Executive Summary

Background


The Disaster Mitigation Act of 2000 (DMA2K) at 44 CFR §201.4 and Public Law 106-390, signed into law October 10, 2000, amended the 1988 Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act). This amendment replaced previous mitigation planning provisions with a new set of requirements emphasizing the need for State, local, and Indian Tribal entities to closely coordinate mitigation planning and implementation efforts. The law established a national pre-disaster hazard mitigation grant program that would help to reduce loss of life and property, human suffering, economic disruption, and disaster assistance costs resulting from natural disasters.

Every locality recognized by the State Code that adopts a local or regional hazard mitigation plan every five years, remains eligible for the funding opportunities from hazards offered through the U.S. Federal Emergency Management Agency (FEMA), as part of the Department of Homeland Security. The adoption of this plan update by the Northern Shenandoah Valley Region communities will satisfy their eligibility for applying for Hazard Mitigation Grant Program (HMGP) funding, as well as Hazard Mitigation Assistance (HMA). HMA programs include Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC), and Severe Repetitive Loss (SRL) grant programs.

The Virginia Department of Emergency Management (VDEM) Grants Office administers HMA Grants. This plan was updated through funds obligated through a PDM Program grant. The PDM Program awards mitigation planning and project grants, with the goal of reducing overall risk to the population and structures from future hazard events, as well as reducing the reliance on Federal funding.

The Commonwealth of Virginia recognizes twenty-one planning district commissions and encourages that they lead in the development of Hazard Mitigation plans. The Northern Shenandoah Valley Regional Commission (NSVRC) was responsible for facilitation of this plan’s update process. The NSVRC encompasses Virginia’s Clarke County, Frederick County, Page County, Shenandoah County, Warren County, their incorporated towns, as well as the city of Winchester. Adoption of a hazard mitigation plan is a prerequisite for mitigation grant assistance set by FEMA; this plan provides the NSVRC jurisdictions with legal basis for those planning requirements.

Hazard Identification and Risk Assessment

Capability Assessment
Mitigation Goals
Mitigation Strategy
Plan Maintenance Procedures
Conclusion
Introduction

Mitigation Planning

Mitigation is a sustainable action taken to prevent or help ease the severity of devastation due to a catastrophic event. Hazard Mitigation Plans specifically aim to help communities better prepare themselves for impending natural disasters. An effective plan lessens or prevents the impacts of disaster, by readying the community with a set of preemptive or reactive procedures, should such an event threaten or occur.

State, tribal and local leaders use mitigation planning for developing a long-term, comprehensive strategy for community disaster readiness. Hazard Mitigation Plans serve as a reference for local officials who make decisions regarding regulations and ordinances, granting permits, and funding capital improvements or other community initiatives. Additionally, these local plans will serve as the basis for states to prioritize future grant funding as it becomes available. These plans are formulated through a systematic process centered on the participation of citizens, businesses, public officials, and other community stakeholders.

DMA2k Planning Requirements

This 2017 update to the Regional Hazard Mitigation Plan (Plan update) is intended to satisfy state mitigation planning requirements of the Disaster Mitigation Act of 2000 (DMA2K) at 44 CFR §201.4 and Public Law 106-390, signed into law October 10, 2000 which amends the 1988 Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act). The Plan update is for the Northern Shenandoah Valley region, including the City of Winchester, the five Counties of Clarke, Frederick, Page, Shenandoah, and Warren and the 14 Towns therein. Under the Act DMA2K, every locality recognized by the State Code that adopts a local or regional hazard mitigation plan every five years, remains eligible for the funding opportunities from hazards offered through the U.S. Federal Emergency Management Agency (FEMA), as part of the Department of Homeland Security. Therefore, by adopting this Plan update, the localities included in this Plan update will remain eligible for (HMGP) funds and the Hazard Mitigation Assistance (HMA) programs which include Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC), and Severe Repetitive Loss (SRL) grant programs.

The Virginia Department of Emergency Management's Emergency Operations Plan Standard Hazard Mitigation Plan, Support Annex 3 (Volume II) requires each of Virginia's cities, counties, and towns to develop or take an active role in the development of a hazard mitigation plan for their respective areas. The PDCs are not required to develop a separate hazard mitigation plan for their regions, as they do not have the enforcement authority of the cities, counties, and incorporated towns. However, as described in Section 6.3.5(d), it was the intent of the Commonwealth of Virginia to combine as many of the mitigation plans as
To assist our localities in meeting the requirements of DMA2K and the suggested guidance through VDEM, the Northern Shenandoah Valley Regional Commission (NSVRC) assisted the regional Steering Committee consisting of representatives from each of the participating localities in the preparation of this Plan update of the Regional Hazard Mitigation Plan. The VDEM, in guidance documentation, noted that regional hazard mitigation plans are more cost effective methods of developing hazard mitigation plans than on a local level stating: "With limited mitigation planning staff at the state level, it is important the local plans continue to remain regionalized to the extent possible." Preparation of this Plan update was prepared under a funding planning grant opportunity through VDEM.

**Organization of the Plan**

Section I – Executive Summary  
Section II – Introduction  
Section III – Planning Process  
Section IV – Northern Shenandoah Valley Regional Profile  
Section V – Capability Assessment  
Section VI – Hazard Identification and Risk Assessment  
Section VII – Mitigation Strategies  
Section VIII – Plan Maintenance  
Section IX - References

**Planning Process**

DMA2K: §201.4(c)(1): Description of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how other agencies participated

The plan update process was organized and executed by the Northern Shenandoah Valley Regional Commission, using the FEMA developed “Local Mitigation Planning Handbook,” as the principal guiding document. Guidance worksheets from the handbook were used to structure the update timeline, meeting agendas and overall update work plan.

The Northern Shenandoah Valley Regional Commission was formed by its local governments in 1968 under the authority of the Virginia Area Development Act. The Commission is made up of eighteen elected officials and twelve citizens appointed to the Commission by the eleven member local governments. The Commission provides a variety of technical services to its member local governments including: planning, mapping, grant application assistance, and network meetings. Programs which serve citizens, the private and non-profit sectors include:

- Consultant selection RFP/RFQ’s  
- General Planning:
Northern Shenandoah Valley Region Multi-Jurisdictional Hazard Mitigation Plan

Potential Future Funding of Strategies in this Plan:
- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation Program (PDM)
- Flood Mitigation Assistance Program (FMA)
- Repetitive Flood Claims Program (RFC)
- Severe Repetitive Loss Program (SRL)

If a grant is awarded by FEMA (often administered through VDEM), then the locality or NSVRC (on behalf of a locality) is a "sub-grantee" and is responsible for managing the sub-grant and complying with program requirements and other applicable Federal, State, and local regulations. The steering committee requested these funding opportunities be clearly presented in this Plan as well as on the NSVRC website. To meet these requests, the following is a list of funding programs.
Overall Funding descriptions: The HMA Unified Guidance can be found on FEMA's website at: http://www.fema.gov and at NSVRC website www.NSVregion.org

Hazard Mitigation Grant Program: Localities with an adopted hazard mitigation plan (approved by FEMA) are eligible to qualify for post-disaster mitigation funds.

Pre-Disaster Mitigation Grant Program: Localities with an adopted hazard mitigation plan (approved by FEMA) are eligible to qualify for pre-disaster mitigation funds, local jurisdictions must adopt a mitigation Plan that is approved by FEMA.

Flood Mitigation Assistance Program: Localities with an adopted, FEMA-approved mitigation plan are eligible to qualify for funds to implement projects including acquisition or elevation of flood-prone structures. The plan must be prepared following the process outlined in the National Flood Insurance Program's (NFIP) Community Rating System.

FEMA/NFIP Repetitive Flood Claim (RFC) Program: The RFC program, authorized by the Flood Insurance Reform Act of 2004, assists communities to reduce flood damages to properties that have at least one NFIP claim payment. Funding includes acquisition, elevation, and flood-proofing of residential structures.

FEMA/NFIP Severe Repetitive Loss Program: The SRL program funds projects that reduce or eliminate the long-term risk of flood damage to residential structures under the NFIP which have suffered repetitive losses. SRL properties have at least four NFIP claim payments (over $5,000 with at least two of the claims within a ten-year time period). Like RFC, SRL funds projects for residential properties and can include acquisition, elevation, and dry flood-proofing of residential structures. Eligible residential properties must have at least two separate claim payments made within a ten-year period with the cumulative amount of the building portion of the claims that exceed the total property value.

Hazards were identified and ranked according to discussions during meetings and in an on-line survey issued to localities. The on-line survey was also available during throughout the update planning process. Outcomes of the hazard evaluations included acknowledgement of the importance of winter ice storms as well as flooding as key natural hazards. Flooding was ranked as the number one natural hazard in terms of likelihood of highest damage.

Mitigation actions and strategies are listed in this plan update that aim to help local governments achieve specific goals aimed at reducing impacts to life and property from natural disasters. The mitigation strategies listed in this Plan were identified through a process of breakout locality meetings based on a review of the strategies in the 2012 Plan and a determination of relevancy and status.

The Northern Shenandoah Valley Region Multi-Jurisdictional Hazard Mitigation Plan Update’s planning process was a collaborative effort that incorporated data and input from the twenty participating localities in the region and state agencies including the VDEM, Virginia Department of Transportation (VDOT), Virginia Department of Forestry (DOF), Virginia Department of Environmental Quality (DEQ), and the Virginia Department of Mines, Minerals, and Energy (DMME). In addition, industries, colleges,
universities, health professionals, and representatives from public and private entities were invited to participate throughout the planning process.

Planning Area and Resources

The Northern Shenandoah Valley Region includes the Northern Virginia counties of Clarke, Frederick, Page, Shenandoah, Warren, their incorporated towns, as well as the City of Winchester.

This plan is a 5 year update to the region’s previously adopted 2012 Multi-Jurisdictional Hazard Mitigation Plan. The 2012 plan was designed for the same planning area as stated above and served as the primary document for the basis of this plan update.

Funds obligated through the Pre-Disaster Mitigation Grant Program (PDM) were granted to the NSVRC in April of 2016. The NSVRC commenced update process in November of 2016, once the grant award package was authorized. An update steering committee comprised of local officials, worked closely with the NSVRC throughout the planning process. This ensured that potential stakeholders participated in the planning process and had opportunities for input in the draft and final phases of the plan.

Steering Committee and Larger Planning Group

A steering committee was organized, with representation from each of the six NSVRC jurisdictions - Clarke, Frederick, Page, Shenandoah, and Warren counties, as well as the City of Winchester. A
Memorandum of Agreement was distributed and signed by these participating localities in order to establish commitment to the collaborative update process. Data was collected from local, regional, state and nationwide sources for use in hazard analysis.

The following were provided opportunities to review and comment on the Plan update were invited as participants to the meetings as well as given the chance to provide input and comment to affect the Plan's content:

- Local and regional agencies involved in hazard mitigation activities (Amy Howard of VDEM and Scott Hudson of VDEM as well as all regional emergency response coordinators);
- Agencies that have the authority to regulate development (each participating locality's planning staff and or designee along with elected officials; and
- Neighboring communities and interested citizens.

Invitations to participate in the hazard mitigation planning process were distributed amongst a list of potential team members comprised of local officials from various agencies and local governmental departments. The MOA that was distributed designated the following jurisdictional representatives, who made up the 2017 Hazard Mitigation Steering Committee:

<table>
<thead>
<tr>
<th>Locality</th>
<th>Member, Title</th>
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<tbody>
<tr>
<td>Clarke County</td>
<td>Brian Lichty, Director of Fire and EMS</td>
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<tr>
<td>Frederick County</td>
<td>Chester Lauck, Deputy EMS Coordinator</td>
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<tr>
<td>Page County</td>
<td>Woody Brown, Emergency Manager</td>
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<tr>
<td>Shenandoah County</td>
<td>Jill Jefferson, Planner</td>
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<tr>
<td>Warren County</td>
<td>Rick Farrell, Deputy Emergency Manager</td>
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<tr>
<td>City of Winchester</td>
<td>Lynn Miller, EMS Coordinator</td>
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This steering committee reviewed the current plan, determined the purpose of the 2017 update, developed a project timeline, established and allocated various plan update responsibilities, and developed the outreach strategy to garner public involvement.
The following project tasks timeline was developed and agreed upon by the committee:

<table>
<thead>
<tr>
<th>Project Task</th>
<th>Jul 17</th>
<th>Aug 17</th>
<th>Sep 17</th>
<th>Oct 17</th>
<th>Nov 17</th>
<th>Dec 17</th>
<th>Jan 18</th>
<th>Feb 18</th>
<th>Mar 18</th>
<th>Apr 18</th>
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<tr>
<td>Organize Resources and Convene Planning Team</td>
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<tr>
<td>Create/Execute Outreach Strategy</td>
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<td>Review Community Capabilities</td>
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<td>Conduct Risk Assessment</td>
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<tr>
<td>Review Public Opinion/Finalize Hazard Rankings</td>
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<tr>
<td>Identify Mitigation Goals and Actions</td>
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<td>Identify Plan Maintenance Procedures</td>
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<td>Review Final Draft/Make necessary final edits</td>
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<td>Submit Plan/State and FEMA Review</td>
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<tr>
<td>Adopt Plan</td>
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</table>

**Meetings**

<table>
<thead>
<tr>
<th>Planning Team</th>
<th>Jul 17</th>
<th>Aug 17</th>
<th>Sep 17</th>
<th>Oct 17</th>
<th>Nov 17</th>
<th>Dec 17</th>
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<tr>
<td>Jurisdictional Sub-Team</td>
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<tr>
<td>Stakeholder/Public Outreach</td>
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</table>

**Figure X – Hazard Mitigation Plan Update Tasks and Timeline**

The plan update process was organized based on tasks as presented in the FEMA "Local Mitigation Planning Handbook," to ensure that the team met the standards expected for an efficient hazard mitigation plan.

The larger planning group consisted of members that provided additional support to the steering committee. This group is made up mostly of county officials that were able to provide reference in mitigation planning as it relates to their specific department or jurisdiction.
### Northern Shenandoah Valley Region Multi-Jurisdictional Hazard Mitigation Plan Update - Larger Planning Group

<table>
<thead>
<tr>
<th>Locality /Organization</th>
<th>Member, Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCR</td>
<td>Charley Banks, Flood Plain Manager</td>
</tr>
<tr>
<td>Town of New Market</td>
<td>Alex Berryman, Town Planner/Zoning Administrator</td>
</tr>
<tr>
<td>Page County</td>
<td>Kelly Butler, Senior Program Support Technician</td>
</tr>
<tr>
<td>Town of Luray</td>
<td>Chief C.S. Bow Cook, Page County Sherriff’s Office</td>
</tr>
<tr>
<td>NSVRC</td>
<td>Brandon Davis, Executive Director</td>
</tr>
<tr>
<td>Town of Berryville</td>
<td>Keith Dalton, Town Manager</td>
</tr>
<tr>
<td>DCR</td>
<td>Gina Dicicco, Flood Plain Manager</td>
</tr>
<tr>
<td>Shenandoah County</td>
<td>David Ferguson, Fire Marshall</td>
</tr>
<tr>
<td>Lord Fairfax Health District</td>
<td>Justin Ferrell, Local Health Emergency Coordinator</td>
</tr>
<tr>
<td>Town of Woodstock</td>
<td>Lemuel Hancock, Urban Designer &amp; Neighborhood Planner</td>
</tr>
<tr>
<td>VDEM</td>
<td>Amy Howard, Mitigation Grants Administrator</td>
</tr>
<tr>
<td>Town of Luray</td>
<td>Charlie Hoke, Town Manager</td>
</tr>
<tr>
<td>VDEM</td>
<td>Alexa Hussar, Emergency Management Planner</td>
</tr>
<tr>
<td>VDEM</td>
<td>Catherine Hughes, All-Hazards Planner</td>
</tr>
<tr>
<td>Town of Toms Brook</td>
<td>Stephanie Langton, Planner &amp; Zoning Administrator</td>
</tr>
<tr>
<td>Page County</td>
<td>Stephanie Lillard, Director of Community and Economic Planning</td>
</tr>
<tr>
<td>Warren County</td>
<td>Taryn Logan, Planning Director</td>
</tr>
<tr>
<td>NSVRC</td>
<td>John Madera, Principal Planner</td>
</tr>
<tr>
<td>Town of Stephens City</td>
<td>Mike Majher, Town Manager &amp; Planner</td>
</tr>
<tr>
<td>Town of Strasburg</td>
<td>Wyatt Pearson, Town Manager</td>
</tr>
<tr>
<td>Town of Stanley</td>
<td>Terry Pettit, Town Manager</td>
</tr>
<tr>
<td>Warren County</td>
<td>Doug Sexton, GIS Coordinator</td>
</tr>
<tr>
<td>Clarke County</td>
<td>Brandon Stidham, Planning Director</td>
</tr>
<tr>
<td>VDEM</td>
<td>Mark Stone, Region 2 Chief Regional Coordinator</td>
</tr>
<tr>
<td>Town of Boyce</td>
<td>Dennis Utterback, Planning Commission Chairman</td>
</tr>
<tr>
<td>Shenandoah County</td>
<td>Shannon Walter, Service Assistant</td>
</tr>
<tr>
<td>Town of Front Royal</td>
<td>Joseph Waltz, Town Manager</td>
</tr>
<tr>
<td>Warren County</td>
<td>Matt Wendling, Planner</td>
</tr>
</tbody>
</table>

**Table X** – Larger Planning Group

Note* The Larger Planning Group was apprised of meetings; however, the majority of meetings was staffed by the Hazard Mitigation Steering Committee

**Public Participation and Citizen Input**

In order to keep the 2017 update project transparent to the public, the NSV Hazard Mitigation online portal was developed – [http://nsvregion.org/hazard-mitigation.html](http://nsvregion.org/hazard-mitigation.html). This allowed for anyone with internet access to get a better understanding of what hazard mitigation is, keep up with the update project status by
downloading meeting agendas/minutes/presentations, review documents and FEMA planning worksheets, review project maps, as well as have access to the timeline and meeting schedule. An online survey was conducted via GoogleForms, to help gain an understanding of what hazards truly concern the NSV region residents. The results from the poll can be found in the public outreach documents in APPENDIX XXX. Results from this poll were used in consideration during the Hazard Identification and Risk Assessment (HIRA) portion of the update’s planning process. In order to gain as much participation as possible, the poll was promoted via flyers and public announcements, including a local radio announcement.

The following were notified of the planning process and invited to participate: Chief Administrative Offers (Town Managers, County Administrators, City Manager), regional emergency managers, Shenandoah University, Lord Fairfax Community College, Christendom College, Shenandoah National Park, George Washington National Service, Rappahannock Rapidan Regional Planning Commission, the City of Harrisonburg, steering committee members on the 2007 Hazard Mitigation Plan, along with additional organizations in the NSV region. Participating jurisdictions were communicated to electronically with updates regarding opportunities to participate, strategy update, and during the review process. Details regarding the monthly planning meetings were provided in the NSVRC monthly media releases announcing each meeting location, time, and purpose to encourage involvement and participation from the community and interested citizens. Press releases and announcements are also included in the appendix to this Plan.
Final Draft Review

A draft of the plan review commenced in early December of 2017. Following public input the Plan was submitted to the VDEM in January 2017. Upon approval, VDEM will forward the Plan to FEMA Region III office for review and approval. These groups provided review and comment and necessary changes were made to the final draft of the plan.

This plan was prepared in accordance with the collaborative process outlined in Section 322 of the Stafford Act to facilitate cooperation between state and local authorities. The identification of, and planning for, disaster response will reduce impacts from natural hazards and result in timely allocation of funds to reduce risks.

Plan Adoption

Following approval from FEMA, each participating jurisdiction will consider adoption of this Plan update. The resolutions for adoption will be presented as part of each City and Town Council and County Board of Supervisor meeting agendas during regularly scheduled meetings. These meetings are publicly advertised by law and will provide the public an additional opportunity to comment on this Plan update. The Steering Committee and or NSVRC staff is scheduled to present a summary of the Plan to each local elected body prior to their consideration of adoption.

The 2012 NSV Regional Hazard Mitigation Plan served as a springboard for the planning team and steering committee to determine a process to update this Plan. The steering committee discussed the organization of the Plan and reviewed strategies considered. The committee meetings provided data review, evaluated data, ranked hazards, evaluated capacity to respond to disasters, identified and reviewed regional and local strategies, noted areas for improved regional emergency response coordination, articulated general training desires, and guided the outreach efforts (development of a regional website and a series of media advisories) for locality and public education to raise awareness of hazard mitigation and the Plan update.

The emergency response coordinators in the NSV region have cultivated excellent communication and cooperation in efforts to respond to disasters. This Plan update was designed to identify opportunities to encourage continued coordinated regional response to disasters and facilitate funding for projects and needs for the localities to reduce adverse impacts from natural disasters.

To satisfy multi-jurisdictional participation requirements, the City, Counties and local Towns were invited to participate in mitigation planning meetings, respond to Capability Assessment inquiries, rank hazards, review, evaluate and prioritize strategies and mitigation projects including County or Town-level goals and mitigation actions, and consider adoption of this Plan. Each locality participated at a level commensurate with staff capacities and each participating jurisdiction will consider adoption of this Regional Hazard Mitigation separately. The localities will commit to the plan maintenance procedures outlined in this Plan and will monitor and update their strategies on a regular basis. Annual updates of this Plan will occur at the end of each calendar year, beginning a year after the Plan is adopted or March 2018.
Regional Profile

Location

Situated within the Northern Virginia portion of the Appalachian Mountain Range, the Northern Shenandoah Valley lies approximately 50 miles east of the U.S. capitol of Washington, D.C. A more rural counterpart to its neighbors to the east, this region features a rural makeup of rolling hills and open farmland. Its western border is shared with West Virginia, and it’s just a short distance from the state of Maryland.

Figure X – Northern Shenandoah Valley Region
Home to nearly 7,000 linear feet of rivers and streams, the region intersects 78 NRCS recognized watershed boundaries, which intersect over 36,000 acres of NWI inventoried wetlands. Flowing south to north, over 300 miles of the Shenandoah River and its branches run through the central part of the valley. It’s separated from Virginia’s Piedmont region by the Blue Ridge Mountain chain. Lying just within the eastern border of Page County is the region’s highest point, known as Stony Man, rises to 4000 feet above sea level (USGS). Clarke’s highest peak is Buzzard Hill, Frederick’s is Pinnacle, Shenandoah’s is Mill Mountain, Warren’s is Hogback Mountain, and the City of Winchester’s highest point is Bower’s Hill.
Figure X – NSV Watersheds and Wetlands
Figure X – NSV Elevation
Climate

There are numerous NOAA weather stations located within the NSV region. Data can be collected and analyzed from these stations using the NOAA Climate Data Online (CDO). The Winchester Regional (KOKV) weather station is recognized as a Large Scale Weather Station. The data presented in the table below was collected from the KOKV station.

<table>
<thead>
<tr>
<th>Northern Shenandoah Valley Region Climate Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Annual Precipitation</td>
</tr>
<tr>
<td>Average Annual Snowfall</td>
</tr>
<tr>
<td>Average Annual Temperature</td>
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<tr>
<td>Average Annual Max Temp</td>
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<tr>
<td>Average Annual Min Temp</td>
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</tbody>
</table>

Table X - Northern Shenandoah Valley Region Climate Statistics

The climate of the Shenandoah Valley, particularly regarding precipitation, is strongly influenced by the surrounding mountains. When moist air flows toward Virginia from areas to the west and northwest, it encounters the high relief of the Allegheny Mountain system to the west of the Shenandoah Valley. As warm air is forced up the face of a mountain, it cools, condenses and ensue precipitation to occur. This process is known as Orographic Uplift. The NSV region experiences rainfall this uplift so as most precipitations falls on the Alleghenies. This leaves comparatively drier air to descend into the Valley and produce less precipitation. Likewise, when moist air from the nearby Atlantic Ocean flows across Virginia from the east, it encounters the Blue Ridge Mountains to the east of the Shenandoah Valley. The same orographic lifting usually results in lower precipitation amounts in the Valley. This double "rain shadow" effect puts the Shenandoah Valley in the driest portion of Virginia and makes it one of the driest locations in the eastern United States.

Typical annual precipitation amounts for nearby stations on the east-facing slopes of the Blue Ridge Mountains run about ten inches higher than the Shenandoah Valley (around 48 inches as opposed to 38 inches). Statewide average annual precipitation is around 40-44 inches. The general mechanisms for precipitation change throughout the course of the year. Larger-scale mid-latitude cyclones and associated frontal passages predominate the colder months and smaller-scale thunderstorm activity usually providing most of the rainfall in the warmer months. The Shenandoah Valley, along with the rest of Virginia, experiences no distinct "dry" or "wet" seasons with respect to precipitation. Nonetheless, the normally high rates of evapotranspiration in the summer months usually lead to an overall loss of moisture, while the colder months allow for the replenishment of deep soil and groundwater reserves. In addition, the varied height and orientation of the flanking mountains can create large differences in precipitation amounts at smaller scales. This is especially true during the summer months, when the primary source of rainfall in Virginia is the thunderstorm.
The predominant flow of surface winds is generally up and down the roughly 160-mile length of the Valley (northeasterly and southeasterly directional categories). Diurnal heating and cooling also gives rise to a mountain and valley breeze, which circulates air from higher surrounding elevations to the Valley floor and up again. Summer average temperatures in the Valley are in the mid-70's (°F) and rarely reach the 100° mark, while winter temperatures average in the mid-30's. The freeze-free growing season averages about six months, from mid-April to mid-October, though local microclimates and elevational differences can bring considerable variation. Rainfall is drained out of the Valley through a series of tributaries and streams that flow into the Shenandoah River, flowing northward to the Potomac River.

**NSVRC Jurisdictional Composition**

The Northern Shenandoah Valley Region covers approximately 1,645 square miles and is comprised of 5 Northern Virginia counties, their respective towns, and the city of Winchester:

<table>
<thead>
<tr>
<th>County</th>
<th>Towns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarke County</td>
<td>Town of Berryville, Town of Boyce</td>
</tr>
<tr>
<td>Frederick County</td>
<td>Town of Middletown, Town of Stephens City</td>
</tr>
<tr>
<td>Page County</td>
<td>Town of Luray, Town of Shenandoah, Town of Stanley</td>
</tr>
<tr>
<td>Shenandoah County</td>
<td>Town of Edinburg, Town of Mount Jackson, Town of New Market, Town of Strasburg, Town of Town of Shenandoah, Town of Toms Brook, Town of Woodstock</td>
</tr>
<tr>
<td>Warren County</td>
<td>Town of Front Royal</td>
</tr>
<tr>
<td>The City of Winchester</td>
<td></td>
</tr>
</tbody>
</table>

These jurisdiction’s local governments work together under the Northern Shenandoah Valley Regional Commission, to pursue common planning goals and work together on regional issues. They are also home to 18 separate sheriff’s offices and police departments, 48 fire/rescue stations, and 3 major hospitals. The region as a whole falls under the Virginia State Police Region II jurisdiction.
Figure X – The Northern Shenandoah Valley Planning Area
Population

Population density is number of people per square mile. Figure 3.5 displays the regional population density according to the U.S. Census designated census blocks. The maps show heavier density within the incorporated towns throughout the region. Also, we see dense areas that have developed east of Winchester and Stephens City. We can also see that there are dense neighborhoods scattered throughout the mountainous areas of Clarke County, and Northeastern Warren County.

Figure X – NSV Population Density
Virginia’s population statistics are recorded by county, city, town and planning district. Cities and counties are separate political entities and do not have any overlap in data. Table X shows the Northern Shenandoah Valley total population as recorded in the 2010 U.S. Census.

<table>
<thead>
<tr>
<th>Northern Shenandoah Valley Region Total Population – 2010 Census</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Locality</strong></td>
</tr>
<tr>
<td>Clarke County</td>
</tr>
<tr>
<td>Berryville</td>
</tr>
<tr>
<td>Boyce</td>
</tr>
<tr>
<td>Frederick County</td>
</tr>
<tr>
<td>Middletown</td>
</tr>
<tr>
<td>Stephens City</td>
</tr>
<tr>
<td>Page County</td>
</tr>
<tr>
<td>Luray</td>
</tr>
<tr>
<td>Shenandoah</td>
</tr>
<tr>
<td>Stanley</td>
</tr>
<tr>
<td>Shenandoah County</td>
</tr>
<tr>
<td>Edinburg</td>
</tr>
<tr>
<td>Mount Jackson</td>
</tr>
<tr>
<td>New Market</td>
</tr>
<tr>
<td>Strasburg</td>
</tr>
<tr>
<td>Toms Brook</td>
</tr>
<tr>
<td>Woodstock</td>
</tr>
<tr>
<td>Warren County</td>
</tr>
<tr>
<td>Front Royal</td>
</tr>
<tr>
<td>Winchester city</td>
</tr>
<tr>
<td>NSVR Total</td>
</tr>
</tbody>
</table>

*Table X – Northern Shenandoah Valley Region Population (source: 2010 Census, ACS 5yr Survey 2010-2015)*

The 2010 U.S. Census total population recorded for the Northern Shenandoah Valley is 222,152. The most populous NSVRC jurisdiction is Frederick County, with a population of 78,305. The City of Winchester has the highest population density, with a rate of 2,848.2 persons per sq mi. The top 3 towns in terms of population density according to the 2010 Census are Berryville, Strasburg and Middletown. Table 3.3 lists the population and population density per county/town.
## Northern Shenandoah Valley Region County/Town Population Density - 2010 Census

<table>
<thead>
<tr>
<th>Locality - (Area)</th>
<th>Total Population</th>
<th>Population Density</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clarke County - (175.9 sq mi)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Berryville (2.3 sq mi)</td>
<td>4,185</td>
<td>1819.6</td>
</tr>
<tr>
<td>Boyce (0.4 sq mi)</td>
<td>589</td>
<td>235.6</td>
</tr>
<tr>
<td><strong>Frederick County - (413.5 sq mi)</strong></td>
<td>78,305</td>
<td>189.4</td>
</tr>
<tr>
<td>Middletown (0.8 sq mi)</td>
<td>1,265</td>
<td>1012.0</td>
</tr>
<tr>
<td>Stephens City (2.4 sq mi)</td>
<td>1,829</td>
<td>762.1</td>
</tr>
<tr>
<td><strong>Page County - (310.8 sq mi)</strong></td>
<td>24,042</td>
<td>77.4</td>
</tr>
<tr>
<td>Luray (4.8 sq mi)</td>
<td>4,895</td>
<td>1019.8</td>
</tr>
<tr>
<td>Shenandoah (2.2 sq mi)</td>
<td>2,373</td>
<td>1078.6</td>
</tr>
<tr>
<td>Stanley (1.4 sq mi)</td>
<td>1,689</td>
<td>1206.4</td>
</tr>
<tr>
<td><strong>Shenandoah County - (508.3 sq mi)</strong></td>
<td>41,993</td>
<td>82.6</td>
</tr>
<tr>
<td>Edinburg (0.8 sq mi)</td>
<td>1,041</td>
<td>832.8</td>
</tr>
<tr>
<td>Mount Jackson (2.7 sq mi)</td>
<td>1,994</td>
<td>738.5</td>
</tr>
<tr>
<td>New Market (2.0 sq mi)</td>
<td>2,146</td>
<td>1073.0</td>
</tr>
<tr>
<td>Strasburg (3.7 sq mi)</td>
<td>6,398</td>
<td>1729.2</td>
</tr>
<tr>
<td>Toms Brook (0.1 sq mi)</td>
<td>258</td>
<td>25.8</td>
</tr>
<tr>
<td>Woodstock (3.9 sq mi)</td>
<td>5,097</td>
<td>1306.9</td>
</tr>
<tr>
<td><strong>Warren County - (213.8 sq mi)</strong></td>
<td>37,575</td>
<td>175.7</td>
</tr>
<tr>
<td>Front Royal (10.3 sq mi)</td>
<td>14,440</td>
<td>1401.9</td>
</tr>
<tr>
<td><strong>Winchester City - (9.2 sq mi)</strong></td>
<td>26,203</td>
<td>2848.2</td>
</tr>
<tr>
<td><strong>NSVR Total - (1,622.3 sq mi)</strong></td>
<td>222,152</td>
<td>136.9</td>
</tr>
</tbody>
</table>

*Table X – County/Town Population Density (source: 2010 U.S. Census, ACS 5yr Survey 2010-2015)*

The University of Virginia’s Weldon Cooper Center for Public Service provides intercensal population estimates, to aid in planning purposes across agencies statewide. The Weldon Cooper Center develops an annual population approximation according to the population count on July 1st of the previous year. The center estimates that the Regional 2016 total population is 230,474. Table 3.4 displays the Weldon Cooper Center’s year 2010-2016 county population estimates.
### Intercensal Population Estimates: 2010-2016

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Virginia</td>
<td>8,001,024</td>
<td>8,025,514</td>
<td>8,096,604</td>
<td>8,185,867</td>
<td>8,260,405</td>
<td>8,326,289</td>
<td>8,382,993</td>
</tr>
<tr>
<td>Clarke County</td>
<td>14,034</td>
<td>14,067</td>
<td>14,211</td>
<td>14,276</td>
<td>14,148</td>
<td>14,323</td>
<td>14,206</td>
</tr>
<tr>
<td>Frederick County</td>
<td>78,305</td>
<td>78,834</td>
<td>79,156</td>
<td>80,118</td>
<td>81,207</td>
<td>82,059</td>
<td>82,623</td>
</tr>
<tr>
<td>Page County</td>
<td>24,042</td>
<td>24,058</td>
<td>24,155</td>
<td>24,215</td>
<td>24,079</td>
<td>24,083</td>
<td>23,719</td>
</tr>
<tr>
<td>Shenandoah County</td>
<td>41,993</td>
<td>42,172</td>
<td>42,114</td>
<td>42,812</td>
<td>42,889</td>
<td>42,916</td>
<td>42,228</td>
</tr>
<tr>
<td>Warren County</td>
<td>37,575</td>
<td>37,729</td>
<td>37,688</td>
<td>38,077</td>
<td>38,387</td>
<td>38,814</td>
<td>38,829</td>
</tr>
<tr>
<td>Winchester City</td>
<td>26,203</td>
<td>26,265</td>
<td>26,167</td>
<td>27,208</td>
<td>26,961</td>
<td>27,200</td>
<td>27,515</td>
</tr>
<tr>
<td>NSVRC Total</td>
<td>222,152</td>
<td>223,125</td>
<td>223,490</td>
<td>226,706</td>
<td>227,671</td>
<td>229,395</td>
<td>229,120</td>
</tr>
</tbody>
</table>

Table X – Intercenal Population Estimates per County (source: Weldon Cooper Center for Public Service, Demographics Research)

According to these projections, the regional population has increased by approximately 8,322 persons. Winchester City still has the highest ranking population density, recording nearly 3,000 persons per square mile, increasing by approximately 150 persons per square mile in comparison the 2010 census record. Table 3.5 displays the projected county population density for year 2016.

### Northern Shenandoah Valley Region

#### County Population Density - 2016 Projections

<table>
<thead>
<tr>
<th>Locality - (Area)</th>
<th>Total Population</th>
<th>Population Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarke County - (175.9 sq mi)</td>
<td>14,240</td>
<td>80.9</td>
</tr>
<tr>
<td>Frederick County - (413.5 sq mi)</td>
<td>83,998</td>
<td>203.1</td>
</tr>
<tr>
<td>Page County - (310.8 sq mi)</td>
<td>23,586</td>
<td>76.1</td>
</tr>
<tr>
<td>Shenandoah County - (508.3 sq mi)</td>
<td>41,938</td>
<td>82.5</td>
</tr>
<tr>
<td>Warren County - (213.8 sq mi)</td>
<td>39,181</td>
<td>183.3</td>
</tr>
<tr>
<td>Winchester City - (9.2 sq mi)</td>
<td>27,531</td>
<td>2992.5</td>
</tr>
<tr>
<td>NSVRC Total - (1,622.3 sq mi)</td>
<td>230,474</td>
<td>142.1</td>
</tr>
</tbody>
</table>


The Weldon Cooper Center’s current 2020-2040 population projections see an increase of 332,465 persons for the state of Virginia, by the year 2020. The center projects the NSV region will increase by 4,818 persons. Table 3.6 exhibits the center’s population projections for year 2020-2040.
Population Projections - 2020, 2030, 2040

<table>
<thead>
<tr>
<th>Locality</th>
<th>Total Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2020</td>
</tr>
<tr>
<td><strong>Virginia</strong></td>
<td>8,744,273</td>
</tr>
<tr>
<td>Clarke County</td>
<td>14,337</td>
</tr>
<tr>
<td>Frederick County</td>
<td>86,574</td>
</tr>
<tr>
<td>Page County</td>
<td>23,387</td>
</tr>
<tr>
<td>Shenandoah County</td>
<td>42,363</td>
</tr>
<tr>
<td>Warren County</td>
<td>39,925</td>
</tr>
<tr>
<td>Winchester city</td>
<td>28,705</td>
</tr>
<tr>
<td>NSVRC</td>
<td>235,292</td>
</tr>
</tbody>
</table>

Table X – Population Projections (source: Weldon Cooper Center for Public Service, Demographics Research)

The Weldon Cooper Center’s 2020 population projections yield a regional population density increase of 8.13, resulting in a 2020 population regional density estimate of 145.04 persons per sq mi. Table 3.7 exhibits the center’s population density projections for year 2020-2040.

NSVRC Population Density Projections - 2020-2040

<table>
<thead>
<tr>
<th>Locality - (Area)</th>
<th>Total Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2020</td>
</tr>
<tr>
<td></td>
<td>Density</td>
</tr>
<tr>
<td>Clarke County - (175.9 sq mi)</td>
<td>15,266</td>
</tr>
<tr>
<td>Frederick County - (413.5 sq mi)</td>
<td>101,471</td>
</tr>
<tr>
<td>Page County - (310.8 sq mi)</td>
<td>23,583</td>
</tr>
<tr>
<td>Shenandoah County - (508.3 sq mi)</td>
<td>46,803</td>
</tr>
<tr>
<td>Warren County - (213.8 sq mi)</td>
<td>44,444</td>
</tr>
<tr>
<td>Winchester City - (9.2 sq mi)</td>
<td>31,107</td>
</tr>
<tr>
<td>NSVR Total - (1,622.3 sq mi)</td>
<td>9,546,958</td>
</tr>
</tbody>
</table>

Table X – Population Density Projections (source: Weldon Cooper Center for Public Service, Demographics Research)

Shenandoah County possesses the largest proportion of elderly persons, with an average of 19.7% of its inhabitants being age 65 or older, around 2.6% higher than the regional average. Berryville, Luray, New Market, and Woodstock all have elderly populations that exceed 20% of their recorded populaces.

Frederick County possesses the largest proportion of younger individuals, with an average of 23.1% of its inhabitants being under the age of 18, around 1.6% higher than the regional average. Luray, Shenandoah, Stanley, and New Market are the only jurisdictions listed that do not exceed 20%. The town of Toms Brook possesses the highest proportion of younger individuals, with 32.3% of its population being under the age of 18. Table 3.8 displays the percentage of under 18 and over 65 years of age, per jurisdiction.
## Northern Shenandoah Valley Region Age Profile

<table>
<thead>
<tr>
<th>Locality</th>
<th>Under 18</th>
<th>Over 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarke County</td>
<td>21.50%</td>
<td>18.80%</td>
</tr>
<tr>
<td>Berryville</td>
<td>24.00%</td>
<td>21.40%</td>
</tr>
<tr>
<td>Boyce</td>
<td>26.50%</td>
<td>13.40%</td>
</tr>
<tr>
<td>Frederick County</td>
<td>23.10%</td>
<td>16.10%</td>
</tr>
<tr>
<td>Middletown</td>
<td>25.80%</td>
<td>10.80%</td>
</tr>
<tr>
<td>Stephens City</td>
<td>20.20%</td>
<td>14.10%</td>
</tr>
<tr>
<td>Page County</td>
<td>20.50%</td>
<td>19.30%</td>
</tr>
<tr>
<td>Luray</td>
<td>17.50%</td>
<td>27.20%</td>
</tr>
<tr>
<td>Shenandoah</td>
<td>18.30%</td>
<td>17.30%</td>
</tr>
<tr>
<td>Stanley</td>
<td>19.20%</td>
<td>18.10%</td>
</tr>
<tr>
<td>Shenandoah County</td>
<td>21.10%</td>
<td>19.70%</td>
</tr>
<tr>
<td>Edinburg</td>
<td>27.30%</td>
<td>16.50%</td>
</tr>
<tr>
<td>Mount Jackson</td>
<td>29.10%</td>
<td>11.00%</td>
</tr>
<tr>
<td>New Market</td>
<td>18.20%</td>
<td>24.40%</td>
</tr>
<tr>
<td>Strasburg</td>
<td>22.70%</td>
<td>16.40%</td>
</tr>
<tr>
<td>Toms Brook</td>
<td>32.30%</td>
<td>13.70%</td>
</tr>
<tr>
<td>Woodstock</td>
<td>25.60%</td>
<td>21.50%</td>
</tr>
<tr>
<td>Warren County</td>
<td>23.00%</td>
<td>14.10%</td>
</tr>
<tr>
<td>Front Royal</td>
<td>23.00%</td>
<td>15.10%</td>
</tr>
<tr>
<td>Winchester City</td>
<td>22.40%</td>
<td>14.30%</td>
</tr>
<tr>
<td>NSVRC Average</td>
<td>21.90%</td>
<td>17.10%</td>
</tr>
</tbody>
</table>

*Table X – NSVRC Age Profile (source: 2010 Census, ACS 5yr Survey 2010-2015)*

### Populations at Risk

The eight factors to identify populations at risk included:

1. Socio-economic status;
2. Wealth;
3. Elderly populations;
4. Female heads of Large Households in densely populated areas;
5. Rural areas;
6. Non-English proficient populations (English as a second language populations, etc.);
7. Female labor force; and
8. Households living in Manufactured Housing.

A challenge in emergency management and in all government support services is to include the immigrant population in the NSV region since these residents are not fully captured by traditional Census or this vulnerability analysis. English as the secondary language is a large portion of much of the Valley, especially for migrant workers in the poultry processing plants and orchard pickers. Special needs populations were not included in this update of the regional Plan but will be considered in future iterations of the plan.

The factors that attract businesses and people to the area present the greatest challenges to regional Emergency Managers and cause significant hazard mitigation challenges including: growth, dense populations, over-taxed transportation routes, communication, and knowledge of how to mitigate vulnerable buildings and prepare for disasters.

Households
The U.S. Census Bureau classifies a household as the number of people who occupy a housing unit (such as a house or apartment) as their usual place of residence. The 2010 Census documented the Northern Shenandoah Valley as accounting for approximately 2.8% of Virginia’s total households. Frederick County possesses the largest number within the region, making up approximately 34% of the region’s total. Table X displays the 2010 U.S. Census recorded households for Virginia and the NSVRC jurisdictions.

<table>
<thead>
<tr>
<th>Locality</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virginia</td>
<td>3,062,783</td>
</tr>
<tr>
<td>Clarke County</td>
<td>5,526</td>
</tr>
<tr>
<td>Frederick County</td>
<td>29,455</td>
</tr>
<tr>
<td>Page County</td>
<td>9,372</td>
</tr>
<tr>
<td>Shenandoah County</td>
<td>17,096</td>
</tr>
<tr>
<td>Warren County</td>
<td>14,364</td>
</tr>
<tr>
<td>Winchester city</td>
<td>10,608</td>
</tr>
<tr>
<td>NSVRC</td>
<td>86,421</td>
</tr>
</tbody>
</table>

Table X – Number of Households (sources: U.S. Census Bureau – 2010 Census, 2011-2015 American Community Survey 5-Year Estimates)

The average household income across the entire Northern Shenandoah Valley is $56,873. Clarke County’s median household income ranks the highest among NSVRC jurisdictions at $71,295 - $14,442 greater than the regional Average. Page County’s median household income ranks lowest amongst the region, at $43,895 - $12,978 lower than the regional average. Table X displays the 2010 regional household income U.S. Census data.
### Northern Shenandoah Valley Region Median Household Income

<table>
<thead>
<tr>
<th>Locality</th>
<th>Median Household Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarke County</td>
<td>$71,295</td>
</tr>
<tr>
<td>Berryville</td>
<td>$56,591</td>
</tr>
<tr>
<td>Boyce</td>
<td>$72,083</td>
</tr>
<tr>
<td>Frederick County</td>
<td>$69,827</td>
</tr>
<tr>
<td>Middletown</td>
<td>$60,625</td>
</tr>
<tr>
<td>Stephens City</td>
<td>$55,625</td>
</tr>
<tr>
<td>Page County</td>
<td>$43,895</td>
</tr>
<tr>
<td>Luray</td>
<td>$39,152</td>
</tr>
<tr>
<td>Shenandoah</td>
<td>$40,139</td>
</tr>
<tr>
<td>Stanley</td>
<td>$32,895</td>
</tr>
<tr>
<td>Shenandoah County</td>
<td>$49,406</td>
</tr>
<tr>
<td>Edinburg</td>
<td>$40,375</td>
</tr>
<tr>
<td>Mount Jackson</td>
<td>$35,750</td>
</tr>
<tr>
<td>New Market</td>
<td>$36,815</td>
</tr>
<tr>
<td>Strasburg</td>
<td>$50,676</td>
</tr>
<tr>
<td>Toms Brook</td>
<td>$55,750</td>
</tr>
<tr>
<td>Woodstock</td>
<td>$35,267</td>
</tr>
<tr>
<td>Warren County</td>
<td>$61,454</td>
</tr>
<tr>
<td>Front Royal</td>
<td>$47,981</td>
</tr>
<tr>
<td>Winchester City</td>
<td>$45,363</td>
</tr>
<tr>
<td>NSVR Total</td>
<td>$56,873</td>
</tr>
</tbody>
</table>

*Table X – NSV Region Median Household Income (sources: U.S. Census Bureau – 2010 Census)*

### Housing

The United States Census Bureau’s American Community Survey inventoried 100,310 housing units throughout the entire Northern Shenandoah Valley region. Frederick County possesses 33,385 housing units, the most in the region. The highest housing unit density was recorded by Winchester, with a rate of 1,294 units per square mile. The highest occupancy rate recorded across the region is 96%, as noted for the towns of Boyce and Middletown. Table X displays the regional housing unit totals, the housing unit density, occupancy rates and median housing unit values.
## Northern Shenandoah Valley Region
### Housing Units, Density, Occupancy Rates and Median Values

<table>
<thead>
<tr>
<th>Locality - (Area)</th>
<th>Number of Units</th>
<th>Housing unit density</th>
<th>% Occupied</th>
<th>Median value of owner-occupied housing units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarke County - (175.9 sq mi)</td>
<td>6,261</td>
<td>36</td>
<td>88%</td>
<td>$329,500</td>
</tr>
<tr>
<td>Berryville (2.3 sq mi)</td>
<td>1,796</td>
<td>781</td>
<td>87%</td>
<td>$295,800</td>
</tr>
<tr>
<td>Boyce (0.4 sq mi)</td>
<td>260</td>
<td>650</td>
<td>96%</td>
<td>$296,400</td>
</tr>
<tr>
<td>Frederick County - (413.5 sq mi)</td>
<td>33,385</td>
<td>81</td>
<td>92%</td>
<td>$243,600</td>
</tr>
<tr>
<td>Middletown (0.8 sq mi)</td>
<td>558</td>
<td>698</td>
<td>96%</td>
<td>$163,500</td>
</tr>
<tr>
<td>Stephens City (2.4 sq mi)</td>
<td>878</td>
<td>366</td>
<td>90%</td>
<td>$171,700</td>
</tr>
<tr>
<td>Page County - (310.8 sq mi)</td>
<td>11,636</td>
<td>37</td>
<td>81%</td>
<td>$176,000</td>
</tr>
<tr>
<td>Luray (4.8 sq mi)</td>
<td>2,227</td>
<td>464</td>
<td>86%</td>
<td>$174,600</td>
</tr>
<tr>
<td>Shenandoah (2.2 sq mi)</td>
<td>1,209</td>
<td>550</td>
<td>84%</td>
<td>$143,700</td>
</tr>
<tr>
<td>Stanley (1.4 sq mi)</td>
<td>794</td>
<td>567</td>
<td>86%</td>
<td>$153,500</td>
</tr>
<tr>
<td>Shenandoah County - (508.3 sq mi)</td>
<td>21,026</td>
<td>41</td>
<td>81%</td>
<td>$198,900</td>
</tr>
<tr>
<td>Edinburg (0.8 sq mi)</td>
<td>571</td>
<td>714</td>
<td>84%</td>
<td>$159,000</td>
</tr>
<tr>
<td>Mount Jackson (2.7 sq mi)</td>
<td>907</td>
<td>336</td>
<td>85%</td>
<td>$130,100</td>
</tr>
<tr>
<td>New Market (2.0 sq mi)</td>
<td>1,043</td>
<td>522</td>
<td>91%</td>
<td>$191,200</td>
</tr>
<tr>
<td>Strasburg (3.7 sq mi)</td>
<td>3,155</td>
<td>853</td>
<td>88%</td>
<td>$182,400</td>
</tr>
<tr>
<td>Toms Brook (0.1 sq mi)</td>
<td>122</td>
<td>1,220</td>
<td>93%</td>
<td>$155,300</td>
</tr>
<tr>
<td>Woodstock (3.9 sq mi)</td>
<td>2,287</td>
<td>586</td>
<td>91%</td>
<td>$188,200</td>
</tr>
<tr>
<td>Warren County - (213.8 sq mi)</td>
<td>16,099</td>
<td>75</td>
<td>89%</td>
<td>$213,500</td>
</tr>
<tr>
<td>Front Royal (10.3 sq mi)</td>
<td>6,348</td>
<td>616</td>
<td>88%</td>
<td>$170,100</td>
</tr>
<tr>
<td>Winchester City - (9.2 sq mi)</td>
<td>11,903</td>
<td>1,294</td>
<td>89%</td>
<td>$216,300</td>
</tr>
<tr>
<td>NSVR Total - (1,622.3 sq mi)</td>
<td>100,310</td>
<td>62</td>
<td>AVG: 89%</td>
<td>$229,633</td>
</tr>
</tbody>
</table>

**Figure X** – NSV Region Housing Units, Density, Occupancy Rates and Median Values *(sources: U.S. Census Bureau – 2010 Census, 2011-2015 American Community Survey 5-Year Estimates)*

Manufactured housing communities consist of homes originally designed to be towed on their own chassis. These types of structures are at the highest risk of succumbing to extensive damage during times of natural disaster. They are also more likely to house elderly or low income residents. Table X was generated using the HAZUS-MH plug in for ArcGIS. Shown on the map are areas with increased numbers of manufactured homes, most being in Frederick County. The largest manufactured housing community in the region belongs to Blue Ridge Mobile Home Park, with nearly 90 lots.
Figure X – Northern Shenandoah Valley Region Manufactured Housing Concentrations (source: U.S. Census Bureau, HAZUS-MH)
Property Values

The following property values were recorded by the commissioner of revenue for each jurisdiction. These numbers are in accordance with the January 1, 2017 Tax Book.

<table>
<thead>
<tr>
<th>Locality</th>
<th>Taxable Structures</th>
<th>Nontaxable Structures</th>
<th>Total Property Values (Commissioner of Revenue January 1, 2017 Tax book)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarke County</td>
<td>$883,785,000</td>
<td>$67,843,100</td>
<td>$1,269,383,800</td>
</tr>
<tr>
<td>Town of Berryville</td>
<td>$341,319,100</td>
<td>$38,137,600</td>
<td>$38,137,600</td>
</tr>
<tr>
<td>Town of Boyce</td>
<td>$44,279,700</td>
<td>$8,305,200</td>
<td>$52,584,900</td>
</tr>
<tr>
<td>Frederick County</td>
<td>$6,149,85,467</td>
<td>$853,673,900</td>
<td>$853,673,900</td>
</tr>
<tr>
<td>Town of Middletown</td>
<td>NDA</td>
<td>NDA</td>
<td>NDA</td>
</tr>
<tr>
<td>Town of Stephens City</td>
<td>NDA</td>
<td>NDA</td>
<td>NDA</td>
</tr>
<tr>
<td>Page County</td>
<td>$876,062,945</td>
<td>$114,710,700</td>
<td>$990,773,645</td>
</tr>
<tr>
<td>Town of Luray</td>
<td>$336,978,500</td>
<td>$49,750,100</td>
<td>$386,428,600</td>
</tr>
<tr>
<td>Town of Stanley</td>
<td>$120,398,300</td>
<td>$13,189,700</td>
<td>$133,588,000</td>
</tr>
<tr>
<td>Town of Shenandoah</td>
<td>$73,582,400</td>
<td>$16,162,100</td>
<td>$89,744,500</td>
</tr>
<tr>
<td>Shenandoah County</td>
<td>$2,817,314,100</td>
<td>$470,471,900</td>
<td>$3,287,786,000</td>
</tr>
<tr>
<td>Town of Edinburg</td>
<td>$59,197,300</td>
<td>$11,645,500</td>
<td>$70,842,800</td>
</tr>
<tr>
<td>Town of Mount Jackson</td>
<td>$116,405,400</td>
<td>$21,758,000</td>
<td>$138,163,400</td>
</tr>
<tr>
<td>Town of New Market</td>
<td>$123,725,400</td>
<td>$14,054,900</td>
<td>$137,780,300</td>
</tr>
<tr>
<td>Town of Strasburg</td>
<td>$416,538,900</td>
<td>$86,299,900</td>
<td>$502,838,800</td>
</tr>
<tr>
<td>Town of Toms Brook</td>
<td>$11,817,900</td>
<td>$2,149,600</td>
<td>$13,967,500</td>
</tr>
<tr>
<td>Town of Woodstock</td>
<td>$356,827,600</td>
<td>$145,712,700</td>
<td>$502,540,300</td>
</tr>
<tr>
<td>Warren County</td>
<td>$1,963,908,900</td>
<td>$214,310,600</td>
<td>$2,178,219,500</td>
</tr>
<tr>
<td>Town of Front Royal</td>
<td>$822,761,300</td>
<td>$296,666,200</td>
<td>$1,119,427,500</td>
</tr>
<tr>
<td>City of Winchester</td>
<td>$2,051,450,600</td>
<td>$836,718,300</td>
<td>$2,888,168,900</td>
</tr>
</tbody>
</table>

Table X – NSV Property Values

Transitional Sheltering Assistance

In cases of displacement, those affected may become eligible for Transitional Sheltering Assistance (TSA). In conjunction with participating hotels, under this program, FEMA will cover the cost of the room and taxes. An interactive map has been produced by FEMA to display participating hotels. It can be found on the FEMA ArcGIS online portal (fema.maps.arcgis.com), and should be checked regularly for regional updates. The FEMA Helpline (800) 621-3362 should be contacted to confirm the inventory of participating hotels displayed on the map, and the establishment should be contacted to confirm availability of vacant rooms. The FEMA TSA webapp currently displays 3 FEMA designated evacuation hotels within the Northern Shenandoah Valley Region:

- Ramada Strasburg –
35 Brandy Ct.
Strasburg, VA 22657
(540) 465-2444
- Quality Inn –
  o 10 S. Commerce St.
    Front Royal, VA 22630
    (540) 635-3161
- Days Inn –
  o 9360 George Collin Pkwy.
    New Market, VA 22844
    (540) 740-4100

Medical

Winchester Medical Center (WMC) serves the Virginia, West Virginia, and Maryland tristate area providing complete health care. The WMC is owned and operated by the Valley Health System. The WMC features their Heart Center, which was ranked as one of the Top 100 in the nation, a Cancer Center, and an Inpatient/Outpatient Rehab Center.

Warren Memorial Hospital located in Front Royal, Virginia is a sister hospital to WMC as they both are owned and operated by Valley Health System. Warren Memorial offers a Women’s Care Center and a 40 bed Nursing Home as part of the hospital’s facilities.

Shenandoah Memorial Hospital located in Woodstock, Virginia, provides primary health care to Shenandoah County and is owned and operated by Valley Health System. Shenandoah Memorial Hospital features their Family Centered Maternity Ward, Intensive/Coronary Care Unit and Ambulatory Surgery.

Page Memorial Hospital is located in Luray, Virginia and provides primary health care to the immediate surrounding area of Page County.

VA Medical Center in Martinsburg, West Virginia provides quality medical care to veterans in the Northern Shenandoah Valley. An Outpatient clinic is now available in Stephens City on Aylor Rd. Emergency airlift is available by Pegasus to the University of Virginia Medical Center and by medivac to INOVA Medical Center.

Research conducted by the NSVRC concluded that there is #X number of urgent care facilities located within the region, which can provide adequate medical service for non-life-threatening injuries/illnesses.
Figure X – Northern Shenandoah Valley Region Medical Facilities (source: U.S. Census Bureau, HAZUS-MH)
Education
Clarke County: 8 schools – Approximately XX students/XX faculty
Frederick County: 22 schools – Approximately XX students/XX faculty
Page County: 10 schools – Approximately XX students/XX faculty
Shenandoah County: 16 schools - Approximately XX students/XX faculty
Warren County: 14 schools, 2 colleges/universities - Approximately XX students/XX faculty
Winchester City: 9 schools, 2 colleges/universities - Approximately XX students/XX faculty

Figure X – Clarke County Schools
Figure X – Frederick County Schools
Figure X – Page County Schools
Figure X – Shenandoah County Schools
Employment Data and Labor force Analysis

According to the Virginia Employment Commission, the top employers in the Northern Shenandoah Valley are listed below (in alphabetical order). These top employers are anticipated to continue to grow throughout the region through 2040 (per Virginia Employment Commission).

- Berryville Graphics
- Cracker Barrel Old Country Store
- Food Lion
- Frederick County
- Frederick County School Board
- George's Chicken, Inc.
- The Home Depot
• Lowes’ Home Centers, Inc.
• Marshall’s
• Martin’s Food Market
• Page County School Board
• Postal Service
• Rubbermaid Commercial Products LLC
• Shenandoah County School Board
• Shenandoah University
• Target Corporation
• U.S. Department of Homeland Defense
• Valley Health System
• VDOT
• Wal-Mart
• Warren County School Board
• Winchester City
• Winchester City Public Schools

These listed employers provide the largest percentage of employment within the Shenandoah Valley as categorized by industry with many serving in manufacturing, construction, retail trade, educational services, health care and social assistance, and accommodation and food services sectors.

Transportation

Highways, Interstates, Major Roads
Two major U.S. Interstates intersect the Northern Shenandoah Valley Region. Interstate 81 operates North/South through the western portions of Frederick and Shenandoah Counties, while Interstate 66 enters Warren County from the East, connecting with Interstate 81 near the Frederick/Shenandoah County borders. Several notable arterial highways provide access to these interstates. U.S. 11 runs parallel to Interstate 81, operating North/South throughout the entire length of region. U.S. 522 proceeds diagonally through Frederick County, enters Clarke at its SW corner, and then connects with U.S. 340 North/South in Warren County. U.S. 50 operates East/West through Frederick County and intersects with U.S. 17 in Clarke. Skyline Drive (State Route 48) is a scenic highway that runs along the Eastern border of Warren and Page Counties, attracting a continuous flow of tourists annually.
Figure X – NSV Highways
Railroads

Nearly 230 miles of rail are established within the Northern Shenandoah Valley Region. The two primary railroads operating in the region are CSX and Norfolk Southern lines. Norfolk Southern has lines running through Clarke, Frederick, Warren, Page and Shenandoah Counties. The CSX rail lines run mainly through Frederick County. Conrail Railroad serves as a shared asset of CSX Railroad and Norfolk Southern Railroad, with its tracks located North of Winchester. The Winchester and Western Railroad connects to the Conrail line, operating through Winchester into the western portions of Frederick County.
Figure X – NSV Railroads
Public Transportation
The City of Winchester and Front Royal operate a bus/trolley service throughout their communities. Winchester’s fixed-route and para-transit services operate 6 days a week Monday-Friday 6:00 a.m. – 7:58 p.m., and on Saturday 8:50 a.m. – 4:58 p.m. The Winchester City Trolley operate Monday/Wednesday/Friday 8:00 a.m. – 6:44 p.m., and on Saturdays 10:10 a.m. – 4:34 p.m. Front Royal manages both a North and South trolley service loop. The North loop runs from 8:30 a.m. – 4:00 p.m., while the South loop runs from 9:00 a.m. – 4:30 p.m. Saturday service is active during the months of May and June, operating from 1:00 p.m. to 5:30 p.m. and Sunday operates between 1:00 p.m. – 6:00 p.m.

Airports
There are 4 airports local to the Northern Shenandoah Valley Region: Front Royal-Warren County Airport, Luray Caverns Airport, New Market Airport and Winchester Regional Airport. Of these local facilities, Winchester Regional is the only to offer a customs service, parallel taxiways and an airport terminal. The nearest international airports are located in Dulles, VA, (Washington/Dulles International Airport), Washington, D.C. (Ronald Regan International Airport) and Baltimore, MD (Baltimore/Washington International – Thurgood Marshall Airport).
Figure X – NSV Airports
Bus Terminals
Greyhound Lines has a bus terminal that is located in Winchester offering intercity transportation to over 3,800 stops throughout the nation.
The Virginia Breeze bus service connects the Northern Shenandoah Valley to cities along Interstate 81 and 66, with serval stops in the New River Valley, Shenandoah Valley and Northern Virginia.
**Figure X – NSV Bus Terminals**
**Virginia Inland Port**

The Virginia Port Authority manages 6 cargo terminals throughout the state of Virginia. These port facilities generate nearly $17.5 billion in annual compensation, contribute $1.4 million in state and local taxes, and are responsible for nearly 10% of the state’s resident workforce (William & Mary).

Front Royal is home to the VA Port Authority’s Virginia Inland Port. The Virginia Inland Port offers wheeled storage, grounded storage, and general open storage. There are currently 19 acres available here for lease. It has direct access to Interstates 81 and 66, and is home to 17,280 linear feet of railroad tracks.
Figure X – NSVRC VA Inland Port
Utilities and Services

Electricity

Power Suppliers: Allegheny Power System and Virginia Power

Power Distributors: Allegheny Power System, Virginia Power, Shenandoah Valley Electric Cooperative and the Town of Front Royal

Public Utilities

<table>
<thead>
<tr>
<th>Locality</th>
<th>Water Max Capacity</th>
<th>Water Average Daily</th>
<th>Sewer Capacity Daily</th>
<th>Sewer Percent load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarke: Berryville</td>
<td>864,000GPD</td>
<td>406,000GPD</td>
<td>450,000GPD</td>
<td>56%</td>
</tr>
<tr>
<td>Boyce/Millwood/ White Post</td>
<td>180,000GPD</td>
<td>65,000GPD</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Boyce/Millwood</td>
<td>-</td>
<td>-</td>
<td>50,000</td>
<td>44%</td>
</tr>
<tr>
<td>Frederick: Middletown</td>
<td>3,200,000GPD</td>
<td>2,213,000GPD</td>
<td>8,400,000GPD</td>
<td>58%</td>
</tr>
<tr>
<td>Stephens City</td>
<td>3,200,000GPD</td>
<td>2,213,000GPD</td>
<td>8,400,000GPD</td>
<td>58%</td>
</tr>
<tr>
<td>Page: Luray</td>
<td>1,224,000GPD</td>
<td>854,000GPD</td>
<td>2,400,000GPD</td>
<td>64%</td>
</tr>
<tr>
<td>Shenandoah</td>
<td>601,000GPD</td>
<td>246,359GPD</td>
<td>250,000GPD</td>
<td>56%</td>
</tr>
<tr>
<td>Stanley</td>
<td>529,600GPD</td>
<td>450,000GPD</td>
<td>300,000GPD</td>
<td>50%</td>
</tr>
<tr>
<td>Shenandoah: Bayse</td>
<td>269,000GPD</td>
<td>150,583GPD</td>
<td>600,000GPD</td>
<td>66%</td>
</tr>
<tr>
<td>Edinburg</td>
<td>250,000GPD</td>
<td>126,000GPD</td>
<td>175,000GPD</td>
<td>53%</td>
</tr>
<tr>
<td>Mt. Jackson</td>
<td>580,000GPD</td>
<td>301,000GPD</td>
<td>200,000GPD</td>
<td>90%</td>
</tr>
<tr>
<td>New Market</td>
<td>1,600,000GPD</td>
<td>545,000GPD</td>
<td>500,000GPD</td>
<td>90%</td>
</tr>
<tr>
<td>Strasburg</td>
<td>1,140,000GPD</td>
<td>800,000GPD</td>
<td>975,000GPD</td>
<td>82%</td>
</tr>
<tr>
<td>Toms Brook/ Maurertown</td>
<td>170,000GPD</td>
<td>95,000GPD</td>
<td>189,796GPD</td>
<td>52%</td>
</tr>
<tr>
<td>Woodstock</td>
<td>1,300,000GPD</td>
<td>750,000GPD</td>
<td>1,000,000GPD</td>
<td>55%</td>
</tr>
<tr>
<td>Warren: Front Royal</td>
<td>3,000,000GPD</td>
<td>2,131,000GPD</td>
<td>4,000,000GPD</td>
<td>62%</td>
</tr>
<tr>
<td>City of Winchester</td>
<td>10,000,000GPD</td>
<td>7,106,000GPD</td>
<td>8,400,000GPD</td>
<td>58%</td>
</tr>
</tbody>
</table>

Table X – NSVRC Water and Sewer Statistics

Solid Waste Disposal

- Frederick Co. Sanitary Landfill (540 Acres) [also serves City of Winchester and Clarke Co.]
- Shenandoah Co. Sanitary Landfill (214 Acres)
- Warren Co. Waste Transfer Station (8 Acres)
- Page Co. Landfill (160 Acres)

Natural Gas Suppliers

- Amerigas-Shengas Division
- Columbia Gas Transmission Corp.
- Shenandoah Gas Co.

**LP Gas Distributors**
- Amerigas-Shengas Division
- Battle of Cedar Creek Campground
- Columbia Gas of Virginia
- Commonwealth Propane
- Holtzman Propane
- Petrolane Gas
- Quarles Petroleum, Inc.
- Roberts Oxygen Co. Inc.
- Shenandoah Valley Oil
- Southern States
- Tri-State Propane
- Valley Gas Corp.

**Fuel Oil Distributors**
- Bauserman Oil
- Clarke Co. Supply
- E.N. Hershberger Co.
- Emmart’s Luray Gas & Oil Co.
- Glover John D. & Sons
- H.N. Funkhouser & Co.
- Holtzman Oil Corp.
- Mercer Oil & Coal Co.
- Mowery Oil Co.
- Quarles Petroleum
- Shenandoah Valley Oil Co.
- Southern States
- Valley Discount Fuel Oil

**Coal Services**
- Al Shirley & Sons, Inc.
- Henry’s Coal Yard; Mercer Oil & Coal Co.
- Orndorff’s Coal Yard
- Vehrencamps

**Communications**

**Telephone Service:**
- Local: Adelphia, Intelos, Sprint, Shenandoah Telephone Co., Verizon
- Long Distance: Equal Access for all of District Region

**Internet Providers:**
- Adelphia
- Intelos
- Megapipe Communications
- Shentel Internet Access
- Virginia Internet Express
- Velocitus Internet
- Visual Link Inc.
- Warren Systems

**Newspapers:**
- Daily (State and Local)
  - Northern Virginia Daily, (Strasburg)
  - The Richmond Times Dispatch, (Richmond)
  - The Washington Post, (Washington, DC)
  - The Winchester Star, (Winchester)
- Weekly (Local)
  - Page News and Courier, (Luray)
  - Shenandoah Valley Herald, (Woodstock)
  - The Warren Sentinel, (Front Royal)
  - The Free Press, (Woodstock)
- Monthly (Regional)
  - Quad State Business Journal, (Winchester)

**Radio Stations:**
- 91.3 WTRM (FM), Winchester
- 92.5 WINC (FM), Winchester
- 93.7 WAZR (FM), Woodstock
- 95.3 WFTR (FM), 1450 AM, Front Royal
- 96.9 WISG (FM), 790 (AM), Mt. Jackson
- 99.3 WFQX (FM), Strasburg
- 102.5 WUSQ (FM), 610 (AM), Winchester
- 103.3 WEZI (FM), Harrisonburg
- 104.9 WAPP (FM), Berryville
- 105.1 WAMM (FM), Woodstock
- 105.5 WBPP (FM), Berryville
- 105.7 WZXI (FM), Luray
- 610 WNTW (AM), Winchester
- 1300 WRAA (AM), Luray
- 1400 WINC (AM), Winchester

**Television Stations:**
o None based in NSVRC

**Cable Television Providers:**

- Adelphia - Clarke, Frederick, Page, Warren Counties; City of Winchester
- Shentel - Shenandoah County.
Hazard Identification and Risk Assessment

The Hazard Identification and Risk Assessment (HIRA) provides information to allow the regional commission and its member jurisdictions to better understand local hazards and the risks posed by such hazards, and to begin to develop mitigation strategies to lessen the impacts of these hazards. When developing this plan, every effort was made to gather input from all of the planning area communities to assure that the results of this analysis were as accurate as possible.

The planning area for this study includes five counties, one city and twelve incorporated towns. All jurisdictions located within these counties have been included in this portion of the study, as this analysis has been completed on a regional basis. It should be noted, however, that a local jurisdiction’s inclusion in the complete hazard mitigation plan is dependent on the community’s participation in the remainder of the planning process.

The purpose of the HIRA is to:

1. Identify what hazards could affect the Northern Shenandoah Valley
2. Profile hazard events and determine what areas and community assets are the most vulnerable to damage from these hazards
3. Estimate losses and prioritize the potential risks to the community

The first step, hazard identification, identifies all the natural hazards that might affect the planning area. The hazards are ranked to determine what hazards are most likely to impact the communities of NSVRC. The hazards that are determined to have significant impact are analyzed in the greatest detail to determine the magnitude of future events and the vulnerability of the community and its critical facilities. Hazards that receive a moderate or limited impact ranking are analyzed at a less detailed level consistent with risk, available data and vulnerability methodology.

Planning Area Description

The area served by the Northern Shenandoah Valley Regional Commission is located in the northern tip of Virginia, west of the Washington, DC, metropolitan area. The region is made up of Clarke County, Frederick County, Page County, Shenandoah County, Warren County, the City of Winchester, and the Towns of Berryville, Boyce, Edinburg, Front Royal, Luray, Middletown, Mount Jackson, New Market, Shenandoah, Stanley, Stephens City, Strasburg, Toms Brook, and Woodstock. Table V-1 and Figure V-1 illustrate the land area of each of the communities in the PDC as well as the populations in the communities and number of households. This information is a key component in determining the risk to communities from natural hazards.

Watersheds

The major watershed for the region is the Potomac River Basin. The Rappahannock River Basin borders the eastern side of the planning area while the James River Basin borders the southern portion of the region. Figure V-2 illustrates the location of the major watershed boundaries for the planning district.
Figure X – NSVRC Watersheds
**Critical Facilities**

According to FEMA State and Local Plan Interim Criteria, a critical facility is defined as a facility, in either the public or private sector, that provides essential products and services to the general public, is otherwise necessary to preserve the welfare and quality of life in the jurisdiction, or fulfills important public safety, emergency response, and/or disaster recovery functions.

Critical facilities for the NSVRC were derived from a variety of sources. Information provided by the Northern Shenandoah Valley Regional Commission was supplemented with ESRI data as well as geocoded facilities completed by the Virginia Tech Center for Geospatial Information Technology (CGIT). Critical facilities include fire/rescue stations, police stations, government/administrative centers, schools, and churches. Figure V-3 shows the locations of critical facilities in the region. A large percentage of the region’s critical facilities are located within town and city boundaries, since most of the population lives within or in close proximity to the region’s towns and the City of Winchester.

Analysis for the region was completed using the best available data. Census blocks were used to assess the area’s vulnerability to specific hazards such as winter storm and wind. The flooding analysis was conducted primarily using floodplain, tax parcel and building footprint data provided by the communities and NSVRC. For some communities, structure points were determined using Virginia Base Mapping imagery, which was then intersected with the floodplain data for the region. Structure value was established using average house value in the 2000 Census data. The 2000 Census data for average structure value per block was used as a replacement cost in the event of a disaster. This value can serve as a guide in assessing the impacts of various hazards.

**Data Limitations**

Inadequate information posed a problem for developing loss estimates for most of the identified hazards. The primary limiting factor was that the hazard mapping precision is at only a relatively large scale (i.e., the county or jurisdiction level) as opposed to precision at a smaller scale such as census block or parcel. In addition, many of the hazards, such as winter storm and wildfire, do not have defined damage estimate criteria, limiting the ability to perform a quantitative loss estimate.

The FEMA guidelines emphasize using “best available” data for this plan. A variety of methodologies were used based on the type of data that was available. The Northern Shenandoah Valley Regional Commission and member jurisdictions provided available base map data including tax parcels, zoning, street mapping and some utilities, building footprints (where available), and critical facility information. All other data were derived from existing sources or created by the Virginia Tech Center for Geospatial Information Technology.
Critical facilities, residential and industrial buildings within the 100 year floodplain were identified for quantitative damage analysis. The Hazards US – Multi-Hazard (HAZUS-MH) model was used to estimate dollar damages from hurricanes in the Northern Shenandoah Valley region.