3

AFFECTED ENVIRONMENT

3.1 ISSUES IDENTIFICATION

This chapter characterizes the environment potentially affected by the alternatives that are described in Chapter 2. To avoid bulk and to concentrate attention on important issues, the discussions are commensurate with the importance of the potential effects, with less important material summarized, consolidated, or simply referenced, thereby establishing a context for the environmental consequences analyses presented in Chapter 4. **Table 3-1** lists environmental issues and summarizes their relevance to the study. The sections following the table provide additional information on principal issues.

Table 3-1
ENVIRONMENTAL ISSUES

Issue	Remarks
Land Use (See Section 3.2.)	Agriculture dominates land use in outlying portions of the study area, while residential, commercial, industrial, and institutional land uses dominate portions of the study area within and closer to the City of Harrisonburg, as well as along major transportation routes (I-81 and U.S. Routes 11 and 33). City and County comprehensive plans outline desired land use patterns in the study area. Land uses evolve over time and transportation facilities often are perceived as being linked to practical and economic uses of land and changes in such uses.
Historic Properties (Districts, Buildings, Sites, Structures, Objects, Archaeological Sites, and Battlefields) (See Section 3.3.)	One of the most frequently mentioned concerns of citizens during scoping, especially with regard to the Cross Keys Battlefield. A number of historic properties have been identified throughout the study area. Section 106 of the National Historic Preservation Act and Section 4(f) of the Department of Transportation Act require consideration of avoidance and minimization of impacts to these properties.
Farmland, Agricultural and Forestal Districts, and Agricultural Economy (See Section 3.4.)	Much of the land in the study area currently is used for agriculture, and, notwithstanding the County's designation of most of the study area for future growth, many public comments expressed concern about farmland loss associated with highway construction or other development. The federal Farmland Protection Policy Act (FPPA) requires assessment of potential conversions of certain farmland to nonagricultural uses. State law protects agricultural and forestal districts, several of which are located within or near the study area.
Karst and Caves (See Section 3.5.)	The project is located within an area of karst terrain (geology characterized by highly soluble rock, such as limestone), which has particular relevance to groundwater quality, threatened or endangered species, drainage, and structural stability.

Table 3-1
ENVIRONMENTAL ISSUES

Issue	Remarks
Streams, Water Quality, and Wetlands (See Section 3.6.)	Surface waters are characterized chiefly by well-defined stream channels without extensive wetland areas. Several streams have been degraded by pollution from nonpoint sources (agriculture and development activities). The federal Clean Water Act requires avoidance and minimization of impacts to the extent practicable.
Endangered Species (See Section 3.7.)	Federal and state agencies identified four federally listed species (Madison Cave isopod, Indiana bat, Virginia sneezeweed, and northeastern bulrush) and one state-listed species (Madison Cave amphipod) as potentially occurring in the study area.
Homes and Neighborhoods	Much of the study area currently can be characterized as rural with homes scattered along existing roadways. Lands closer to main travel arteries (such as I-81 and U.S. Routes 11 and 33) have been intensively developed over the last couple of decades. The County's comprehensive plan designates most of the study area for future development.
Community Facilities (Churches, Cemeteries, Schools, Fire Stations, Medical Facilities) (See Section 3.2.)	Churches and cemeteries are scattered throughout the study area; two public schools and two fire stations are in the study area; Rockingham Memorial Hospital proposes to relocate from downtown Harrisonburg to a site in the study area (the Rockingham County Board of Supervisors has approved the rezoning required for the move).
Visual Character	The visual character of the area is notable due to the surrounding mountains and the rolling farmland that many perceive as picturesque.
Noise	There are many noise-sensitive receptors (mainly residential sites) within the study area.
Air Quality	Air quality generally is good and the region is in attainment of all National Ambient Air Quality Standards.
Parks and Recreation Areas (See Section 3.2.)	Several parks and recreation areas are located within the study area. These properties are given special consideration due to their value to the community and the protection provided them under Section 4(f) of the U.S. Department of Transportation Act.
Floodplains (See Section 3.6.)	Several floodplains have been designated by the Federal Emergency Management Agency along streams within and near the study area; however, they are not large.
Hazardous Material Sites	The hazardous material sites (sites potentially containing flammable, explosive, corrosive, or toxic substances) in the area are typical of those for a small city and rural agricultural community. They include gas stations, industrial sites, underground tanks, and others. Concerns associated with them include health hazards, liability issues, and potentially very high costs of clean-up.
Forest Land	Forest land has been largely displaced and fragmented due to agricultural and development activities within the study area. Approximately 2,494 acres of forest, mainly comprised of mixed hardwoods, are scattered across the area, amounting to roughly 12% of the total study area.
Wildlife and Habitat (See Section 3.7.)	Former natural habitats have been extensively altered by agriculture and development and few native woodlands exist. Nevertheless, a number of animal species adapted to human-altered environments reside in or migrate through the remaining mosaic of forests, farms, and yards.
Migratory Birds	U.S. Fish & Wildlife Service requested this issue be addressed. However, migratory bird habitat is limited in the study area due to extensive agricultural areas and development.

Table 3-1
ENVIRONMENTAL ISSUES

Issue	Remarks
Public Water Supplies	There are no surface public water supplies in the study area. Groundwater is the water supply source for a number of homes and for several small community groundwater waterworks. There are no sole-source aquifers designated by the U.S. Environmental Protection Agency in the study area. A few comments were received during scoping expressing concerns about possible effects on water supplies.
Navigable Waterways	There are no navigable waterways in the study area.
Scenic Byways/Scenic Rivers	No state-designated scenic byways or scenic rivers and no federally designated wild and scenic rivers are located within or near the study area.

3.2 LAND USE AND SOCIOECONOMICS

3.2.1 Existing Land Use

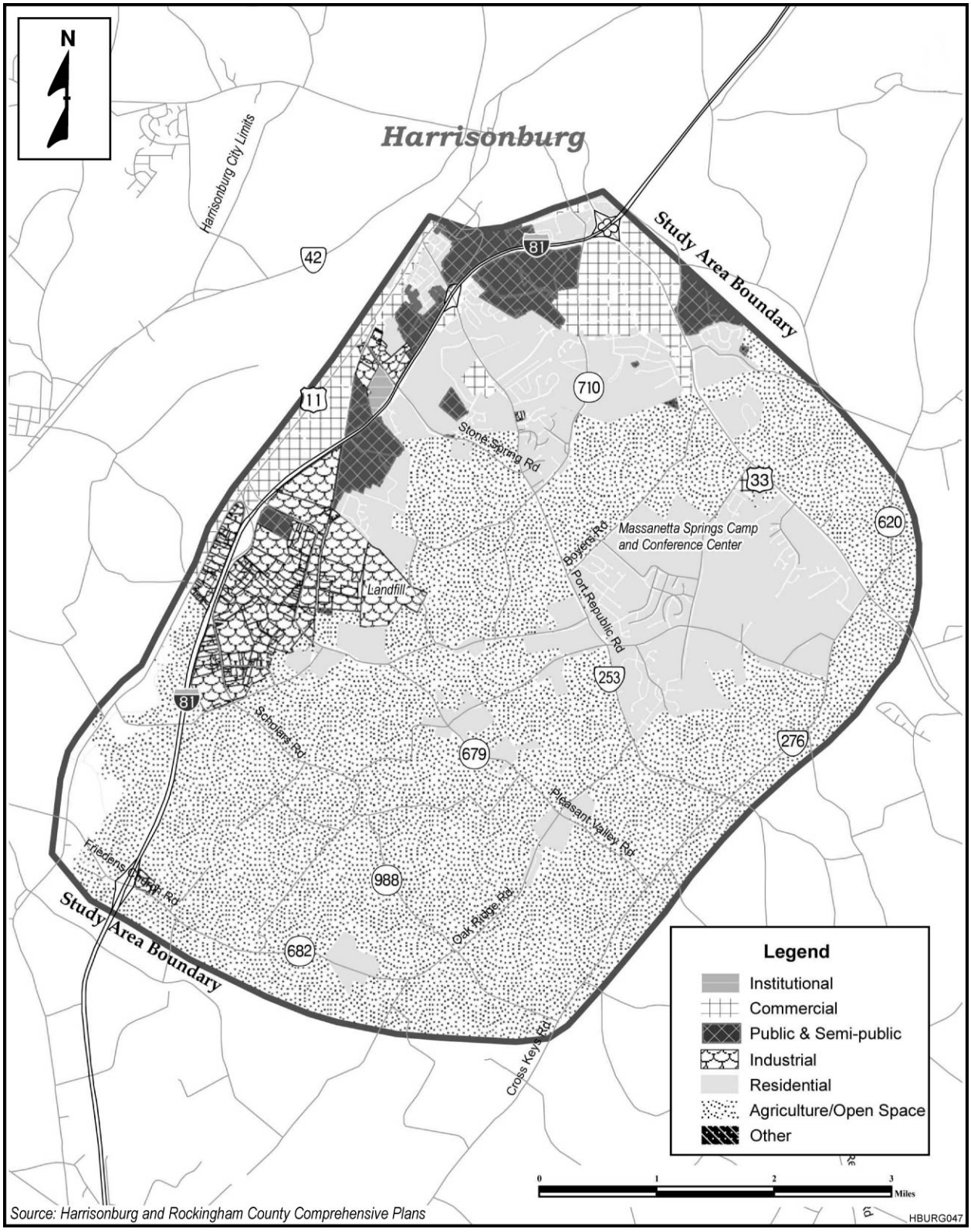
Existing land use in the study area consists of a mix of agricultural, residential, commercial, industrial, and institutional land uses, with the heavier development concentrated in the City of Harrisonburg and near major roadways such as U.S. Route 11, U.S. Route 33, Route 253, and the I-81 interchanges. Additional communities in or near the study area include Pleasant Valley, Massanetta Springs, Peales Crossroads, Mount Crawford, and Keezletown. Within the City of Harrisonburg, James Madison University is a major landholder. **Figure 3-1** depicts existing land uses within the study area.

3.2.2 Status of Local Planning

The Rockingham County Board of Supervisors on April 28, 2004 unanimously adopted a new comprehensive plan, entitled *Comprehensive Plan for 2020 and Beyond*, pursuant to Section 15.2-2223 of the Code of Virginia. Adoption of the plan followed a three-year public involvement program that included 15 meetings with a 30-member Citizen Advisory Committee, 20 citizen input meetings, and a formal public hearing (January 14, 2004) over a period of three years. The Harrisonburg City Council adopted a new comprehensive plan, entitled *Comprehensive Plan 2004 Update*, on February 24, 2004. Adoption of the city's plan followed extensive consultations with a 15-member Comprehensive Plan Advisory Committee, two rounds of community input sessions, and a formal public hearing (February 24, 2004). These comprehensive plans lay out the respective local governments' long-term visions, goals, and strategies for land uses, infrastructure, and community and economic development.

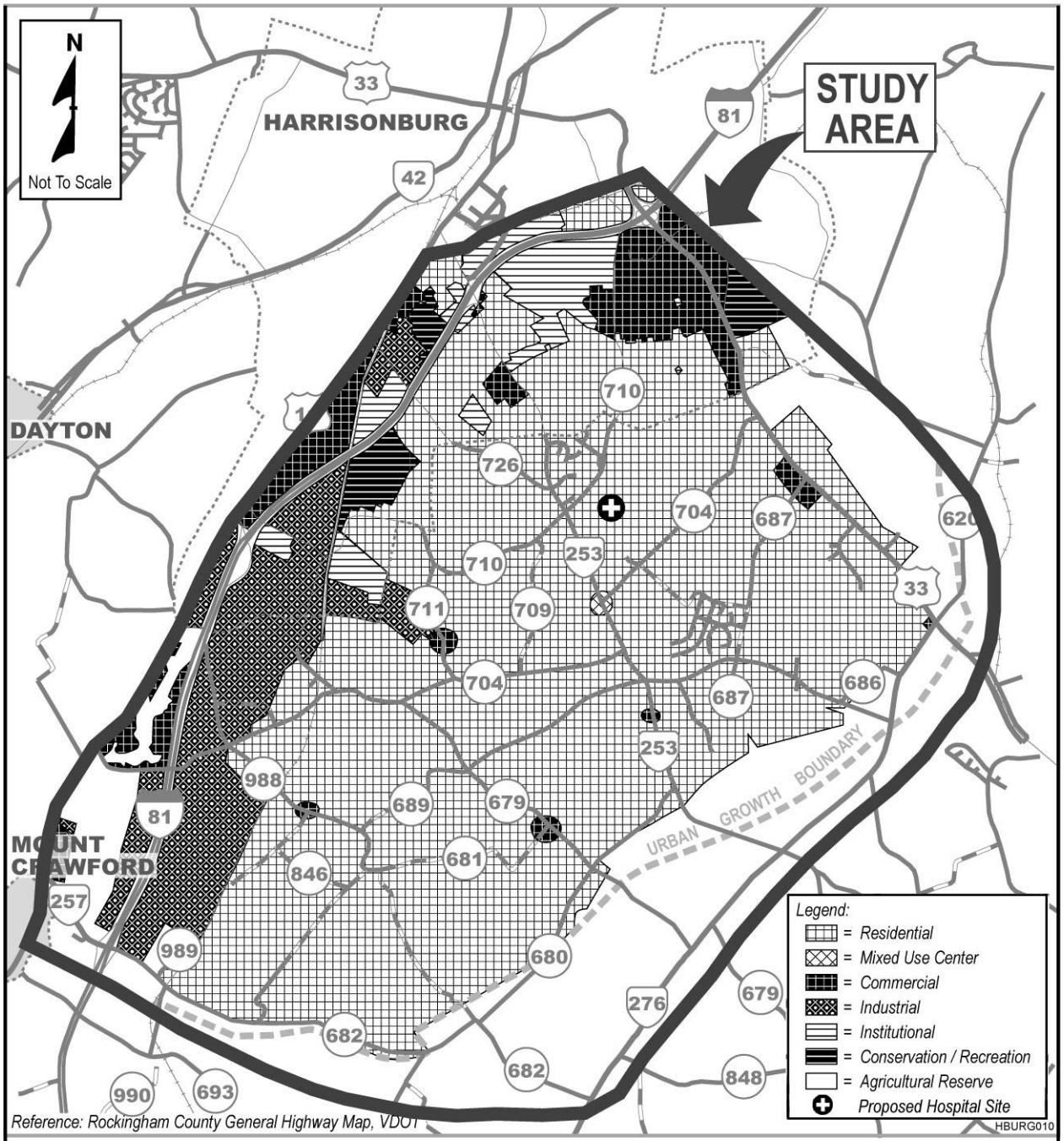
3.2.3 Development Trends

Rockingham County is directing new development to areas in or near existing towns in order to preserve its agricultural roots and economy. According to its *Comprehensive Plan for 2020 and Beyond*, the County plans to extend public water and sewer services to these development areas in concert with increases in population and employment. With the phasing proposed in the comprehensive plan, the bulk of the study area will have public water and sewer service by 2050. In the City of Harrisonburg's comprehensive plan, the two main land use goals are 1) to improve the quality and compatibility of land use and development and 2) to promote novel patterns of development like those developed early in the city's history – vital, well planned, and well integrated mixed-housing and mixed-use urban areas of distinct character. **Figure 3-2** is a composite map of designated future land uses from the city and county comprehensive plans.



Harrisonburg Southeast Connector Location Study

EXISTING LAND USE
Figure 3-1



Sources: City of Harrisonburg Comprehensive Plan (Land Use Guide) and
Rockingham County Comprehensive Plan for 2020 & Beyond (Conceptual Land Use Plan - 2050)

HBURG010

Harrisonburg Southeast Connector Location Study

FUTURE LAND USE
Figure 3-2

Future land uses are expected to consist of the gradual expansion of residential, commercial, and industrial uses into the existing agricultural areas within the county's designated urban growth boundary. According to projections by local planners, population and employment in the study area are both expected to grow approximately 77% by the year 2030, while the number of households is expected to grow approximately 120% (household growth is greater than population growth because of declining household size). These trends reflect a continuation of recent expansions in population and employment in the Harrisonburg region. Since 1970, the Rockingham/Harrisonburg population has increased more than 70 percent and currently exceeds 100,000. Economic growth in recent years has resulted largely from growth of James Madison University, growth in the poultry processing industry, and growth in the services sector including warehousing, distribution, and tourism. The recent opening of a large merchandise distribution center adjacent to I-81 in the southwest portion of the study area is representative of an ongoing orientation of portions of the study area to the distribution industry. The recent proposal by the regional hospital to relocate from downtown Harrisonburg to a larger tract in the study area, as well as other development proposals, are indicative of an expanding services infrastructure to keep pace with the growing population. The region boasts a high quality of life in a rural historic setting with easy access to the interstate and major metropolitan areas. Over the past decade, tourism spending in Harrisonburg and Rockingham has steadily increased, growing faster than for Virginia as a whole. Both the city and the county have low unemployment rates compared to Virginia and the nation.

3.2.4 Community Facilities and Services

Schools. Pleasant Valley Elementary School, a Rockingham County school located within the City of Harrisonburg, and Stone Spring Elementary School, a city school, are in the study area. Also in the study area are Massanutten Technical Center (jointly owned by the city and county), Dominion Business School (a private business school), and portions of James Madison University (JMU, a four-year state-supported university with an enrollment of close to 14,000). The East Campus of JMU is located at the northern end of the study area.

Utilities. Virginia Power, Harrisonburg Electric Commission, and Shenandoah Valley Electric Cooperative provide electricity in the region. Several major power transmission lines traverse the study area. Columbia Gas of Virginia provides natural gas service. Solid waste in Harrisonburg and Rockingham County is disposed at the 100-acre landfill located in the west center of the study area. Public water supply sources for the City of Harrisonburg are the North River, Rawley Springs, Silver Lake, and the South Fork Shenandoah River, all outside the study area. Rockingham County's public water supply is provided through two wells located outside the study area near McGaheysville. The Harrisonburg-Rockingham Regional Sewer Authority provides sewage treatment to Harrisonburg and adjoining portions of the county. The treatment plant located near Mount Crawford discharges to the North River, outside the study area.

Fire and Police Protection. Police services are provided by the Rockingham County Sheriff's Department, the Harrisonburg Police Department, and the Virginia State Police. Fire protection is provided by the Harrisonburg Fire Department, with four stations, and the Rockingham County Fire Department, with eleven stations. Both departments operate with a mix of full-time and volunteer firefighters. Each department also is equipped to respond to hazardous material incidents. There are two fire stations in the study area.

3.2.5 Parks and Recreational Areas

The following publicly owned parks are in the study area:

- The City of Harrisonburg's Purcell Park contains 67 acres, with softball/baseball fields, tennis courts, playground areas, picnic shelters, and walking trails.
- The City of Harrisonburg's Ramblewood Fields contains 60 acres, with lighted softball/ baseball fields, concession stands, and electronic scoreboards.
- Rockingham County's Albert Long Park contains 6 acres, with a softball/baseball field and a picnic area.

Rockingham County Public Schools has a formal agreement with the Rockingham County Recreation Department whereby school recreational facilities may be used for various county athletic and recreational programs. The City of Harrisonburg does not have a similar formal arrangement; however, facilities on school properties are available for public use after school hours. The James Madison Arboretum, a garden area open for public tours, also is located in the study area. The East Rockingham Recreation Association operates a private club open only to members and offering a swimming pool, tennis courts, picnic shelter, playground, and basketball courts on Route 689 (Shen Lake Drive) near Route 276 (Cross Keys Road). Two privately owned golf courses also are located in the study area: Lakeview (36 holes) and Spotswood Country Club (18 holes).

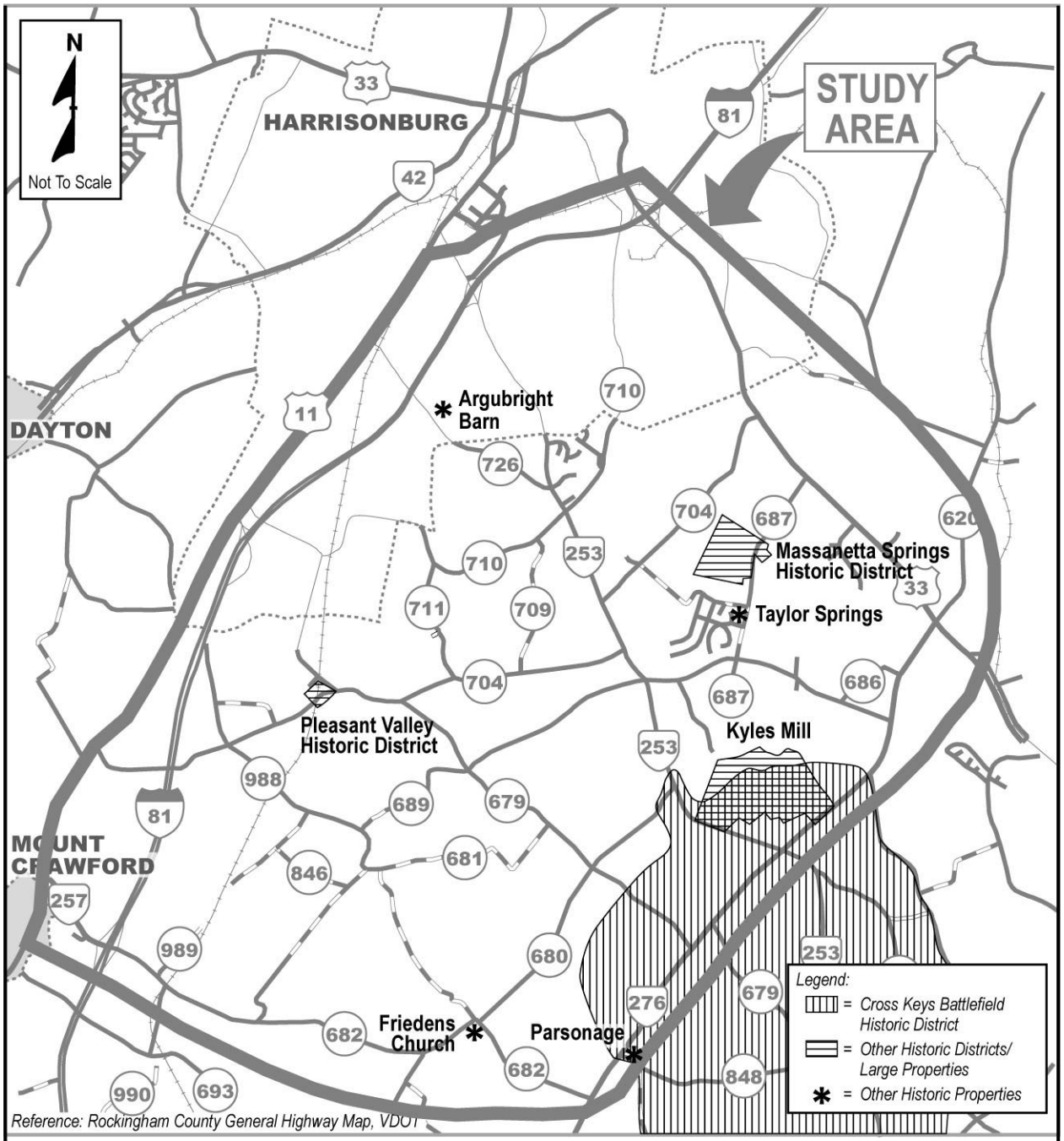
3.3 HISTORIC PROPERTIES

Historic properties are archaeological sites and historic buildings, structures, objects, and districts that are listed in, or eligible for listing in, the National Register of Historic Places (NRHP). The NRHP was established by the National Historic Preservation Act. Section 106 of the Act requires federal agencies to consider the effects of their actions on historic properties.

3.3.1 Historic Architectural Properties and Districts

A review of Virginia Department of Historic Resources (VDHR) archives of previously recorded properties showed several NRHP-listed or NRHP-eligible properties in the study area. They are located as shown on **Figure 3-3** and listed in **Table 3-2**. [Note: identification of additional properties along the Candidate Build Alternatives is discussed in Chapter 4, Environmental Consequences.]

The largest historic resource in the study area is the Cross Keys Battlefield. The June 8, 1862 battle at Cross Keys, along with the nearby battle at Port Republic that occurred the next day, capped Stonewall Jackson's famous 1862 Valley Campaign. With the defeat of the Union armies at Cross Keys and Port Republic, Jackson was able to march his troops out of the Valley and join General Robert E. Lee in the defense of Richmond. The Cross Keys Battlefield boundaries encompass more than 5,400 acres, more than two-thirds of which are outside the study area, and include all places related or contributing to the battle event (i.e., where troops deployed and maneuvered before, during, and after the engagement). Details on the battlefield are included in the report, *Cross Keys Battlefield Boundary Review*, which was submitted to VDHR for purposes of establishing the NRHP-eligible boundaries of the Battlefield.



Source: Virginia Department of Historic Resources records, Cross Keys Battlefield Boundary Review report by Coastal Carolina Research, Inc.

Note: These are recorded properties for which National Register of Historic Places eligibility determinations had been made prior to or shortly after beginning this Location Study. Additional historic properties have been identified along the Candidate Build Alternatives, as described in Chapter 4, Environmental Consequences, of this Environmental Impact Statement.

Harrisonburg Southeast Connector Location Study

PREVIOUSLY RECORDED HISTORIC RESOURCES
Figure 3-3

Table 3-2
PREVIOUSLY RECORDED HISTORIC RESOURCES

VDHR File #[a]	Resource Name	Description	NRHP Status & Criteria[b]
082-0102	Friedens Church and Cemetery	Early 19th century church & cemetery	Eligible, A & C
082-0376	Cross Keys Battlefield	1862 Civil War battlefield	Eligible, A
082-0509	Massanetta Springs Historic District	Early 20th century resort hotel and associated buildings and appurtenances	Eligible, C
082-0635	Taylor Springs	Ca. 1850 single dwelling & spring/ springhouse	Listed, C
082-0641	Pleasant Valley Historic District	Late 19th/early 20th century historic district of dwellings & other buildings	Eligible, A & C
082-5075	Kyles Mill Farm	Mid 18th century farm complex	Listed, C
082-5204	German Reformed Church Parsonage	Late 18th century parsonage	Eligible, C
115-5055	Argubright Barn	Mid 19th century barn	Eligible, A & C

[a] VDHR (Virginia Department of Historic Resources) is the office of the State Historic Preservation Officer (SHPO), who has responsibilities under the National Historic Preservation Act for administering the state historic preservation program, which includes maintenance of an archive of recorded historic properties, consultation in the evaluation of properties for National Register eligibility, consultation in determinations of effects on those properties, and provision of other guidance and input on historic resources issues.

[b] 36 CFR 60.4, National Register Eligibility Criteria: **A.** Associated with important historical **events**, which could be of local, statewide, or national significance (e.g., Civil War battle); **B.** Associated with important historical **persons** (e.g., Stonewall Jackson); **C.** Embody **distinctive characteristics** of a type, period, or workmanship (usually architecture, e.g., 19th century Federal-style dwelling); **D.** Contains **information** important in history or prehistory (archaeological sites, e.g., Indian campsites, Cross Keys Tavern site).

The Cross Keys Battlefield also is an element of the Shenandoah Valley Battlefields National Historic District established by Congress in the Shenandoah Valley Battlefields National Historic District and Commission Act of 1996 (P.L. 104-333). The eight-county District contains 10 Civil War battlefields mapped by the National Park Service (NPS) in 1992 (the Cross Keys Battlefield is the only element of the District that is within the study area). Under provisions of the Act, a Management Plan was developed to establish a planning process for the preservation and interpretation of battlefields included in the District, and to increase public awareness of the legacy of the Civil War in the Shenandoah Valley. The Shenandoah Valley Battlefields National Historic District is an entity established by Congress and is not the same as a historic district established under the criteria used to determine NRHP eligibility under the National Historic Preservation Act; nor are any properties in the District within the study area that are beyond the boundaries of the Cross Keys Battlefield eligible for the NRHP, except to the extent they merit eligibility for factors unrelated to the District or the Battlefield. P.L. 104-333 imposes no restrictions on landowners or local, state, or federal agencies with respect to actions or land use decisions within the District.

3.3.2 Archaeology

A search of VDHR's archives revealed 21 recorded archaeological sites in the study area, of which 10 are Native-American artifact scatter sites, nine are 18th, 19th, or 20th century historic domestic sites, and two have both Native-American and historic components. Though recorded,

most of these sites remain unevaluated for NRHP eligibility. Additional sites from all time periods are potentially present throughout the study area; however, the potential for large prehistoric base camps and villages is generally low given the lack of riverine settings (i.e., broad floodplains and terraces). Civil War-related sites may be present in the area given the extensive troop movements and battle-related activities that occurred. Several local residents have reported that camping and other troop activities occurred on their lands. Other historic period sites representative of domestic occupations also may be present.

Because substantial expense is associated with archaeological field surveys of long corridors, because the historic value of most archaeological sites can be realized only through scientific excavation, and because most archaeological sites are of value chiefly for what can be learned through archaeological data recovery, intensive efforts to identify archaeological sites potentially affected by the Candidate Build Alternatives are being deferred until after a preferred alternative has been identified. This approach is consistent with 36 CFR 800.4(b)(2), which provides for the phased identification of historic properties on projects "where alternatives under consideration consist of corridors or large land areas," and with Stipulation 9 of the Programmatic Agreement Between the Virginia Departments of Transportation and Historic Resources Concerning Interagency Project Coordination (1999). If a build alternative is identified as the preferred alternative, archaeological field studies then will be conducted in consultation with VDHR and other consulting parties to determine if archaeological sites eligible for the NRHP within the corridor associated with the preferred alternative will be affected. The results of these studies will be reported in the Final EIS.

Although intensive archaeological investigations have been deferred, an archaeological assessment was conducted for the Candidate Build Alternatives to evaluate any appreciable differences among alternatives in terms of the potential range, quantity, and integrity of archaeological resources. The assessment also included evaluation of the potential for alternatives to contain sites meriting preservation in place, or sites that would be extraordinarily complex and/or expensive to excavate. Discussion of the archaeological assessment is included in Chapter 4, Environmental Consequences.

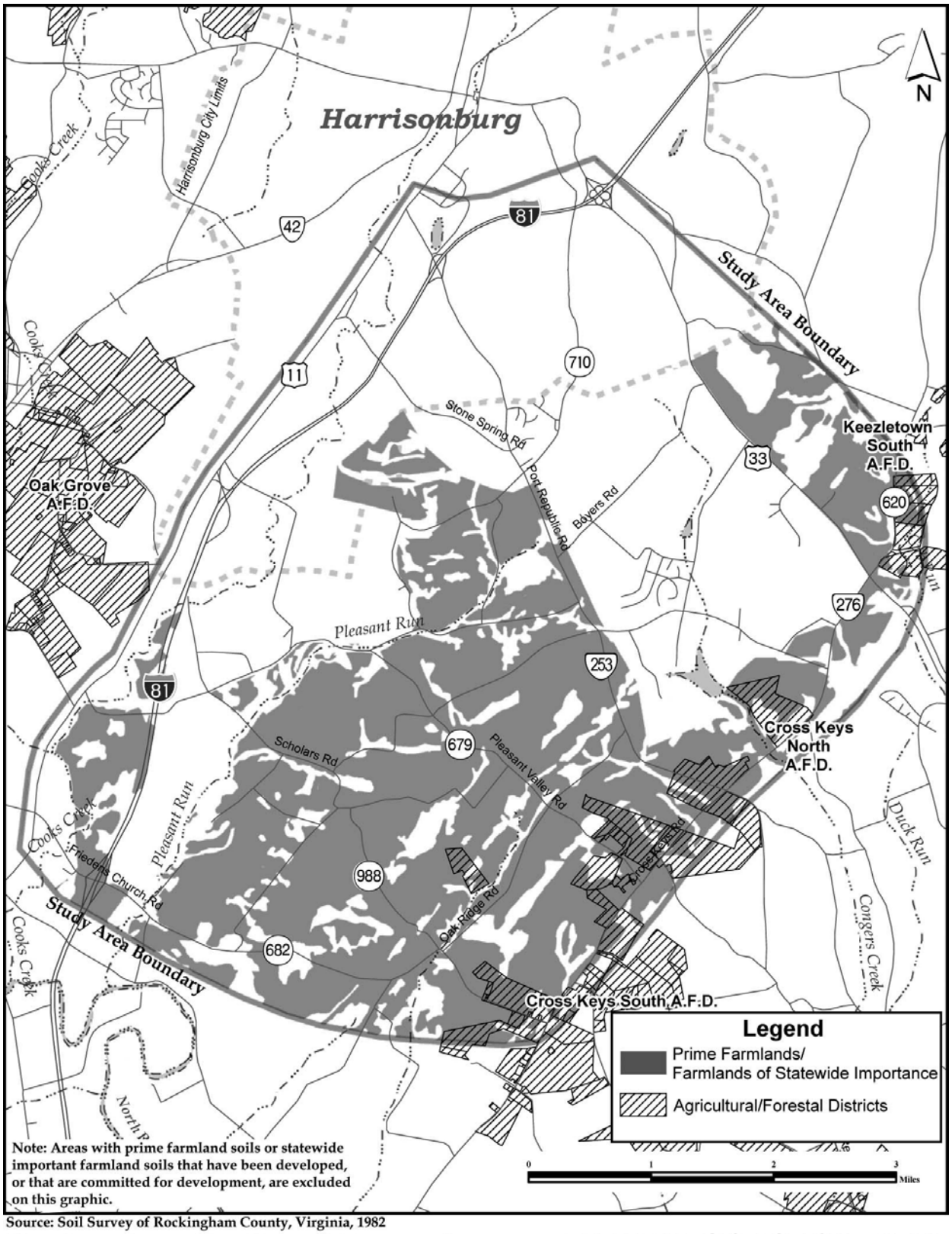
3.4 FARMLAND AND AGRICULTURE

3.4.1 Farmland

Under the federal Farmland Protection Policy Act, the U.S. Department of Agriculture defines "farmland" as:

- Prime farmland - land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses.
- Unique farmland - land other than prime farmland that is used for production of specific high-value food and fiber crops.
- Farmland other than prime or unique farmland that is of statewide or local importance for the production of food, feed, fiber, forage, or oilseed crops.

The land may be in cultivation, forest, pasture, or other uses except for urban or built-up land or water uses. **Figure 3-4** shows the combined extent of soils classified as prime and statewide important, but excludes areas that no longer are available for producing crops. There are no unique farmlands in the study area.



Source: Soil Survey of Rockingham County, Virginia, 1982

Harrisonburg Southeast Connector Location Study

FARMLANDS & AGRICULTURAL & FORESTAL DISTRICTS

Figure 3-4

Table 3-3 lists the soils indicative of prime farmlands and farmlands of statewide importance that occur within the study area along with the extent of each soil type within the study area. The soil survey from which this information was taken was completed in 1982, and some areas underlain by these soil types have been developed. Therefore, the percentages indicated in Table 3-3 are higher than the current actual extent of farmland, which has been reduced by development in the study area.

Table 3-3
SOILS INDICATING PRIME FARMLANDS AND FARMLANDS OF STATEWIDE IMPORTANCE

Soil Map Unit Name	Farmland Classification	Acreage in Study Area	Percentage of Study Area
Edom silty clay loam, 2 to 7 percent slopes, eroded	Prime farmland	424	2.08%
Endcav silt loam, 2 to 7 percent slopes, eroded	Prime farmland	314	1.54%
Endcav silt loam, 2 to 7 percent slopes, rocky, eroded	Prime farmland	109	0.53%
Frederick and Lodi silt loams, 2 to 7 percent slopes, eroded	Prime farmland	2,061	10.13%
Frederick and Lodi gravelly silt loams, 2 to 7 percent slopes, eroded	Prime farmland	512	2.52%
Frederick and Lodi silt loams, rocky, 2 to 7 percent slopes, eroded	Prime farmland	139	0.68%
Guernsey silt loam, 2 to 7 percent slopes	Prime farmland	24	0.12%
Massanetta silt loam, 0 to 2 percent slopes	Prime farmland	94	0.46%
Sequoia silt loam, 2 to 7 percent slopes, eroded	Prime farmland	7	0.03%
Shenval loam, 2 to 7 percent slopes	Prime farmland	145	0.71%
Swimley silty clay loam, 2 to 7 percent slopes, eroded	Prime farmland	106	0.52%
Wheeling fine sandy loam, 0 to 4 percent slopes, rarely flooded	Prime farmland	2	0.01%
Aquic Udifluvents, nearly level	Farmland of statewide importance	347	1.71%
Endcav silt loam, 7 to 15 percent slopes, eroded	Farmland of statewide importance	83	0.41%
Endcav silt loam, 7 to 15 percent slopes, rocky, eroded	Farmland of statewide importance	95	0.47%
Frederick and Lodi silt loams, 7 to 15 percent slopes, eroded	Farmland of statewide importance	5,418	26.65%
Frederick and Lodi silt loams, 15 to 25 percent slopes, eroded	Farmland of statewide importance	933	4.59%
Frederick and Lodi gravelly silt loams, 7 to 15 percent slopes, eroded	Farmland of statewide importance	1,905	9.37%
Frederick and Lodi gravelly silt loams, 15 to 25 percent slopes, eroded	Farmland of statewide importance	1,228	6.04%
Frederick and Lodi silt loams, rocky, 7 to 15 percent slopes, eroded	Farmland of statewide importance	582	2.86%
Frederick and Lodi silt loams, rocky, 15 to 25 percent slopes, eroded	Farmland of statewide importance	202	0.99%
Nixa-Frederick-Lodi gravelly loams, 2 to 7 percent slopes	Farmland of statewide importance	57	0.28%

Table 3-3
SOILS INDICATING PRIME FARMLANDS AND FARMLANDS OF STATEWIDE IMPORTANCE

Soil Map Unit Name	Farmland Classification	Acreage in Study Area	Percentage of Study Area
Nixa-Frederick-Lodi gravelly loams, 7 to 15 percent slopes	Farmland of statewide importance	97	0.47%
Sequoia-Berks silt loams, 7 to 15 percent slopes, eroded	Farmland of statewide importance	8	0.04%
Shenval loam, 7 to 15 percent slopes, eroded	Farmland of statewide importance	28	0.14%
TOTAL	Prime farmland and farmland of statewide importance	14,920	73%

Source: Soil Survey of Rockingham County, Virginia, U.S. Department of Agriculture, 1982.

3.4.2 Agricultural and Forestal Districts

Agricultural and Forestal Districts are protected under Section 15.2-4300 of the Code of Virginia, also known as the Agricultural and Forestal Districts Act. This Act was enacted in 1977 to protect and encourage the development and improvement of the Commonwealth's agricultural and forestal lands for the production of food and other products and to protect these lands as valued natural and ecological resources. The power to create districts lies with the localities upon the agreement of all landowners forming the district. Districts are not established in perpetuity and may be renewed periodically. The acquisition of land from an Agricultural and Forestal District by a state agency, such as VDOT, requires adherence to procedures outlined in the code. **Table 3-4** lists the four agricultural/forestal districts that have parcels within or adjacent to the study area; Figure 3-4 shows their locations.

Table 3-4
AGRICULTURAL AND FORESTAL DISTRICTS

Name of District	Total Size of District (acres)	Number of Parcels of District in Study Area	Acreage in Study Area	Percentage of Study Area	Expiration Date
Oak Grove	1,381	0[a]	0[a]	0%[a]	1/26/10
Cross Keys South	1,447	16	163	0.80%	4/25/08
Cross Keys North	699	18	613	3.02%	4/25/08
Keezletown South	438	8	121	0.60%	6/23/12
Total		42	898	4.42%	

[a] The Oak Grove District abuts the western study area boundary along U.S. Route 11, but does not extend into the study area. It is included here because it could be affected by alternatives connecting with U.S. Route 11.

3.4.3 Agricultural Economy

Agriculture remains a staple of the region's economy and Rockingham County leads all counties in Virginia in terms of market value of agricultural products sold. It also ranks in the top twenty in the nation for livestock and poultry production. According to the County's comprehensive plan, there are more than 230,000 acres in farms in Rockingham County.

3.5 GEOLOGY AND TOPOGRAPHY

Rockingham County lies on a broad valley floor bordered to the east by the Blue Ridge Mountains and to the west by the Appalachian Mountains. Massanutten Mountain is a notable geologic feature dividing this broad valley into two portions, which are drained by the North Fork and South Fork of the Shenandoah River, respectively. The study area is located in the Ridge and Valley geologic province. Ridges of sandstone and shale and valleys of limestone and dolomite comprise this province. This karst terrain is distinguished by long-term subterranean dissolution and erosion of carbonate rocks, the presence of sinkholes and caves, and relatively direct interaction between surface and groundwater systems. Karstic aquifers generally are considered more vulnerable to contamination than normal aquifers because of the highly porous and permeable rocks and direct connections through sinkholes. There are a few small documented caves and sinkholes in the study area. Undocumented sinkholes and caves may occur in the area.

3.6 WATER RESOURCES

3.6.1 Surface Waters

Surface waters in the study area include Cooks Creek, Blacks Run, Pleasant Run, Mill Creek, Congers Creek, Cub Run, several intermittent unnamed tributaries, Lake Shenandoah (formed by a dam across Congers Creek), and a number of farm ponds. **Figure 3-5** shows the drainage pattern in the study area. Based on the Cowardin classification system for waters and wetlands,[1] surface water types include palustrine unconsolidated bottom, palustrine unconsolidated shore, palustrine aquatic bed, and palustrine submerged bed. The U.S. Environmental Protection Agency (EPA) and the Virginia Department of Environmental Quality (VDEQ) have categorized Cooks Creek, Blacks Run, Pleasant Run, Mill Creek, and Cub Run as impaired, because water quality in those streams does not meet water quality standards (for E-Coli bacteria in the case of Cub Run and for fecal coliform bacteria and benthic aquatic life in the case of the other four streams). EPA and VDEQ established total maximum daily loads (TMDL)[2] for the applicable pollutants (E-Coli bacteria, fecal coliform bacteria, sediment, and phosphorus) in these streams. The principal sources of these pollutants are agricultural and urban runoff.

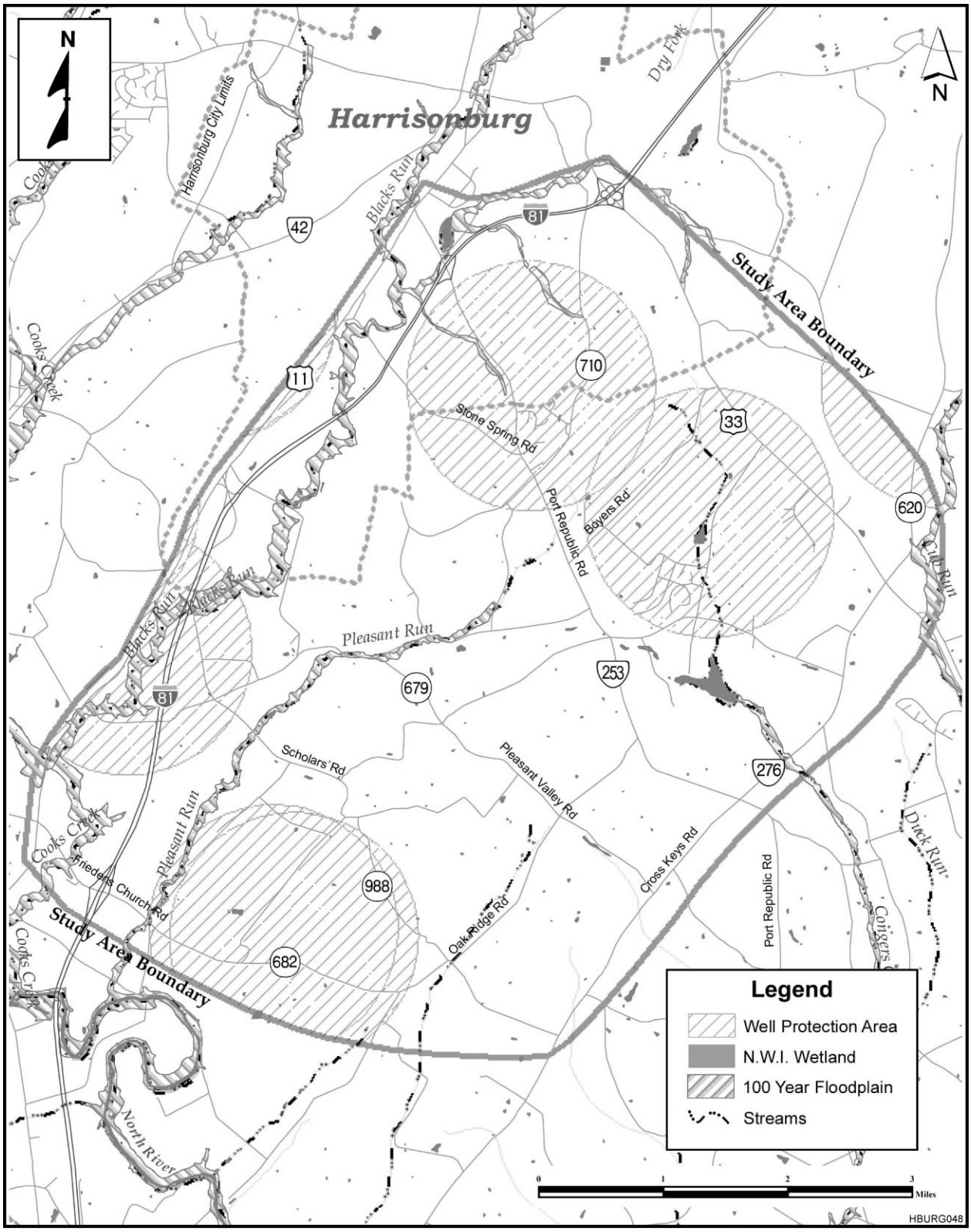
3.6.2 Groundwater

Nearly two-thirds of the housing units in Rockingham County are served by individual water systems (i.e., wells). In a study conducted several years ago by the Virginia Cooperative Extension, tests of groundwater samples from some portions of Rockingham County showed elevated levels of iron, manganese, hardness, total dissolved solids, sodium, nitrate, and bacteria. Groundwater contamination sources identified during the study included home heating oil storage tanks, septic system drainfields, and agricultural activities.

---

[1] Cowardin, Lewis M., Virginia Carter, Francis C. Golet, & Edward T. LaRoe. 1979. *Classification of wetlands and deepwater habitats of the United States*. U.S. Department of the Interior, Fish and Wildlife Service. FWS/OBS-79/31. Classifies waters and wetlands based on hydrological and ecological characteristics, widely used by state and federal agencies in mapping and evaluating water resources.

[2] A TMDL identifies the sources polluting a water and expresses the amount of a pollutant that can be introduced from those sources without causing the water to exceed a State's water quality standards. The objective of a TMDL is to allocate allowable loads among different pollutant sources so that appropriate control actions can be taken in order to achieve water quality standards.



Harrisonburg Southeast Connector Location Study

WATER RESOURCES AND FLOODPLAINS
Figure 3-5

The presence of sinkholes and subterranean solution channels in the karst terrain make groundwater in the area more susceptible to contamination. The Virginia Department of Health runs a well protection program for small community groundwater waterworks. As part of that program, well protection areas, essentially consisting of one-mile-radius buffer zones representing the well recharge areas, are designated around community groundwater facilities. As shown on Figure 3-5, there are several such well protection areas in the study area. These wells are not for general public water supply, but, rather, serve facilities such as the Massanetta Springs Camp and Conference Center and mobile home parks. The protection area designation does not confer any particular restrictions on activities in the area, but is a tool to help localities manage groundwater resources.

3.6.3 Wetlands

Wetlands are defined by the presence of surface and/or groundwater hydrology, hydric soils (soils that develop under wet conditions), and hydrophytic vegetation (plants that are favored by wet conditions). Wetlands in the study area were identified initially from National Wetland Inventory (NWI) mapping (see Figure 3-5). Field observations were conducted to identify wetlands in greater detail along the Candidate Build Alternatives (see Chapter 4).

Wetlands in the study area generally occur along streams or pond margins and at groundwater seeps. Hydric soils that have developed in these areas are poorly to somewhat poorly drained and have a water table at or near the surface or are frequently ponded or flooded during the growing season. Based on the classifications of waters and wetlands developed by Cowardin, et al., the wetland types present include palustrine emergent (PEM) systems with persistent vegetation and palustrine scrub-shrub (PSS) systems with broad-leaved deciduous vegetation, with temporary (A) or seasonal (C) flooding regimes. Common species include New York ironweed (*Vernonia noveborecensis*), swamp aster (*Aster puniceus*), fox sedge (*Carex vulpinoidea*), pale sedge (*Carex lurida*), soft rush (*Juncus effusis*), a variety of bulrushes (*Scirpus spp*.), common alder (*Alnus serrulata*), black willow (*Salix nigra*), and sycamore (*Platanus occidentalis*). The functions of these wetlands include groundwater discharge to support low-flow conditions, sediment/toxicant retention, nutrient removal, sediment stabilization, and wildlife habitat.

3.6.4 Floodplains

The 100-year floodplains within the study area, shown on Figure 3-5, were identified through Rockingham County's geographic information system (GIS) database. One-hundred-year floodplains have a one percent chance of flooding in any given year. These areas, which represent the floodplains designated by the Federal Emergency Management Agency (FEMA), are located along Blacks Run, Pleasant Run, Cooks Creek, Cub Run, and Congers Creek. Floodplains have a number of natural and beneficial values, including flood flow moderation, water quality maintenance, and wildlife habitat.

3.7 WILDLIFE, HABITAT, AND ENDANGERED SPECIES

Wildlife habitat in the study area consists of a mosaic of forestland, farmland, and landscaped residential land, dissected by roads, powerlines, and streams. Most forested areas are relatively small, totaling approximately 2,500 acres across the entire study area (about 12% of the study

area). A variety of wildlife species adapted to these conditions occur in the study area, either as permanent populations or as transient migrants.

The Madison Cave isopod (*Antrolana lira*), a subterranean aquatic crustacean endemic to karst aquifers of the Shenandoah Valley, is listed as threatened under the U.S. and Virginia Endangered Species Acts. One of the 11 documented locations is the nearby Massanutten Caverns to the northeast of the study area. According to the Virginia Division of Natural Heritage's Karst Protection Coordinator, the species could be present beneath the surface of the study area, though there are no recorded occurrences there. Another subterranean aquatic crustacean that may be present in the study area, the Madison Cave amphipod (*Stygobromus stegorum*), is listed as threatened under the Virginia Endangered Species Act. There are no recorded occurrences of this species in the study area.

Additionally, the U.S. Fish and Wildlife Service (USFWS) stated during scoping that the Indiana bat (*Myotis sodalis*), Virginia sneezeweed (*Helenium virginicum*), and Northeastern bulrush (*Scirpus ancistrochaetus*) may potentially occur within the study area. The Indiana bat and Northeastern bulrush are both federally listed as endangered while the Virginia sneezeweed is federally listed as threatened.

Though the Indiana bat occurs at least occasionally in 27 states, USFWS estimates that 87% of the entire population uses just seven known major wintering hibernacula, all in Indiana, Kentucky, and Missouri. There are no recorded occurrences of Indiana bat in Rockingham County, but there are occurrences in two adjacent counties: Shenandoah County in Virginia and Pendleton County in West Virginia. Caves or mines meeting the bat's specific temperature requirements are used for winter hibernation. Riparian and upland forest may be used in the summer for roosting and foraging. Both dead and living trees are used for multiple roost maternity colonies if suitable conditions are met.

The habitat of the Northeastern bulrush consists of open tall herbaceous wetlands. It usually grows at the water's edge. It also is found in sinkhole ponds with a sandstone substrate.

The Virginia sneezeweed is found only in seasonally flooded limestone ponds in Rockingham and Augusta Counties, Virginia. It is known from 30 sites and is found along the shores of ponds with other herbaceous plants in acidic silty loam soils.