates the most acute infectious disease vulnerability profile in the region. During a severe outbreak, virtually all serious medical cases would require transport outside the county. Telehealth

is effectively unavailable for most residents. The county's population decline means fewer community resources – healthcare workers, volunteers, public health staff – available locally during an outbreak.

HAZARDOUS MATERIALS | Highland County has no TRI facilities and limited transportation corridor exposure. Its primary HazMat risk is groundwater contamination given 50% karst coverage and near-universal well dependency. A chemical spill on the county's limited road network could contaminate springs and groundwater serving large portions of the small population.

CRITICAL INFRASTRUCTURE FAILURE | Highland County has 1,969 unserved broadband locations (Table 4.11.1) – essentially one per household – meaning a telecommunication outage eliminates virtually all connectivity for the entire county. The NRQZ compounds this by restricting radio frequency alternatives. The county has 37 residents within 5 miles of High Hazard Potential Dams, but road network fragility and communication limitations mean that dam failure warning and evacuation would face severe challenges. Power outages eliminate water supply for 88.8% of residents simultaneously. Highland County's persistent population decline and EDRC status create structural barriers to the infrastructure investment needed to reduce this vulnerability.

ACTIVE ASSAILANT | Highland County's active assailant risk is low probability. The county's sparse population, limited public gathering places, and remote location reduce exposure. However, emergency response times are the longest in the region and NRQZ communication restrictions could severely impair coordination during an event.

TOWN OF MONTEREY

As Highland County's sole incorporated town and county seat, Monterey is the hub for county government, commerce, and services. Its small size means its vulnerability profile mirrors that of Highland County across all hazard types: extreme cold wave frequency; near-universal private well dependency with no municipal backup; lack of any hospital within the county; effectively universal lack of adequate broadband; NRQZ communication constraints; and the highest proportion of elderly residents of any sub-area in the region. Flooding affects 4.4% of the Town's land area (Zone A only, with significant uncertainty). The Town's role as the county's primary services hub means that disruption to Monterey's infrastructure – whether from flooding, winter weather, or utility failure – has cascading consequences for the entire county population that far exceed what the Town's 172 residents would suggest.

HARRISONBURG-ROCKINGHAM SUBAREA

The Harrisonburg-Rockingham sub-area encompasses the City of Harrisonburg, Rockingham County, and the towns of Bridgewater, Broadway, Dayton, Elkton, Grottoes, Mount Crawford, and Timberville. With a combined 2023 population of approximately 141,543 (the largest of the four sub-areas), this sub-area is a key economic engine for the CSPDC region.

The City of Harrisonburg grew by 7.8% between 2013 and 2023, and Rockingham County grew by 7.9% over the same period – both above the regional average – with continued growth projected through 2040 (Rockingham at 12.8%). This growth is concentrated in census tracts surrounding the City, particularly south of downtown (Map 3.3), placing increasing numbers of residents and structures in areas that may have previously had lower hazard exposure. All seven towns in the sub-area gained population between 2013 and 2023, with Timberville (+20.2%) and Bridgewater (+16.3%) showing the strongest growth.

Harrisonburg is home to James Madison University (over 22,000 students and approximately 4,000 faculty and staff- see Special Districts section), the region's two largest hospitals (Sentara RMH Medical Center and UVA Health Rockingham, combined 320 beds and 20 ICU beds), and a highly diverse population that includes a large immigrant community. The City's median age of 26 years is the lowest in the region by a significant margin, driven by JMU's student population (Chart 3.2). Several census tracts in Harrisonburg show SVI scores above 0.75 – among the highest in the region – indicating concentrations of socially vulnerable populations facing barriers to preparedness and recovery (Map 3.4).

Rockingham County is Virginia's most productive agricultural county, contributing 22% of the Commonwealth's total agricultural sales. The sub-area's economy also includes significant food and beverage processing, manufacturing, and tourism. The sub-area's road network includes Interstate 81 (the region's primary commercial freight corridor) and a dense network of secondary roads serving dispersed agricultural communities. Karst terrain underlies significant portions of the County and the City. The sub-area contains 44 National Register properties in Rockingham County and 14 in Harrisonburg.

CITY OF HARRISONBURG

FLOODING | Harrisonburg's flood vulnerability is driven primarily by urban stormwater and flash flooding. With 44.1% impervious surface coverage (Table 4.1.2) stormwater runoff during heavy precipitation events is rapid and substantial. Although only 6.1% of the City's land falls within the 100-year flood zone, that zone encompasses 1 emergency/medical facility, 2 public service facilities, 1 water system facility, and 2 utility facilities. The Basic Hazus analysis conducted for this plan (Map 4.1.6) estimates that several areas, particularly around major road corridors, could experience economic losses exceeding $10 million in a 100-year flood event.

Importantly, Harrisonburg serves as the region's primary healthcare hub; flood-related disruptions to transportation can impair patient access to the region's two largest hospitals. Several high-SVI census tracts

concentrated in the City's lower-income neighborhoods (Map 3.4) are more likely to include residents in lower-cost housing near flood-prone stream corridors who have less capacity to prepare for or recover from flood events. Continued population growth south of the City is likely to create new impervious surfaces and increasing stormwater runoff into existing drainage systems.

TROPICAL STORM/HURRICANE | Harrisonburg's vulnerability to tropical storms encompasses both the flood risk described above and the cascading effects of high winds. According to the Commonwealth of Virginia's 2023 Hazard Mitigation Plan estimates, Harrisonburg has the third-highest estimated annualized hurricane wind loss in the region ($51,506), reflecting its large population and concentration of structures (Table 4.2.3). JMU's 22,000+ students in dormitories and campus buildings represent a major institutional vulnerability during tropical events that bring simultaneous wind, flooding, and power outages. The City's role as the region's primary healthcare center means a major tropical event would simultaneously increase patient demand and potentially compromise the facilities serving that demand. Furthermore, the City's large non-English-speaking population may face language barriers to emergency alerts and evacuation information during rapidly developing storm events.

HIGH WINDS | Harrisonburg has the highest NRI strong wind risk rating in the sub-area. The City's high impervious surface coverage and density of structures, combined with mature street trees in older residential neighborhoods, create significant downed-tree and power outage risk. The city's vulnerability is further concentrated by two converging trends. James Madison University's large assembly buildings, athletic facilities, and residential halls place thousands of people in structures with significant exposure during tornado or derecho events. At the same time, rapid population growth is steadily increasing the density of both people and structures in wind-exposed areas — meaning each successive event affects more. High wind events also carry secondary hazards that extend their damage well beyond the initial storm. Downed power lines can ignite structures, and in dense urban environments, wind-driven fire poses a cascading risk that emergency services may struggle to contain while simultaneously managing storm response.

WILDFIRE | Harrisonburg has the lowest wildfire vulnerability in the region, with 59% of structures having minimal exposure and only 12% facing direct exposure (Table 4.4.9). One water system facility is in the WUI (Table 4.4.5). The City's primary wildfire concern is as a regional emergency hub: a large wildfire in surrounding communities could create surge demand on City hospitals and shelter resources. JMU may serve as a regional shelter for displaced residents from wildfire-affected communities in surrounding Rockingham County.

DROUGHT | Harrisonburg is primarily served by surface water municipal systems, giving it greater drought resilience than surrounding rural areas. The City's food processing and agricultural supply industries create indirect drought vulnerability through dependence on regional farm production. High-SVI households in the City (Map 3.4) including renters who may have less ability to stockpile water or respond to voluntary water use restrictions - face greater drought-related hardship during periods of mandatory conservation.

SINKHOLES | Harrisonburg has 11 emergency/medical, 31 public service, 11 water system, 5 utility, 16 industrial, 8 major employers, and 90 social centers over carbonate bedrock (Table 4.6.4) – the most extensive critical facility exposure over karst terrain of any single jurisdiction. The City's dense urban

development over karst creates particular risk where water mains and sewer lines can both trigger sinkhole formation and be damaged by it. JMU Amphitheatre Dam is located within the City over carbonate bedrock.

EXTREME TEMPERATURES | Harrisonburg's 44.1% impervious surface coverage (Table 4.1.2) makes its population most susceptible to the Urban Heat Island effect in the region, where urban temperatures can significantly exceed surrounding rural areas during heat waves. The City has the highest average number of extreme heat days (Map 4.7.1). The City's large immigrant community, including outdoor agricultural and processing workers who commute into the City, may face language and access barriers to heat emergency information and cooling resources. Additionally, multiple high-SVI census tracts (Map 3.4) indicate concentrations of low-income residents who may lack air conditioning.

SEVERE WINTER WEATHER | Harrisonburg is identified in the 2023 Commonwealth HMP as one of the top jurisdictions in Virginia for higher winter weather risk. JMU is identified as one of three high-hazard winter weather institutions in the CSPDC region, given its concentration of students in large assembly buildings and residential halls vulnerable to ice-related utility outages. The City's 79 bridges include 11% in Poor condition (Table 4.8.3) – a significant infrastructure risk during ice events. The City's large student and immigrant populations may include residents unfamiliar with winter driving conditions, increasing injury risk during ice storms.

INFECTIOUS DISEASE OUTBREAK | JMU's 22,000+ students in congregate living settings create conditions for rapid disease spread. The City's large immigrant community may face barriers to vaccination and public health information. The City's multiple high-SVI census tracts indicate concentrations of residents with limited healthcare access and recovery capacity. Harrisonburg reported 1 COVID case per 3.9 people. As the region's healthcare hub, the City's hospitals serve the entire region during outbreaks, meaning healthcare infrastructure must be protected for regional benefit.

HAZARDOUS MATERIALS | Harrisonburg has 6 TRI facilities with 2,300 lbs. on-site and 841 lbs. off-site toxic releases in 2022. Its I-81 corridor position creates daily transportation HazMat risk. The City's dense population and role as the regional healthcare hub mean a major HazMat release would simultaneously affect large numbers of people and strain the medical resources needed to treat victims.

CRITICAL INFRASTRUCTURE FAILURE | Harrisonburg has 742 unserved broadband locations (Table 4.11.1) - a meaningful gap given its role as an emergency coordination hub. Newman Lake Dam (High Hazard Potential) is located within the City, with 48 homes, 1 park, and 7 roadways in its inundation zone. The City's population of 45,060 is within 5 miles of HHPDs - the highest of any city in the region. Rapid population growth is increasing demand on water, sewer, and stormwater systems that were not designed for current or projected capacity.

ACTIVE ASSAILANT | Harrisonburg has the highest active assailant vulnerability in the region. JMU's concentration of 22,000+ students in a campus setting, the City's downtown entertainment district, and a 2022 active assailant event causing 8 injuries demonstrate real and present risk. The City has the region's strongest law enforcement response capacity, but the concentration and diversity of soft targets - retail centers, entertainment venues, campus buildings, and places of worship- creates ongoing preparedness challenges. The City's diverse population requires multilingual emergency communications planning.

ROCKINGHAM COUNTY

FLOODING | Rockingham County is the region's most flood-active jurisdiction by historical event count, experiencing multiple documented events annually. The County's 840 square miles encompass the Shenandoah River and major tributaries, with 4.8% of land in the 100-year flood zone. Its 3,120 manufactured homes - the highest count in the region and concentrated in rural floodplain-adjacent areas- represent the largest rural flood-vulnerable housing stock. The County's projected population growth of12.8% by 2040 is creating new development on previously rural land, some of which is adjacent to flood-prone stream corridors.

Twelve repetitive loss and 1 severe repetitive loss structures indicate localized chronic impact. Critical facilities in the 100-year flood zone include 1 emergency/medical, 2 water system, 1 industrial, and 2 historic place facilities. Modeled annual average flood losses are $7.1 million. The Basic Hazus analysis conducted for this plan (Map 4.1.6) estimates that several areas, particularly around major road corridors and western Rockingham, could experience economic losses exceeding $10 million in a 100-year flood event. The County's FIRM data, partly from 2008 and some from 2014, is approaching 20 years old and may not reflect current floodplain conditions.

TROPICAL STORM/HURRICANE | Rockingham County's vulnerability to tropical storms encompasses both the flood risk described above and the cascading effects of high winds. According to the Commonwealth of Virginia's 2023 Hazard Mitigation Plan estimates, Rockingham County has the highest estimated annualized hurricane wind loss in the region at $81,727 (Table 4.2.3). Its extensive poultry industry (dependent on climate-controlled facilities requiring uninterrupted power) is acutely vulnerable to prolonged outages from tropical systems. The County's dense secondary road network, serving dispersed agricultural operations, creates extensive exposure to simultaneous wind and flood impacts.

HIGH WINDS | Rockingham County has the highest historical tornado count in the sub-area. Along with Augusta County, it accounts for most of the region's recorded tornadoes since 1950. The County's 3,120 manufactured homes (Table 3.2) are acutely vulnerable to higher winds. Poultry and dairy operations in large-span metal-roofed structures face direct wind damage and secondary losses from power outages. The County's rapid population growth is increasing the number of residents in areas exposed to wind hazards.

WILDFIRE | Rockingham County has 73% of its structures with direct wildfire exposure (Table 4.4.9) and 25 woodland communities in the WUI (Table 4.4.6). Critical WUI facilities include 6 emergency/medical facilities, 8 public service facility, 1 water system, 2 industrial facilities, 2 historic places, and 1 special populations facility. The County's 19.6 million broiler chickens are vulnerable to air quality impacts from wildfire smoke and to power disruptions from utility line damage in wildfire areas. The County's projected population growth may also lead to more residents in WUI areas.

DROUGHT | Rockingham County's agricultural economy – 22% of Virginia's total agricultural sales – faces acute drought vulnerability through crop losses, forage reduction, livestock water shortages, and cascading impacts on processing and supply chains. With approximately 46,887 residents on private wells (56% of population) (Table 4.5.6), drought-related water table decline threatens a large share of the rural population's primary water source. The County has the highest average number of extreme heat days in the region (27.9 annually), compounding drought conditions.

SINKHOLES | Rockingham County has 9 emergency/medical facilities, 7 public service facilities, 4 water systems, 5 industrial sites, 15 major employers, and 14 historic place facilities over carbonate bedrock (Table 4.6.4). Interstate 81 passes through the County and has experienced multiple sinkhole closures. Lake Shenandoah Dam (High Hazard Potential) is located over carbonate bedrock. The County's 199 documented springs represent both a resource and groundwater contamination vulnerability.

EXTREME TEMPERATURES | Rockingham County has the highest average number of extreme heat days in the region (27.9 annually, maximum 53 in 2022). Its large agricultural workforce faces disproportionate heat exposure. With approximately 87,674 total residents - including 5,238 children under age 5 (6.0% - the highest proportion in the region) and 18,015 adults aged 65 and over - Rockingham County has the largest absolute vulnerable population bases of any jurisdiction (Table 4.9.4). The County's 3,120 manufactured homes, which are less well-insulated than site-built housing, concentrate heat vulnerability in rural areas where cooling centers may not be readily accessible.

SEVERE WINTER WEATHER | Rockingham County is identified in the 2023 Commonwealth HMP as one of the top Virginia jurisdictions for winter weather risk. The County has 523 VDOT-maintained bridges (5% Poor condition) and an extensive secondary road network serving dispersed agricultural operations. Dairy farms face power outage vulnerability that can result in animal welfare emergencies and significant economic losses. Furthermore, heavy snow may lead to roof collapses, particularly for farm structures. The County's rapid population growth is adding residents to rural areas that may have longer VDOT maintenance response times during winter events.

INFECTIOUS DISEASE OUTBREAK | Rockingham County has the region's largest absolute poultry inventory, creating the greatest zoonotic disease risk. An HPAI outbreak affecting 5% of the County's commercial poultry could produce losses exceeding $50 million in total economic impact. In terms of human-risk, the County's 5,238 children under age 5 represent the largest pediatric vulnerable population in the region (Table 4.9.4). The County's large immigrant agricultural workforce may face barriers to public health information and vaccination access during outbreak events.

HAZARDOUS MATERIALS | Rockingham County has 9 TRI facilities with 149,000 lbs. on-site and 152,500 lbs. off-site toxic releases (Table 4.10.1) – the highest off-site volume of any jurisdiction. Its karst terrain and 199 springs (Table 4.6.2) amplify the potential geographic footprint of a surface spill into widespread groundwater contamination. HazMat transportation along the Interstate-81 corridor creates high risk.

CRITICAL INFRASTRUCTURE FAILURE | Rockingham County has 9,313 unserved broadband locations - the highest absolute count in the region (Table 4.11.1). Its 41,129 residents within 5 miles of HHPDs represent the highest county-level count in the region. Multiple HHPDs including Lake Shenandoah Dam (which is over carbonate bedrock) present downstream inundation risk. The County's agricultural economy faces catastrophic losses from utility outages affecting dairy and poultry operations. Rapid population growth is increasing demand on infrastructure systems without commensurate investment in capacity expansion.

ACTIVE ASSAILANT | Rockingham County includes Bridgewater College, the site of the February 2022 active assailant event. The County is also the site of several other school campuses, which are relatively higher-targeted areas for active assailant events. Notably, the County's rural character means law enforcement response times to many locations are longer than in the City of Harrisonburg.

TOWNS OF BRIDGEWATER, BROADWAY, DAYTON, ELKTON, GROTTOES, MOUNT CRAWFORD, AND TIMBERVILLE

These seven towns share a common vulnerability framework shaped by their locations along tributary stream corridors within Rockingham County, their small populations and limited municipal fiscal and staff capacity, and their dependence on County and state resources for emergency response and recovery.

All seven towns gained population between 2013 and 2023, with growth ranging from 3.9% (Mount Crawford) to 20.2% (Timberville), reflecting the broader suburbanization pressure around the Harrisonburg urban core. This growth is adding new residents and structures in communities with limited local hazard mitigation capacity. Each town's median household income data is not available at the town level, but the surrounding County median of $78,468 suggests moderate economic capacity.

The Basic Hazus analysis conducted for this plan (Map 4.1.6) estimates that several of these towns — particularly those with higher proportions of land in the 100-year flood zone, including Elkton (18.1%), Grottoes (18.9%), and Bridgewater (11.9%) — could experience economic losses exceeding $10 million in a 100-year flood event. These figures are significant for communities with small tax bases and limited independent recovery capacity.

Bridgewater (11.9% in 100-year flood zone; 43.7% in levee-protected area; population 6,765 in 2023) faces compound flood vulnerability: significant riverine exposure and a levee-dependent protected area whose residents may have a false sense of security regarding residual risk. The 2022 Bridgewater College active assailant event - 2 law enforcement officers killed - elevated this town's profile for that threat. Bridgewater is identified as a higher winter weather risk jurisdiction in the Commonwealth HMP. Its population growth of 16.3% since 2013 is the second-highest among towns in the sub-area, adding new residents to a community with limited municipal resources.

Grottoes (18.9% in 100-year zone; 32.9% in 500-year zone - highest in the region; population 2,996 in 2023) has the highest proportional 500-year flood zone coverage of any jurisdiction in the region. Three utility facilities and 10 social centers are in WUI areas. Its position at the base of the Massanutten Mountain range creates both flood and wildfire exposure.

Elkton (18.1% in 100-year zone; population 3,036 in 2023) has the second-highest proportional flood zone coverage among County towns. Three emergency/medical,3 public service, 2 water system, 1 industrial, and 12 social center facilities are in WUI areas - significant WUI exposure for a small community. One water system facility is in the 100-year flood zone.

Broadway, Dayton, Mount Crawford, and Timberville each face moderate flood, wind, and winter weather risk consistent with their Valley locations. Dayton has 2 water system facilities in the 100-year flood zone – a specific vulnerability for a small community. All towns face sinkhole risk from karst terrain. Their small tax bases and limited staff capacity mean that any significant hazard event will likely require County or state assistance for effective response and recovery.

STAUNTON-AUGUSTA-WAYNESBORO SUBAREA

The Staunton-Augusta-Waynesboro sub-area encompasses Augusta County, the Cities of Staunton and Waynesboro, and the Town of Craigsville. With a combined 2023 population of approximately 126,233, this is the second-largest sub-area and occupies the geographic center of the planning district along the 1-81/1-64 corridor.

Augusta County grew by 4.8% between 2013 and 2023 and is projected to grow by 8.7% by 2040 - the highest projected growth rate among the region's counties. The Cities of Staunton (+4.7%) and Waynesboro (+6.2%) also grew modestly over the same decade. This growth is creating new development that expands impervious surface coverage and increases flood exposure in previously undeveloped areas.

Augusta County is Virginia's second most productive agricultural county (8% of Commonwealth agricultural sales). The sub-area is home to three high-hazard institutional facilities identified in the 2023 Commonwealth Hazard Mitigation Plan: Western State Hospital (Staunton), the Woodrow Wilson Rehabilitation Center (Augusta County), and Augusta Health (255 beds, 18 ICU). The City of Waynesboro is home to the largest natural resource damage settlement in Virginia history – the former DuPont/Invista mercury contamination of the South River – creating ongoing compound HazMat and flood vulnerability. The sub-area's dam inventory, concentrated in the South River watershed, includes the highest number of High Hazard Potential Dams in the region.

Augusta County contains the region's greatest concentration of National Register historic properties (60 properties, 3 National Historic Landmarks: Grand Caverns, Skyline Drive, and the Blue Ridge Parkway). The City of Staunton has 36 National Register properties and 1 National Historic Landmark – Woodrow Wilson's Birthplace. The loss of these resources to any hazard would represent a cultural loss of statewide and national significance.

Several census tracts in Staunton show high Social Vulnerability Index scores (0.50-0.75), indicating concentrations of socially vulnerable residents who face greater barriers to preparedness and recovery. Median household incomes in the sub-area range from $54,458 (Buena Vista) to $79,972 (Augusta County), with both Staunton ($62,586) and Waynesboro ($56,364) below the County median – reflecting urban concentrations of lower-income renters and working families in the cities.

AUGUSTA COUNTY

FLOODING | Augusta County carries the highest modeled annual average flood loss in the region at $11.0 million. The Basic Hazus analysis conducted for this plan (Map 4.1.7) estimates that the County could experience economic losses exceeding $10 million in a 100-year flood event in several areas. Its12 repetitive loss and 1 severe repetitive loss structures indicate significant patterns of chronic flood damage. Critical facilities in the 100-year flood zone include 2 emergency/medical facilities,1 public service facility, 7 water system facilities, 4 utility facilities, 6 industrial facilities, as well as 5 historic places and 6 social centers

(Table 4.1.7). The agricultural sector faces crop, livestock, and infrastructure losses during major flood events. The County's 2,946 manufactured homes – including many in rural floodplain-adjacent locations – represent an acutely vulnerable housing stock. Projected population growth of 8.7% by 2040 is creating new development that may increase impervious surfaces and alter floodplain dynamics.

TROPICAL STORM/HURRICANE | Augusta County's vulnerability to tropical storms encompasses both the flood risk described above and the cascading effects of high winds. According to the Commonwealth of Virginia's 2023 Hazard Mitigation Plan estimates, the county has the highest estimated annualized hurricane wind loss among the region's counties at $77,929 (Table 4.2.3). Its agricultural infrastructure – poultry houses, grain storage, dairy barns – is vulnerable to wind and flood damage. Hurricane Juan (1985) caused $8 million in road damage in the County alone, along with $7 million in additional property damage, illustrating the magnitude of potential impacts. The County's 60 National Register properties – including the Grand Caverns NHL, portions of Skyline Drive, and the Blue Ridge Parkway – face irreplaceable loss risk from tropical system wind and flood damage.

HIGH WINDS | Augusta County has the highest NRI strong wind risk rating in the sub-area and has recorded more tornadoes than any other jurisdiction since 1950. The May 1990 F2 tornado caused 2 fatalities, 10 injuries, and $2.5 million in damage; the April 2016 EF0 caused $2.2 million in property damage – demonstrating that even weaker tornadoes produce significant losses in this large, developed county. The County's 2,946 manufactured homes (Table 3.2) are acutely vulnerable to tornado winds.

WILDFIRE | Augusta County has the highest wildfire incident count in the region (122 incidents since 2014) and 43 woodland communities in the WUI (Table 4.4.6). With 78% of structures facing direct wildfire exposure (Table 4.4.9) and the most extensive critical facility WUI exposure in the region (7 emergency/medical, 8 public service, 31 water system, 26 utility, 20 industrial, 38 social centers, 2 special populations facilities) (Table 4.4.5), the County's distributed rural landscape creates broad and persistent wildfire risk. The Big Levels Fire in December 2024 burned approximately 1,300 acres near Greenville, demonstrating the area's ongoing exposure. Projected population growth of 8.7% by 2040 will place more residents in WUI areas. Shenandoah National Park, as well as 60 National Register properties, represent irreplaceable cultural and natural assets in wildfire-prone terrain.

DROUGHT | Augusta County's 40,359 residents on private wells (Table 4.5.6), dominant agricultural economy, and karst terrain collectively create severe drought vulnerability. The County received primary natural disaster designations in 2023 and 2024 due to agricultural drought events. Its 224 springs (Table 4.6.2) are vulnerable to flow reduction during drought. The County's declining farm count (part of a statewide trend from 43,225 to 38,995 farms between 2017 and 2022) reflects drought-driven economic pressure that is weakening agricultural resilience over time.

SINKHOLES | Augusta County has the highest critical facility concentration over carbonate bedrock in the region: 20 emergency/medical facilities,52 public service facilities, 37 water system facilities, 64 utility facilities, 53 industrial facilities, and 10 major employer facilities (Table 4.6.4). Multiple documented sinkhole events demonstrate ongoing ground failure risk. With 60 mines and the highest spring count in the region, Augusta County has extensive groundwater resources acutely vulnerable to karst contamination. Increased development over carbonate bedrock associated with projected population growth will add to the inventory of assets at risk.

EXTREME TEMPERATURES | Augusta County has the largest absolute number of elderly residents in the region (18,836 individuals aged 65 and over). Its dispersed rural settlement pattern and 52.1% private well dependency create challenges for reaching vulnerable residents during temperature extremes. The Woodrow Wilson Rehabilitation Center – a population with physical disabilities dependent on continuous climate control and medical services – requires specific attention during both heat and cold extremes. The County's chronic disease rates – near or above state averages for diabetes, heart disease, and COPD – amplify the health consequences of temperature extremes for a large share of the population.

SEVERE WINTER WEATHER | Augusta County is identified in the 2023 Commonwealth Hazard Mitigation Plan as one of the Virginia's top jurisdictions for winter weather risk. The County has the highest number of VDOT-maintained bridges in the region (728), with 72% in Fair condition and 3% in Poor condition (Table 4.8.3). The Woodrow Wilson Rehabilitation Center – a high-hazard winter weather institution per the Commonwealth Hazard Mitigation – requires uninterrupted staff access and power for medical systems and climate control during winter events.

INFECTIOUS DISEASE OUTBREAK | Augusta County's 18,836 elderly residents, large poultry presence, high chronic disease prevalence, and dispersed rural population create compounding infectious disease vulnerability. The County reported 1 COVID case per 4.1 people (Table 4.9.2). As Virginia's second-largest agricultural producer, Augusta County is the region's most economically exposed jurisdiction to zoonotic disease outbreaks affecting livestock and poultry.

HAZARDOUS MATERIALS | Augusta County has 11 TRI facilities – the highest count in the region – with 63,300 lbs. on-site and 35,900 lbs. off-site toxic releases. Its I-81 transportation corridor exposure, 60 mines, karst terrain, and extensive agricultural chemical use create multiple fixed, mobile, and diffuse HazMat release pathways. The County's 40,359 private well users (Table 4.5.6) are highly vulnerable to groundwater contamination given karst connectivity.

CRITICAL INFRASTRUCTURE FAILURE | Augusta County has 6,139 unserved broadband locations (Table 4.11.1). Its South River watershed HHPDs – including South River Dams #23 and #26, each with inundation zones covering 875 homes, 193 businesses, 1 school, and multiple utility and railroad assets – represent the most consequential potential dam failure scenarios in the region. With 29,628 residents within 5 miles of HHPDs, a major dam failure would be a region-defining catastrophe. Projected population growth increases both the asset base at risk and the demand on aging infrastructure.

ACTIVE ASSAILANT | Augusta County's primary vulnerability is shaped by its rural geography, which produces long law enforcement response times and long transport times to trauma care. Agricultural fairs, outdoor recreation events, and rural soft targets represent environments in a large county with limited law enforcement coverage.

CITY OF STAUNTON

FLOODING | 3.8% of Staunton's land area is in the 100-year flood zone, with 1 emergency/medical facility, 3 utility facilities, 1 transportation facility, and 1 social center at risk (Table 4.1.7). The Basic Hazus analysis conducted for this plan (Map 4.1.7) estimates that the City could experience economic losses exceeding

$10 million in a 100-year flood event in several areas, particularly in the southwest part of the City. The City's downtown historic district – including Woodrow Wilson's Birthplace NHL and 36 National Register properties – contains irreplaceable assets vulnerable to flash flooding from tributary stream corridors. Modeled annual average flood losses of $2.1 million reflect meaningful economic exposure (Table 4.1.4). Census tracts with a high social vulnerability index indicate concentrations of lower-income renters who face greater barriers to flood preparedness and recovery.

TROPICAL STORM/HURRICANE | Staunton's vulnerability to tropical storms encompasses both the flood risk described above and the cascading effects of high winds. According to the Commonwealth of Virginia's 2023 Hazard Mitigation Plan estimates, the City has an estimated annualized hurricane wind loss of $30,691 (Table 4.2.3). The asset at highest risk to tropical storm winds is the City's utility infrastructure.

HIGH WINDS | Staunton's high wind vulnerability is shaped primarily by its urban tree canopy and aging utility infrastructure. The City's mature street trees in historic residential neighborhoods and downtown corridors create significant downed-tree risk during derecho and severe thunderstorm events, with cascading impacts on power lines and road access. According to FEMA's National Risk Index, Augusta County and the surrounding area carry a relatively elevated strong wind risk rating compared to the rest of the sub-area (Map 4.3.6). The City has 22 VDOT-maintained bridges, none of which are in Poor condition, but the concentration of overhead utility lines in older neighborhoods increases the likelihood of extended outages following wind events.

WILDFIRE | Staunton's wildfire vulnerability is relatively low compared to surrounding rural areas. With 37% of its structures having minimal exposure and 22% facing direct exposure (Table 4.4.9), the City sits primarily outside the most hazardous WUI zones. Three utility facilities are located in WUI areas (Table 4.4.5), which, if damaged by wildfire or wildfire-related power disruptions, could affect municipal services. The City's primary wildfire vulnerability is indirect: smoke from wildfires in the surrounding Augusta County landscape — which has the highest wildfire incident count in the region — can affect air quality and pose health risks for residents with respiratory conditions.

DROUGHT | Staunton is served by a municipal water system with surface water sources, providing greater drought resilience than surrounding rural areas. However, if source reservoirs experience sustained drawdown during multi-year droughts, the City could face supply constraints and mandatory water use restrictions that affect residents, businesses, and institutional users. Western State Hospital and Augusta Health each require uninterrupted water supply for medical operations, making water system drought resilience a direct life-safety issue. High-SVI census tracts in the City indicate concentrations of lower-income residents who may face disproportionate hardship under water use restrictions due to limited capacity to stockpile water or modify water-intensive routines.

SINKHOLES | Staunton has 5 emergency/medical facilities,12 public service facilities, 2 water system facilities, 32 utility facilities, 10 industrial facilities, 1 major employer facility, 24 historic places, and 31 social centers over carbonate bedrock (Table 4.6.4). An event in January 2016 in which a sinkhole swallowed a car and condemned a house following water main failures during a snowstorm demonstrates active karst risk to the City's urban infrastructure. The City's 24 historic places over carbonate bedrock represent nationally significant cultural assets vulnerable to ground failure.

EXTREME TEMPERATURES | Staunton is identified in the 2023 Commonwealth Hazard Mitigation Plan as a higher winter weather risk jurisdiction and is home to Western State Hospital – one of three high-hazard winter weather institutions in the CSPDC region. Western State's population of psychiatric patients who cannot self-evacuate requires uninterrupted heating, medical systems, and care staff access. Augusta Health must maintain continuous operations during winter and heat events while simultaneously managing increased patient demand. Several census tracts with high Social Vulnerability Index scores indicate concentrations of lower-income residents who may lack reliable cooling or heating, increasing vulnerability during temperature extremes.

SEVERE WINTER WEATHER | Staunton is identified in the 2023 commonwealth hazard mitigation plan as one of the top jurisdictions in Virginia for winter weather risk. Western state hospital — one of three high-hazard winter weather institutions identified in the Commonwealth HMP — houses a population of psychiatric patients who cannot self-evacuate, requiring uninterrupted heating, medical systems, and care staff access during winter events. Augusta health must maintain continuous operations while simultaneously managing increased patient demand from weather-related injuries across the region. The city averages 10–20 inches of snowfall annually (Map 4.8.1), and its lower valley elevation makes it particularly susceptible to ice storm events where temperatures hover near the freezing mark, creating freezing rain rather than snow. Ice accumulation on the city's historic streetscapes, sidewalks, and utility infrastructure poses direct injury risk and service disruption.

INFECTIOUS DISEASE | Staunton's infectious disease vulnerability is shaped primarily by the presence of Western State Hospital and Augusta Health. Western State houses a population of psychiatric patients with limited immune function, chronic health conditions, and inability to self-isolate — making it a high-priority setting for outbreak prevention and control. Augusta Health (255 beds, 18 ICU) serves as the region's largest hospital and must maintain surge capacity during disease events that simultaneously affect patients across multiple jurisdictions. The City reported 1 COVID case per 4.7 people during the pandemic (Table 4.9.2), a moderate rate consistent with its role as a regional service center with daily commuter and patient populations. Several high-SVI census tracts indicate concentrations of lower-income residents who may face barriers to vaccination, telehealth, and healthcare access during outbreaks.

HAZARDOUS MATERIALS | Staunton has 1 tri facility with minimal on-site and no off-site releases in 2022 (table 4.10.1), reflecting a relatively low fixed-facility hazmat risk. The city's primary hazmat vulnerability is from I-81 and I-64 transportation corridor traffic, which carries hazardous materials through or adjacent to the city daily. A transportation incident on either corridor near Staunton could affect densely populated areas and create demand on Augusta Health for treatment of affected individuals. The city's karst terrain — with 32 utility facilities over carbonate bedrock — also creates risk that a surface spill could rapidly enter the groundwater system through karst pathways.

CRITICAL INFRASTRUCTURE FAILURE | Staunton's vulnerability across these hazards is primarily shaped by the presence of Western State Hospital and Augusta Health, both of which house or serve populations with severe health vulnerabilities requiring continuous power, climate control, water supply, and staff access. The City has 1 TRI facility (minimal releases) and 84 unserved broadband locations (Table 4.11.1). The City's median household income of $62,586 - below the County average – reflects an urban population with more limited individual recovery capacity than surrounding suburban areas.

ACTIVE ASSAILANT | Staunton's active assailant vulnerability is moderate, shaped by the presence of Mary Baldwin University (MBU), downtown commercial and entertainment areas, and public event venues. MBU enrolls approximately 1,800 students across its Staunton and Fishersville campuses, including a residential campus on 58 acres overlooking downtown Staunton.

CITY OF WAYNESBORO

FLOODING | Waynesboro has one of the most acute flood vulnerability profiles in the region. Its 39 repetitive loss and 12 severe repetitive loss structures are the highest counts in the CSPDC region, demonstrating a persistent and unresolved pattern of flood damage. The South River rises regularly during storm events – reaching 12.4 feet during Hurricane Helene (October 2024) – and has historically inundated downtown under 5 feet of water during Hurricane Agnes (1972). Critical facilities in the 100-year flood zone include 1 emergency/medical facility, 2 water system facilities, 4 utility facilities, 2 industrial facilities, and 2 major employer facilities (Table 4.1.7).

The Basic Hazus analysis conducted for this plan (Map 4.1.7) estimates that several areas of the City — particularly along the South River corridor — could experience economic losses exceeding $10 million in a 100-year flood event. Every major flood event mobilizes mercury-contaminated sediments from the former DuPont facility, creating concurrent HazMat and flood emergency conditions unique to this jurisdiction. The City's median household income of $56,364 – the lowest of any city in the region – indicate that the population most exposed to South River flooding has the least capacity to prepare and recover. The City's 60 manufactured homes in flood-prone areas compound this vulnerability.

TROPICAL STORM/HURRICANE | Waynesboro's South River location makes it vulnerable to tropical system flooding. The City’s vulnerability to tropical storms encompasses both the flood risk described above and the cascading effects of high winds. Hurricane Agnes (1972) submerged downtown under 5 feet of water; Hurricane Helene (2024) raised the South River nearly 3 feet above flood stage. Each major tropical flood event carries the additional consequence of mercury sediment mobilization from the former DuPont site.

HIGH WINDS | Waynesboro's high wind vulnerability is consistent with the broader sub-area profile: mature street trees in residential neighborhoods and overhead utility infrastructure create downed-tree and power outage risk during derechos and severe thunderstorm events. The City has 50 VDOT-maintained bridges, 8% of which are in Poor condition (Table 4.8.3) — bridges that are particularly susceptible to ice accumulation and structural stress during wind and winter events. Wind-driven flood events along the South River corridor, where the City's 39 repetitive loss structures are concentrated, can compound the damage from high winds with simultaneous flooding and mercury sediment mobilization.

WILDFIRE | Waynesboro has 28% of its structures with minimal wildfire exposure, 55% with indirect exposure, and 17% with direct exposure (Table 4.4.9), reflecting its position at the base of the Blue Ridge Mountains. Two emergency/medical facilities, 13 public service facilities, 5 water system facilities, 16 utility facilities, 7 industrial facilities, 2 major employers, 27 social centers, and 3 special populations facilities are located in WUI areas (Table 4.4.5) — a notably high WUI critical facility concentration for an urban jurisdiction. Smoke from wildfires in the adjacent Blue Ridge terrain and George Washington National Forest

can affect air quality across the City, posing health risks for residents with respiratory conditions. The City's South River corridor, already affected by mercury contamination, could face additional water quality degradation from wildfire ash and debris entering the watershed.

DROUGHT | Waynesboro is served by municipal water infrastructure with South River surface water sources. During drought events, reduced South River flows create supply constraints that the City must manage against sustained residential and commercial demand. The South River's mercury contamination advisory adds complexity to drought management: lower flows concentrate contaminants and reduce the dilution that limits mercury concentrations in the water column, potentially affecting downstream recreational and ecological resources further. High-SVI census tracts and the City's low median household income ($56,364) indicate that mandatory water use restrictions during drought would fall disproportionately on residents least able to adapt.

SINKHOLES | Waynesboro has 9 public service facilities, 2 water system facilities, 18 utility facilities, 8 industrial facilities, 1 major employer, 2 historic places, and 29 social centers over carbonate bedrock (Table 4.6.4). The South River corridor in Waynesboro, already affected by mercury contamination from the former DuPont facility, passes through karst terrain where sinkhole activity could further disrupt contaminated sediments and accelerate groundwater contamination pathways — creating a compound HazMat and karst risk unique to this jurisdiction. The February 2025 sinkhole near Hopeman Parkway, which caused multiple days of traffic detour impacts, demonstrates that karst activity in Waynesboro is ongoing and actively affecting its urban infrastructure.

EXTREME TEMPERATURES | Waynesboro's 28.0% impervious surface coverage contributes to Urban Heat Island conditions, where urban temperatures exceed surrounding rural areas during heat events. The City has 3,998 residents aged 65 and over (17.7% of the population) (Table 4.9.4) — a significant elderly cohort that is particularly vulnerable to heat illness and hypothermia. High-SVI census tracts and the City's lowest-in-region median household income ($56,364) indicate that concentrations of lower-income residents may lack reliable air conditioning or heating, increasing vulnerability at both ends of the temperature spectrum. The City's 60 manufactured homes are less well-insulated than site-built housing, concentrating temperature vulnerability in the most economically exposed households.

SEVERE WINTER WEATHER | Waynesboro averages 10–20 inches of snowfall annually and, like Staunton, faces elevated ice storm risk given its lower valley elevation where freezing rain is more likely than snow during transitional weather events (Map 4.8.3). The City has 50 VDOT-maintained bridges, 8% of which are in Poor condition — bridges that face heightened risk of closure under heavy ice loads (Table 4.8.3). The South River bridges are particularly critical to connectivity across the City, and their closure during a winter event would impair access to emergency services for residents on either bank. The City's 60 manufactured homes are vulnerable to roof collapse under heavy snow loads.

INFECTIOUS DISEASE OUTBREAK | Waynesboro reported 1 COVID case per 4.3 people during the pandemic (Table 4.9.2), a relatively high rate that reflects the City's role as a regional commercial center with significant daily worker populations in manufacturing and retail. The City's 3,998 elderly residents and its high-SVI census tracts indicate concentrations of residents who face elevated disease severity risk and barriers to healthcare access. The City's low median household income ($56,364) and renter-heavy housing

market mean that residents most at risk from infectious disease may also have the least flexibility to isolate, take time off work, or seek medical care proactively.

HAZARDOUS MATERIALS | Waynesboro's primary HazMat vulnerability is the ongoing South River mercury contamination. Mercury continues to be transported downstream through surface water, sediments, and floodplain soils. The $42 million natural resource damage settlement funds ongoing restoration, but remediation is not yet complete. The South River's ongoing advisory status depresses recreational use of the river corridor and affects Waynesboro's tourism economy and quality of life for residents.

CRITICAL INFRASTRUCTURE FAILURE | All of Waynesboro's approximately 22,651 residents live within 5 miles of High Hazard Potential Dams in the South River watershed. The City has only 4 unserved broadband locations – near-universal coverage, supporting communication resilience. The City has 50 VDOT-maintained bridges, 8% of which are in Poor condition.

ACTIVE ASSAILANT | Waynesboro's active assailant vulnerability is moderate, shaped by its downtown commercial corridor, retail centers, and manufacturing facilities that generate concentrations of workers and shoppers. The City's median household income — the lowest of any city in the region — and its high-SVI census tracts indicate populations that may face barriers to preparedness and security awareness. The City's law enforcement capacity is modest relative to larger jurisdictions, and its position at the I-64/I-81 interchange means that the City may need to coordinate responses to incidents occurring on or near the interstate corridor in addition to those within its boundaries.

TOWN OF CRAIGSVILLE

Craigsville is a small Augusta County town with approximately 910 residents (-1.2% since 2013). Identified as an EDRC under FEMA Region 3 mapping, 7.8% of its land in the 100-year flood zone. Critical assets in the flood zone include 1 public service facility and 5 social centers – a significant proportion of the Town's service infrastructure for its small population. The Basic Hazus analysis conducted for this plan (Map 4.1.7) estimates that portions of Craigsville could experience economic losses in a 100-year flood event, though the Town's small geographic extent limits the total modeled loss relative to larger jurisdictions.

One water system and 1 industrial facility are in WUI areas, along with 11 social centers – demonstrating both flood and wildfire exposure. The Town's slight population decline and EDRC designation reflect limited economic capacity. With minimal local fiscal and staff capacity, Craigsville's vulnerability across all hazards is heavily dependent on Augusta County and state resources for emergency response and recovery.

LEXINGTON-ROCKBRIDGE-BUENA VISTA SUBAREA

The Lexington-Rockbridge-Buena Vista sub-area encompasses Rockbridge County and the Cities of Lexington and Buena Vista, along with the towns of Glasgow and Goshen. With a combined 2023 population of approximately 35,985, this sub-area encompasses significant institutional, historic, and ecological assets that extend its regional and statewide significance well beyond its population size.

Population trends in this sub-area are mixed. Rockbridge County grew only 0.7% between 2013 and 2023 - and is projected to grow only 3.4% more by 2040. The City of Lexington grew 1.7%, while the City of Buena Vista declined 2.7%. The Town of Glasgow lost 6.3% of its population and the Town of Goshen 9.7%- the steepest town-level declines in the region. These trends indicate communities with limited growth capacity and, in some cases, declining tax bases that constrain mitigation investment.

A high proportion of the sub-area's population is over the age of 60 (28%). Rockbridge County has the second-highest proportion of well-dependent residents in the region (78.6%), making it highly sensitive to drought and power outages.

The sub-area's most consequential hazard exposure is flooding. The Maury River – a tributary of the James River formed by the confluence of the Cowpasture and Calfpasture Rivers – runs through all three Cities/Counties and has produced some of the most catastrophic flood events in the region's history. Hurricane Camille (1969) killed 23 people in Rockbridge County, submerged Glasgow under 14 feet of water, and inundated Buena Vista under 6 feet. The sub-area's FIRM data, effective from 2000, is the oldest in the region, significantly limiting the precision of flood risk assessments across the entire sub-area.

Culturally, the sub-area is of remarkable significance. Lexington is home to Virginia Military Institute (VMI) and Washington and Lee University, both nationally recognized institutions with historic campuses. Rockbridge County has 52 National Register properties and 3 National Historic Landmarks: Cyrus McCormick Farm and Workshop, Rich Hole, and Natural Bridge. The City of Lexington has 18 National Register properties and 4 National Historic Landmarks associated with VMI and Washington and Lee. Natural Bridge State Park – a nationally recognized landmark – attracts visitors from around the world and is a significant economic asset for the sub-area. Several communities in this sub-area – including the City of Buena Vista, the Town of Glasgow, and portions of Rockbridge County – are identified as economically disadvantaged or potentially disadvantaged under FEMA's Region 3 mapping (Map 3.5).

The Maury Service Authority (MSA) provides water and wastewater services to approximately 8,000 customers across roughly 50 square miles in Rockbridge County and Lexington. The Authority's treatment facilities, distribution systems, and wastewater infrastructure are critical lifeline systems for the sub-area and are discussed further in the Special Districts section below.

ROCKBRIDGE COUNTY

FLOODING | Rockbridge County carries the second-highest modeled annual average flood loss in the region. The Basic Hazus analysis conducted for this plan (Map 4.1.8) estimates the potential losses at $10.0 million. Its 14 repetitive loss and 7 severe repetitive loss structures indicate chronic flood damage. With 1,183 manufactured homes, a large portion of the rural housing stock is acutely vulnerable. The area's critical facilities are also at risk as two emergency/medical facilities, one public service facility, one water system, one utility, three historic sites, and two social centers are located within the 100-year flood zone. Natural Bridge NHL and 52 National Register properties along the Maury River corridor represent irreplaceable cultural assets whose flood risk is inadequately characterized by this outdated data.

TROPICAL STORM/HURRICANE | The Maury River corridor has produced the region's most catastrophic tropical flood events. Hurricane Camille (1969) killed 23 people in the County – the deadliest disaster event in the region's recorded history – and inundated Glasgow under 14 feet of water. The County's estimated annualized hurricane wind loss of $26,044 substantially understates the potential for catastrophic loss given this historical record.

HIGH WINDS | Rockbridge County's high wind vulnerability is shaped by its topographic position between the Blue Ridge Mountains to the east and the Allegheny Highlands to the west, a configuration that can channel and amplify localized wind speeds through the Maury River valley during derecho and severe thunderstorm events. According to FEMA's NRI risk rating, Rockbridge County has a relatively elevated strong wind risk rating (Map 4.3.6). The 2012 derecho caused $16.81 per capita in public assistance costs in Rockbridge County (Table 4.3.3) — one of the higher per-capita impacts in the region — demonstrating meaningful wind exposure. The County has 680 VDOT-maintained bridges, 4% of which are in Poor condition (Table 4.8.3), representing critical infrastructure that can be blocked by downed trees or damaged by wind loads during major events. The County's extensive secondary road network, lined with mature trees over many rural routes, creates significant downed-tree and access impediment risk during high wind events.

WILDFIRE | Rockbridge County has the most severe wildfire damage record in the region: 5,072 acres burned and $2,426,150 in timber damages since 2014. The 2023 Matts Creek Fire (11,000 acres – the largest recent fire in the region) demonstrates active exposure. Ninety-one percent of structures face direct wildfire exposure. Natural Bridge NHL and 52 National Register properties represent irreplaceable cultural and natural assets at wildfire risk.

DROUGHT | Rockbridge County's 78.6% groundwater dependency (approximately 17,618 residents on private wells) creates the second most severe drought-related water supply vulnerability in the region. The County was designated a primary disaster area in the 2019, 2023, and 2024 agricultural drought events. Its declining farm count and stable-to-declining population reflect an agricultural community under economic stress from repeated drought impacts.

SINKHOLES | Rockbridge County has 9 emergency/medical facilities,13 public service facilities, 9 water system facilities, 2 utility facilities, 6 industrial facility, 1 major employer, 17 historic places, and 28 social centers located over carbonate bedrock. A recent sinkhole near the Moores Creek Dam demonstrates how active karst topography threatens the area's critical infrastructure. With 23 mines, the County has the third-highest mine count in the region, adding to karst instability risk.

EXTREME TEMPERATURES | Rockbridge County's 26.8% elderly population (6,048 individuals aged 65 and over) (table 4.9.4) and 78.6% private well dependency collectively create significant temperature vulnerability. Power outages that accompany extreme temperature events disable electric well pumps, simultaneously leaving rural residents without water and without the means to heat or cool their homes. The county's rural settlement pattern and sparse road network slow emergency response to residents in distress, and bath community hospital's limited capacity means that temperature-related medical emergencies in Rockbridge County may require transport to facilities in Lexington or beyond. The sub-area has the highest proportion of population over age 60 (28%) of any sub-area in the region (chart 3.2), and Rockbridge County's elderly rural population is particularly isolated during temperature extremes.

SEVERE WINTER WEATHER | Rockbridge County averages 10–20 inches of snowfall annually in valley areas, with higher accumulations at elevation (Map 4.8.1). Its 680 VDOT-maintained bridges — the second-highest count in the region — include 4% in poor condition, representing critical infrastructure vulnerable to ice accumulation and freeze-thaw damage (table 4.8.3). The Lexington-Rockbridge sub-area's lower valley elevations are particularly prone to ice storm conditions, where temperatures near the freezing mark produce freezing rain rather than snow (map 4.8.3). Ice accumulation along the Maury River corridor — including on historic structures at VMI and Washington and Lee University, orchard and vineyard operations, and rural roads — creates both safety hazards and economic losses. The county's 78.6% private well dependency means that power outages accompanying winter events also eliminate water supply for most rural residents.

INFECTIOUS DISEASE | Rockbridge County's 26.8% elderly population, 78.6% private well dependency, and rural character create significant vulnerability across these hazards. The County is identified in the 2023 Commonwealth Hazard Mitigation Plan as a top jurisdiction for winter weather risk. The 7,843 unserved broadband locations (2.9 people per location) represent meaningful communication gaps that affect emergency alerting, telehealth, and response coordination for its elderly rural population.

HAZARDOUS MATERIALS | Rockbridge County has 5 TRI facilities with 6,900 lbs. on-site releases. Its primary HazMat risk is from the CSX rail corridor, the 1-64 transportation corridor, and karst groundwater contamination pathways. The Maury River – a significant recreational and ecological resource and a key economic driver for Natural Bridge State Park and regional tourism – would be acutely vulnerable to contamination from a rail or road spill.

CRITICAL INFRASTRUCTURE FAILURE | Rockbridge County contains multiple High Hazard Potential Dams with significant downstream exposure. Goshen Dam has 752 homes, 86 businesses, 12 infrastructure items, and 1 railroad in its inundation zone. Robertson Dam has 68 homes, 1 school, and 13 roadways in its inundation zone. The County's EDRC-adjacent designation reflects limited fiscal capacity to address these compounding infrastructure vulnerabilities.

ACTIVE ASSAILANT | Rockbridge County's active assailant vulnerability is shaped primarily by the presence of VMI and Washington and Lee University in the City of Lexington, Natural Bridge State Park (a major public attraction drawing visitors from across the nation), and the Virginia Horse Center (a large public event venue near Lexington). Rural areas of the County face elevated consequence vulnerability due to long law enforcement response times and long transport distances to Carilion Stonewall Jackson Hospital (25 beds, no ICU) or higher-level trauma facilities in Roanoke or Charlottesville. Large outdoor events — including

equestrian competitions, agricultural fairs, and public celebrations — represent soft target environments in a County with limited law enforcement coverage relative to its geographic extent.

CITY OF BUENA VISTA

FLOODING | Buena Vista has one of the most severe flood vulnerability profiles of any jurisdiction in the region. Its location at the confluence of the Maury River and the James River has produced catastrophic flooding. Most notably, Hurricane Camille inundated the City under 6 feet of water (1969) and Hurricane Agnes caused similar impacts (1972). Its 30 repetitive loss and 3 severe repetitive loss structures indicate persistent flood damage. The Basic Hazus analysis conducted for this plan (Map 4.1.8) estimates that several areas of the City — particularly along the Maury River corridor — could experience economic losses exceeding $10 million in a 100-year flood event.

Critical facilities in the 500-year flood zone include 2 emergency/medical, 2 public service, 2 water system, 4 industrial, 1 major employer, 2 historic places, and 5 social centers – suggesting that a major flood event would simultaneously disrupt emergency services, water supply, and multiple community facilities. With a modeled annual average flood loss of $4.3 million for a City of only 6,523 people, Buena Vista's per-capita flood loss exposure is among the highest in the region. The City's low median household income ($54,458) and declining population indicate that the community is particularly vulnerable to the area's flooding threat. The City's 133 manufactured homes in or near the floodplain compound this vulnerability.

TROPICAL STORM/HURRICANE | Buena Vista's location on the Maury River makes it among the most vulnerable jurisdictions to tropical system flooding. The historical record — 6-foot inundation during both Camille and Agnes — demonstrates that extreme rainfall from decaying tropical systems can produce devastating results at this location. Beyond flooding, the Commonwealth of Virginia's 2023 Hazard Mitigation Plan estimates $7,352 in annualized wind loss for Buena Vista based on a Hazus hurricane wind analysis (Table 4.2.3).

HIGH WINDS | Buena Vista's high wind vulnerability is consistent with the broader sub-area profile. The City's 17 VDOT-maintained bridges, none of which are in Poor condition (Table 4.8.3), represent critical crossings over the Maury River that could be blocked or damaged during high wind events. Mature trees along the City's residential streets and river corridor create downed-tree and power outage risk during derechos and severe thunderstorm events. The City's modest law enforcement capacity means that coordinating wind emergency response — including road clearance and utility restoration — requires County and state assistance even for moderate events. The Virginia Horse Center, a major regional event venue on the outskirts of the City, represents an outdoor venue where wind events during public gatherings could create mass casualty conditions.

WILDFIRE | Buena Vista has less than 1% of its structures with minimal exposure, 85% with indirect wildfire exposure, and 15% with direct exposure (table 4.4.9), reflecting its position at the base of forested mountain terrain. The city has 2 emergency/medical facilities, 5 public service facilities, 2 water system facilities, 5 industrial facilities, 1 major employer, 4 historic places, and 15 social centers in WUI areas (table 4.4.5) — a disproportionately high WUI critical facility concentration for a city of just over 6,500 people.

DROUGHT | Buena Vista is served by a municipal water system, providing greater drought resilience than surrounding rural areas. However, the Maury River — the City's source water corridor — is subject to reduced flows during drought events, which can constrain supply and concentrate existing pollutants. The City's low median household income and high-SVI census tracts indicate that mandatory water use restrictions during drought would fall disproportionately on residents least able to adapt. The Virginia Horse Center's water requirements for livestock operations create additional demand pressure during drought-related supply constraints.

SINKHOLES | Buena Vista has 1 emergency/medical facility, 1 public service facility, 2 industrial facilities, 1 major employer, 1 historic place, and 1 social center over carbonate bedrock (Table 4.6.4). The City's location at the Maury River confluence places it in the Valley and Ridge physiographic province where karst terrain is prevalent. While the City has a smaller number of critical facilities over carbonate bedrock than larger jurisdictions, its limited municipal capacity means that even a single sinkhole event affecting a critical facility could strain local response resources and require County assistance.

EXTREME TEMPERATURES | Buena Vista has 18.3% of its population aged 65 and over (1,213 individuals) (Table 4.9.4). The City's 133 manufactured homes are less well-insulated than site-built housing, concentrating temperature vulnerability in the most economically exposed households. The City's single hospital — Carilion Stonewall Jackson (25 beds, no ICU) — has extremely limited capacity to manage temperature-related medical emergencies, meaning serious cases must be transported to higher-level facilities in Roanoke or Charlottesville.

SEVERE WINTER WEATHER | Buena Vista averages 10–20 inches of snowfall annually and faces elevated ice storm risk at its lower valley elevation (Map 4.8.1, Map 4.8.3). The City's 17 VDOT-maintained bridges are critical to connectivity across the Maury River, and their closure during ice events would impair access to emergency services for portions of the City. The City's declining population (-2.7% since 2013) limits its fiscal capacity to invest in road maintenance equipment and pre-event preparedness measures, creating dependence on VDOT and Rockbridge County for winter road operations.

INFECTIOUS DISEASE | Buena Vista reported 1 COVID case per 3.3 people during the pandemic (Table 4.9.2) — one of the higher rates among the region's cities, likely reflecting the City's concentration of manufacturing and service workers who cannot telework and face workplace transmission risk. The City's low median household income and high-SVI census tracts indicate populations who may face barriers to vaccination, telehealth access, and the ability to isolate during outbreaks. Carilion Stonewall Jackson Hospital's 25 beds and absence of ICU capacity means that serious infectious disease cases require transfer outside the City, placing patients at risk during transport and straining regional healthcare capacity.

HAZARDOUS MATERIALS | Buena Vista has 3 TRI facilities with 111 lbs. on-site and 11 lbs. off-site toxic releases in 2022 (Table 4.10.1) — a relatively low fixed-facility HazMat burden. The City's primary HazMat vulnerability is from the I-64 and CSX rail corridor traffic adjacent to the City's southern boundary, both of which carry hazardous materials through the Maury River gorge corridor daily. A transportation incident on either corridor near Buena Vista could affect the City's residents and its river corridor, with Carilion Stonewall Jackson Hospital having very limited capacity to manage a mass casualty HazMat event.

CRITICAL INFRASTRUCTURE FAILURE | Buena Vista has 38 unserved broadband locations — a relatively low count suggesting reasonable broadband access for most residents (Table 4.11.1). The City has 0 residents estimated within 5 miles of High Hazard Potential Dams per FEMA's RAPT proximity metric, but portions of the City fall within mapped dam inundation zones, indicating downstream risk from upstream South River and Maury River watershed dams that is not fully captured by the 5-mile metric.

ACTIVE ASSAILANT | Buena Vista's active assailant vulnerability is relatively low given its small population and limited concentration of soft targets. The Virginia Horse Center — a major regional equestrian event venue that draws large public gatherings — represents the most significant soft target environment in the City. During major events, the venue's large outdoor assembly areas and transient visitor populations create conditions where an active assailant event could affect large numbers of people before law enforcement response is established. The City's limited local law enforcement capacity means that major incident response would require County and state mutual aid.

CITY OF LEXINGTON

FLOODING | Lexington has 3 repetitive loss structures and modeled annual average flood losses of $100,000, which may understate the true risk given the concentration of nationally significant historic structures in the Maury River tributary corridor. The Basic Hazus analysis conducted for this plan (Map 4.1.8) estimates that portions of the City could experience economic losses in a 100-year flood event, though the relatively limited extent of the City's mapped flood zones constrains the total modeled economic loss.

TROPICAL STORM/HURRICANE | Lexington's vulnerability to tropical storms encompasses both the flood risk described above and the cascading effects of high winds. The Commonwealth of Virginia's 2023 Hazard Mitigation Plan estimates $9,729 in annualized wind loss for Lexington based on a Hazus hurricane wind analysis (Table 4.2.3). VMI and Washington and Lee University contain historic structures, outdoor facilities, and large assembly buildings vulnerable to wind damage from tropical systems. The City's urban tree canopy — an important historic and aesthetic feature — creates downed-tree and power outage risk during high-wind events associated with tropical systems.

HIGH WINDS | Lexington's high wind vulnerability is moderate, consistent with its Valley floor location and the NRI strong wind risk rating for the sub-area (Map 4.3.6). The City has 20 VDOT-maintained bridges, 10% of which are in Poor condition (Table 4.8.3) — a meaningful proportion for a small city where bridge access is critical to connectivity across the Maury River and its tributaries. Downed trees during wind events create particular risk to VMI and W&L's historic campus structures and to the City's historic downtown streetscape, where mature trees line streets adjacent to National Historic Landmark buildings. The City maintains its own road network independent of VDOT, meaning Lexington bears direct financial responsibility for storm cleanup and road restoration costs.

WILDFIRE | Lexington has less than 1% of its structures with minimal wildfire exposure, 85% with indirect exposure, and 15% with direct exposure (Table 4.4.9), reflecting its position at the base of forested mountain terrain similar to Buena Vista. The City has 1 emergency/medical facility, 1 public service facility, 1 water system facility, 1 major employer, and 1 historic place in WUI areas (Table 4.4.5). VMI's extensive campus,

including historic barracks and academic buildings, faces indirect wildfire exposure from the forested South Hill terrain to its west. Smoke from wildfires in the surrounding George Washington National Forest can degrade air quality across the City, posing health risks for the VMI cadet corps engaged in outdoor training activities and for elderly residents.

DORUGHT | Lexington is served by the Maury Service Authority for water supply, creating shared vulnerability to drought conditions that reduce Maury River source water availability. The City reported the highest COVID case rate in the region, suggesting a highly interconnected institutional population that would similarly amplify drought impacts if campus operations require significant water use adjustments. The City's high median household income ($89,598) provides greater individual capacity to adapt to conservation measures than most jurisdictions, but the large student populations at VMI and W&L create concentrated institutional water demand that cannot easily be reduced during drought emergencies.

SINKHOLES | Lexington has 10 emergency/medical facilities,14 public service facilities, 2 water system facilities, 14 major employers, and 18 historic place facilities over carbonate bedrock. The Moores Creek Dam sinkhole – where karst-driven seepage caused ground failure at the dam's base – demonstrates that karst activity is actively threatening the City's critical water infrastructure. The dam's inundation zone encompasses 57 homes and 17 roadways. Lexington's 18 National Register properties and 4 NHLs over carbonate bedrock represent cultural assets of national significance vulnerable to ground failure.

EXTREME TEMPERATURES | Lexington's median age is approximately 26 years, driven by VMI and W&L student populations, which means the permanent resident population — including 1,214 individuals aged 65 and over (16.4% of the population) (Table 4.9.4) — can be obscured in aggregate statistics. The City's older permanent residents face elevated heat and cold vulnerability, while the large student population creates unique extreme temperature concerns: VMI cadets engaged in outdoor military training during summer heat waves face heat illness risk, and students in historic residential buildings with older heating and cooling infrastructure may face comfort and safety risks during extreme cold events. Carilion Stonewall Jackson Hospital's 25 beds and absence of ICU capacity mean that serious temperature-related medical emergencies must be transferred to higher-level facilities.

SEVERE WINTER WEATHER | Lexington averages 10–20 inches of snowfall annually and, like other sub-area communities at lower valley elevations, faces elevated ice storm risk during transitional weather events (Map 4.8.1, Map 4.8.3). The City maintains its own road network independently of VDOT, bearing direct financial responsibility for snow and ice removal — a meaningful fiscal burden for a small city. Ice accumulation on VMI's parade ground, athletic facilities, and historic barracks creates both safety hazards and operational disruptions for the military institution. W&L's historic campus buildings, constructed before modern insulation standards, face elevated risk from freeze-related pipe failures during extended cold events.

INFECTIOUS DISEASE | Lexington reported the highest COVID case rate in the region at 1 case per 2.6 people (Table 4.9.2), a rate that likely reflects the congregate living conditions at VMI and Washington and Lee University, where cadets and students share barracks, dormitories, dining halls, and classrooms in close proximity. Both institutions have student health systems with limited capacity to manage significant outbreak independently; surge demand falls on Carilion Stonewall Jackson Hospital — which has only 25 beds and no ICU — or requires patient transfer to higher-level facilities in Roanoke or Charlottesville. The

City's permanent resident population includes 1,214 individuals aged 65 and over (16.4% of the population) (Table 4.9.4), an elderly cohort that faces elevated risk of severe illness and who may be disproportionately affected when local hospital capacity is consumed by an institutional outbreak.

HAZARDOUS MATERIALS | Lexington has no TRI facilities. Its primary HazMat vulnerability is from the I-64 and CSX rail corridor traffic adjacent to the City, both of which carry hazardous materials through the Maury River gorge corridor daily. The Maury River — a significant recreational resource and a key economic driver for Natural Bridge State Park — would be acutely vulnerable to contamination from a rail or road spill in this corridor. Carilion Stonewall Jackson Hospital's very limited capacity (25 beds, no ICU) means that a major HazMat event in the corridor could simultaneously overwhelm local medical capacity and affect the City's water supply infrastructure.

CRITICAL INFRASTRUCTURE FAILURE | Lexington has 26 unserved broadband locations (Table 4.11.1), suggesting near-universal broadband access within the City. The Moores Creek Dam sinkhole (December 2024) directly threatened the City's water supply infrastructure managed by the Maury Service Authority. The dam's inundation zone encompasses 57 homes and 17 roadways, meaning a dam failure would affect a meaningful portion of the City's structure inventory and road network. The City's 0 residents estimated within 5 miles of HHPDs per the FEMA RAPT proximity metric understates actual risk, as the Moores Creek Dam inundation zone demonstrates. As a small city that maintains its own infrastructure independently of the County, Lexington faces the full cost of infrastructure failures within its boundaries with a limited tax base.

ACTIVE ASSAILANT | Lexington is particularly vulnerable to active assailants due to the presence of VMI and Washington and Lee University’s residential campuses with large student populations, significant public event calendars, and national visibility.

INFECTIOUS DISEASE | Lexington reported the highest COVID case rate in the region (1 case per 2.6 people) likely reflecting congregate living at VMI and W&L. Despite Lexington's high median household income ($89,598), its small permanent resident population and high institutional dependence create fragility during disease events that strain campus health and municipal services simultaneously.

TOWNS OF GLASGOW AND GOSHEN

Glasgow (1,037 residents in 2023, -6.3% since 2013; identified as an EDRC) has 35.2% of its land in the 100-year flood zone and 46.4% in the 500-year zone – the highest proportional flood zone coverage of any jurisdiction in the region. Glasgow is located at the confluence of the Maury and James Rivers, a location that produced 14-foot inundation during Hurricane Camille (1969). The Town has 12 repetitive loss structures and 1 water system facility in the 100-year flood zone. The Basic Hazus analysis conducted for this plan (Map 4.1.8) estimates that Glasgow could experience significant economic losses in a 100-year flood event. The potential for community-wide economic impact from a major flood event is acute relative to the Town's small size and limited recovery capacity. Glasgow also has WUI exposure, with 3 emergency/medical facilities, 1 public service facility, 2 water system facilities, and 1 industrial facility in WUI areas. The Town's declining population, EDRC designation, and history of flooding create a vulnerability profile that requires ongoing support.

Goshen (334 residents in 2023, -9.7% since 2013) has 24.7% of its land in the 100-year flood zone and 25.3% in the 500-year zone – the second-highest proportional coverage among the region's towns. The Town sits along the Maury River in the narrow Goshen Pass gorge, which concentrates and accelerates river flows. Goshen has 2 repetitive loss and 1 severe repetitive loss structures. The Basic Hazus analysis conducted for this plan (Map 4.1.8) estimates that Goshen could experience significant economic losses in a 100-year flood event. The Town's position within the narrow Goshen Pass gorge means that floodwaters concentrate rapidly, and the modeled economic losses reflect the high proportion of land — 24.7% — within the 100-year flood zone for a community of only 334 residents.

Two emergency/medical facilities and 3 social centers are in WUI areas. Goshen Dam – a High Hazard Potential Dam – has 752 homes, 86 businesses, and 1 railroad in its inundation zone. The Town's steep population decline (-9.7%) and small absolute size mean that even moderate hazard events can affect a significant share of all residents. Goshen is served by the Maury Service Authority, whose infrastructure is discussed in the Special Districts section.

SPECIAL DISTRICTS

Four special districts participated in this hazard mitigation plan as independent plan participants, including James Madison University (JMU), Maury Service Authority (MSA), Bath County Service Authority (BCSA), and Augusta Water. Their vulnerability is described below.

JAMES MADISON UNIVERSITY (JMU)

Assets: Over 22,000 students; approximately 4,000 faculty and staff; an extensive campus in the City of Harrisonburg encompassing residential halls, academic buildings, athletic facilities, and public assembly venues; JMU Amphitheatre Dam (state-regulated, over carbonate bedrock) within the campus footprint; identified as a high-hazard winter weather institution in the 2023 Commonwealth Hazard Mitigation Plan.

Vulnerability: JMU's vulnerability is shaped by the concentration of a large, transient student population in a dense campus environment, a condition that amplifies risk across nearly every identified hazard type. As a major regional employer and economic anchor, disruptions to JMU's operations from any hazard event carry cascading economic consequences for the City of Harrisonburg and the broader CSPDC region.

Flooding poses risk to low-lying campus areas and access roads during heavy rainfall events, complicating evacuation and impeding emergency response access. The campus' extensive impervious surfaces accelerate stormwater runoff, contributing to flash flooding that can affect both the campus and surrounding City neighborhoods. The JMU Amphitheatre Dam, located on campus over carbonate bedrock, introduces an additional infrastructure risk: failure of this high-hazard structure could inundate downstream City neighborhoods with little warning.

High winds from tornadoes and derechos threaten the University's large-span assembly buildings, outdoor athletic facilities, and mature campus tree canopy. Downed trees and power lines during wind events can simultaneously strand thousands of students on campus and impede the emergency response vehicles attempting to reach them.

Severe winter weather is among JMU's most acute institutional vulnerabilities. The University is identified as one of three high-hazard winter weather facilities in the CSPDC region by the 2023 Commonwealth HMP. Ice storms that disrupt power and close roads can strand students in residential halls, overwhelm campus dining and heating capacity, and create dangerous conditions for students dispersed across off-campus housing who lack transportation.

Infectious disease can spread rapidly in the University's congregate living and classroom environment. JMU's campus health system has limited capacity to manage a significant outbreak independently, and surge demand would fall primarily on Sentara RMH Medical Center and UVA Health Rockingham — the region's two largest hospitals, both of which are located within the City of Harrisonburg. During regional disease events, JMU's residential population creates a sustained transmission risk that extends beyond the campus into the broader community.

Active assailant vulnerability is among the highest in the region, given JMU's open campus design, large and densely concentrated population, high-visibility national profile, and the range of soft targets present — from athletic events to residence halls to entertainment venues. The 2022 active assailant event at Bridgewater College, a smaller institution in the same sub-area, underscores that Virginia colleges and universities face real and present risk from this threat.

MAURY SERVICE AUTHORITY (MSA)

Assets: Water and wastewater treatment facilities, pump stations, and distribution and collection infrastructure serving approximately 8,000 customers across roughly 50 square miles in Rockbridge County and the City of Lexington.

Vulnerability: The Maury Service Authority's infrastructure vulnerability is defined first and foremost by its location in the Maury River watershed — the most historically flood-prone major river corridor in the region. MSA's treatment facilities and distribution infrastructure along the Maury River face recurring flood risk; inundation of a water or wastewater treatment facility can simultaneously disrupt drinking water delivery and wastewater management for thousands of customers across a geographically large service area that has limited redundancy.

Flooding represents the Authority's most immediate threat. The Maury River has produced catastrophic flood events during tropical systems — Hurricane Camille (1969) and Hurricane Agnes (1972) both caused devastating inundation throughout the corridor MSA serves.

Sinkholes and karst instability represent a compounding and active threat to MSA infrastructure. The December 2024 discovery of a sinkhole at the base of Moores Creek Dam in Lexington — caused by karst-driven seepage from a reservoir that MSA relies upon — illustrates that ground failure is not a hypothetical future risk but an ongoing condition that directly threatens water supply infrastructure in this sub-area. Rockbridge County's extensive carbonate bedrock coverage means that MSA's distribution system traverses terrain that is inherently susceptible to subsurface dissolution and sudden ground failure.

Infrastructure failure and utility outages present a persistent operational vulnerability. Extended power outages — which have occurred regionally at least four times in the six years between 2018 and 2024 — can disable pump stations serving rural customers who have no alternative water supply. MSA's service area includes a high proportion of elderly residents (26.8% of Rockbridge County's population is aged 65 and over) who are particularly vulnerable to water service disruptions during temperature extremes.

Drought conditions that reduce source water availability in the Maury River watershed create supply constraints that MSA must manage across its entire service area. As drought events become more frequent and severe — the region received back-to-back agricultural disaster designations in 2023 and 2024 — source water management will become an increasingly significant operational challenge for the Authority.

BATH COUNTY SERVICE AUTHORITY (BCSA)

Assets: Water and wastewater treatment systems, pump stations, and distribution and collection infrastructure serving residents and businesses of Bath County, including Warm Springs and surrounding communities.

Vulnerability: The Bath County Service Authority serves as a critical water and wastewater lifeline for one of the region's most geographically isolated, demographically vulnerable, and infrastructure-limited jurisdictions. Its vulnerability profile mirrors and is inseparable from that of Bath County itself.

Flooding from the Cowpasture River and its tributaries threatens BCSA infrastructure located in or near valley floor areas. Flood damage to treatment or pumping infrastructure could leave the Omni Homestead Resort (the county's largest employer), the county's healthcare facilities, and hundreds of rural residential customers without service simultaneously.

Infrastructure failure and utility outages are a primary operational threat. Extended power outages disable BCSA's electric pump stations, interrupting service for customers throughout the system. This vulnerability is compounded by the county's broader infrastructure context: 74.4% of Bath County residents depend on private electric well pumps for water, meaning a power outage simultaneously compromises both BCSA service and the independent water supply of most county households. During a major outage, the Authority's customers and the broader county population lose water access together, with no practical alternative supply available at scale.

Wildfire poses a risk of infrastructure damage and service disruption in a county where 95% of structures face direct wildfire exposure. Wildfire in BCSA's service area could damage power lines feeding pump stations, compromise road access needed for maintenance and repair crews, and degrade water quality through ash and sediment entering source water.

Drought affects BCSA's source water availability and its customers' demand simultaneously. As drought conditions draw down surface water sources and groundwater levels, the Authority must manage reduced supply against sustained or increased demand — particularly from agricultural operations and the Homestead Resort, both of which require reliable water supply for continued operations.

AUGUSTA WATER

Assets: Ten (10) separate public water systems and nine (9) wastewater treatment facilities, together with associated distribution and collection infrastructure, serving more than 16,000 water customers and 10,000 wastewater customers in communities throughout Augusta County — including Verona, Stuarts Draft, Fishersville, Weyers Cave, Mount Sidney, Greenville, Dooms, and surrounding areas. The largest concentrations of customers are in the South River and Verona service areas.

Vulnerability: As the primary water and wastewater utility for Virginia's second most productive agricultural county, Augusta Water's infrastructure underpins not only residential public health but also the county's dominant economic sector. A disruption to Augusta Water's service is a disruption to Augusta County's

agricultural and food processing operations, its healthcare facilities, and the daily lives of its more than 16,000 water customers.

Flooding poses the most immediate and recurring threat. The South River — the primary hydrologic corridor for Augusta Water's largest service areas — has a well-documented history of significant flood events. Critical facilities in Augusta County's 100-year flood zone include 7 water system facilities, and the South River watershed contains the highest concentration of High Hazard Potential Dams in the CSPDC region. South River Dams #23 and #26, each with inundation zones covering 875 homes, 193 businesses, 1 school, and multiple utility assets, represent the most consequential potential dam failure scenarios in the region. Inundation of Augusta Water's South River service area infrastructure during a major flood event — or following a dam failure — could simultaneously disrupt drinking water and wastewater service to thousands of customers, with repair and restoration timelines extending far beyond the flood event itself.

Sinkholes and karst instability present a persistent underground threat across Augusta County's carbonate bedrock terrain. Augusta Water manages 37 water system facilities over carbonate bedrock (Table 4.6.4). Ground failure beneath water mains, pump stations, or treatment facilities can cause sudden, unplanned service interruptions and costly infrastructure damage. Augusta County has documented multiple sinkhole events affecting roads and utilities in recent years, including events on Interstate 81 near Greenville (2017) and Weyers Cave (2024), demonstrating that karst activity in the county is ongoing and active.

Infrastructure failure and utility outages from severe weather events can disable Augusta Water's electrically operated pump stations, interrupting service across multiple systems simultaneously. The county has experienced at least four significant regional utility outages between 2018 and 2024. Because Augusta Water serves a dispersed rural population — including many customers in agricultural and manufacturing operations that require continuous water supply — even brief outages carry significant economic and public health consequences. Cyber threats to Augusta Water's operational technology — including SCADA systems that control and monitor treatment and distribution operations — represent a growing and serious risk. Water utilities nationally have experienced targeted cyber-attacks, and Augusta Water's role as a provider of essential services to a large population makes it a meaningful target.

Drought threatens Augusta Water's source water availability while simultaneously increasing demand from the county's agricultural sector. Augusta County received primary agricultural disaster designations in both 2023 and 2024, reflecting an escalating drought pattern. Source water management during multi-year drought events will require Augusta Water to balance reduced supply against sustained agricultural and residential demand in ways that current infrastructure capacity may not fully support.