

3.0 AFFECTED ENVIRONMENT

The Council on Environmental Quality (CEQ) regulations (40 CFR Part 1500) implementing the National Environmental Policy Act (NEPA) require documentation succinctly describing the environment of the area(s) to be affected by the alternatives under consideration, as well as a discussion of the impacts in proportion to their significance. The affected environment includes land use, socioeconomic conditions, community facilities and services, physical, natural and cultural resources, air quality, and ambient noise levels, among others.

The purpose of this chapter is to identify resources and aspects of the built and natural environments that may be affected by the proposed action. This chapter summarizes data collected during the course of the study relevant to the project study area and provides a basis for the impacts discussion presented in Chapter 4.

3.1 Land Use, Plans, Aesthetics and Coastal Zone Management

Land use influences traffic patterns. Transportation planners consider many aspects of regional and local needs, character, and growth expectations in developing location and design of proposed transportation facilities. Transportation facilities and the traffic on them can have positive or negative effects on business success, character of residential neighborhoods, and other aspects of the social and natural environment.

3.1.1 Existing Land Use

The majority of the study area is located inside of federal property, both Fort Belvoir and the adjacent Humphreys Engineer Center (HEC) within Fairfax County. (The regional setting and locale was shown in Figures 1-1 through 1-3.) The county is a fast-growing and congested metropolitan area of northern Virginia. Fairfax County covers 395 square miles, and the Connector Road study area covers approximately 7 square miles. The southeastern part of Fairfax County, where the project is located, is a mix of military, historical, commercial and residential land uses. There are also areas of undeveloped lands including wetlands and wildlife refuges, and open areas of golfing ranges or golf courses. See **Figure 3-1**.

3.1.1.1 Institutional Land Use - Fort Belvoir and HEC

About two-thirds of the study area is located within Fort Belvoir and HEC land. Fort Belvoir consists of 8,259-acres of the Main Post, and the separate 807-acre Engineer Proving Ground parcel located several miles to the northwest. The Main Post is divided by U.S. Route 1 into North Post and South Post. The study area is located within the North Post. In recent years, Fort Belvoir has functioned primarily as an administrative and logistic support center for the U.S. Army, and as host for 107 tenant organizations. Facilities with large footprints and parking requirements and the need for good regional transportation access characterize development over the past 15 years within the North Post.¹ The North Post accommodates troop and family housing, support facilities, and large tenant organizations

¹ Unpublished Draft Revision, U.S. Army Garrison Fort Belvoir, April 2005: *Real Property Master Plan – Long Range Component (LRC)*, 5-10

such as the Defense Communications-Electronics Evaluation and Test Activity (DCEETA). Several community activities are also contained within the North Post, such as the North Post Golf Course, the Fort Belvoir Elementary School, the commissary, the Post Exchange, two child development centers and several recreation facilities, including a golf course, for military personnel and their families.

Much of the North Post was farmland at the time of its initial acquisition by the Army during World War I. Like much of the Post, natural reforestation has occurred with second stage succession hardwood growth on those areas not specifically used for facilities.

In 1993, Fort Belvoir established a continuous, 742-acre Forest and Wildlife Corridor through Fort Belvoir lands. The Corridor is approximately 15 miles long with a minimum width of 250 meters and traverses the entire project study area. (See additional description later in this chapter.) Both Beulah Street and Woodlawn Road cross it.

The North Post also contains former munitions test ranges and various solid waste management units (SWMU) including landfills. One landfill² is located within the Forest and Wildlife Corridor, approximately ½ mile north of the intersection of Pole and Old Mill Roads.

HEC is a 538-acre Post located in the northeastern portion of the study area.. Its facilities are all located within an approximately 80-acre portion of its northern section. This area has been developed with four or five major buildings, roads and parking along with numerous smaller structures. Dense second-growth coniferous and deciduous forest covers the remainder of HEC.

3.1.1.2 Residential

The North Post of Fort Belvoir contains a mix of land uses including on-Post military housing. The Lewis Heights housing complex, between Woodlawn and Meeres Roads, is presently under complete reconstruction; Woodlawn Village, a housing community of duplex and quadruplex units, lies north of Pole Road at the eastern edge of the Fort Belvoir boundaries.

In the study area outside Fort Belvoir, residential development is concentrated along U.S. Route 1, Telegraph Road, and Mount Vernon Memorial Highway. Medium density population, including townhouses and multi-family housing, characterize the area along Old Mill Road. Most of the homes off Telegraph Road and Mount Vernon Memorial Highway are single-family dwellings. Outside the federal installations, subdivisions in the study area include: Old Mill Gardens, Hayfield Farms, and Grist Mill Estates. Along U.S. Route 1 near the northeastern limit of the study area are two small trailer parks.

3.1.1.3 Commercial

Within the study area, commercial development exists along U.S. Route 1, north from the Old Mill Road/Mount Vernon Memorial Highway intersections. Southwest of the intersection of Telegraph Road and Beulah Street is another commercial center. The commercial developments are a mix of retail, office complexes, and fast food/chain restaurants. The character along U.S. Route 1 is more uncoordinated, strip-type retail uses, while development along Telegraph/Beulah is newer and generally more coherent in design. Northeast of HEC, a small cluster of commercial development exists on the side of Telegraph

² Fort Belvoir SWMU A07a.

Road opposite Fort Belvoir. As mentioned, Fort Belvoir's North Post contains commercial activities including retail stores, a gas station, and a bank.

3.1.1.4 Open Space/Undeveloped Areas

Along U.S. Route 1, on Fort Belvoir property, the parade grounds offer a large expanse of undeveloped open space. In years past, these have been used for various local recreational events; with the advent of the 9/11 security measures, public use has been limited. Another area of open space is the Woodlawn Plantation property. This property straddles U.S. Route 1 between Woodlawn and Old Mill Roads. The property consists of pasture/open space, the historic plantation estate, and riding areas for the associated horse stables. On Telegraph Road near Piney Run, a golf driving range provides open space and recreational use to the public.

Both Fort Belvoir and HEC have large tracts of forested and undeveloped property. Fort Belvoir maintains a golf course in the northwest part of the study area. The North Post and HEC also contain portions of the 742-acre forest and wildlife corridor that crosses these federal lands diagonally connecting Huntley Meadows Park to Pohick Bay Regional Park to the Jackson Miles Abbot Wetland Refuge (JMAWR), bordering the study area to the northeast.

Several pockets of previously undeveloped land outside of the Post and HEC have been converted to "in-fill" residential development within the past decade. A landfill is located near the intersection of Beulah Street and Telegraph Road; portions of a former gravel operation have been converted to a golf driving range with other development planned.

3.1.1.5 Prime and Unique Farmland

The Farmland Protection Policy Act (PL 97-98; 7 U.S.C. 4201 et seq.) requires federal actions to minimize the unnecessary and irreversible conversion of farmland to nonagricultural uses. Some of the study area contains soils, which can be classified as prime farmland soils³; however, none of the study area is used, or planned to be used, or has been used for farming for over 50 years. As discussed in Chapter 1, institutional land uses (military) in various forms have occurred at the Fort Belvoir since World War I, precluding use as farm land.

3.1.2 Comprehensive and Master Plans

3.1.2.1 Fort Belvoir and HEC

Fort Belvoir was in process of updating its long-range plan for the North Post when the Base Realignment and Closure Commission (BRAC) announced its decision in May 2005 to relocate approximately 21,000 Washington-area Department of Defense (DoD) employees to Fort Belvoir by 2011. Future land uses at Fort Belvoir are expected to follow the Post's mission as an administrative, regional support, and housing post. The draft long range plan had called for near-term future growth to add approximately 3,000 new employees to the Post's 29,000 employees, with another 3,000 by 2025.⁴ In addition to BRAC's

³ U.S. Department of Agriculture, Natural Resources Conservation Service, Retrieved on July 19, 2005 at <http://soildatamart.nrcs.usda.gov/>

⁴ LRC, *Op. Cit.*, 1-3

recommendations, a hospital and a national army museum are planned by 2010.⁵ The road closures, and other public access restrictions and security measures necessitated by post-September 11, 2001, will continue into the foreseeable future.

The Post's 1993 land use plan prioritizes building on previously disturbed and infill sites and on preserving existing recreational facilities on the North Post. To address potential development the Post developed a constrained land use overlay; the forest and wildlife corridor running through the North Post is an example of such a constrained land use. Similarly, the Chesapeake Bay Resource Protection Areas (RPAs) on the Post are considered by Fort Belvoir to be environmentally sensitive and compatible only with very low or no development.

HEC's 1998 Master Plan identifies the 80-acre area near its northeastern boundary for its infrastructure, with the remaining acres as open space. A draft proposal from the mid-1990's to relocate the USACE headquarters from downtown Washington, D.C. to HEC continues to be under consideration. The site suggested would be within the current open-space designated area. HEC is currently evaluating its Master Plan components.

Fairfax County is in the National Capital Region, and thus both Fort Belvoir and HEC are required to have new development reviewed by the National Capital Planning Commission (NCPC). NCPC is the central planning agency for the federal government. It adopted a new *Comprehensive Plan for the National Capital: Federal Elements* on August 5, 2004, which establishes goals and planning policies for growth and development for federal agencies. One element of the NCPC plan, *Parks and Open Space*, lists a policy of conserving portions of military reservations that add significantly to the inventory of park, open space, and natural areas and should, to the extent possible, be used by the public for recreation.

3.1.2.2 Fairfax County

The study area straddles four of Fairfax County's Planning Districts: The Lower Potomac, Mount Vernon, Rose Hill and Springfield districts. Most of the study area is located within the Lower Potomac planning district, which includes Fort Belvoir and HEC. The opposite side of Telegraph Road to the Post, bounded by Beulah Street, is located within the Rose Hill planning district. The Springfield planning district is also located within the study area bounded by Telegraph Road and Beulah Street. The eastern part of the study area lies within the Mount Vernon Planning District, which includes the Woodlawn Plantation and Historic District, VA Route 235 (Mount Vernon Memorial Highway) and its intersection with U.S. Route 1.

The plans for future development in the Lower Potomac Planning district call for continued large institutional land use in area LP4 and low-density residential in the remaining area. Other recommendations in the Plan include the creation of a focal point of development, or "Town Center," in the Lorton-South Route 1 area. In addition, there are some areas of higher density residential development in the Lower Potomac Planning District, and the Plan recognizes the need to preserve stable residential areas through compatible infill development. The Laurel Hill Community Planning Sector recognizes a number of uses (largely parkland, but also residential, elderly care (with supporting uses), and public facility uses) in the area formally occupied by the D.C. Department of Corrections.

⁵ Ibid, 3-2

The County's 2003 Comprehensive Plan calls for the development of five *Community Business Centers* along the Richmond Highway corridor. These business centers are a land use category for which the county envisions a pedestrian-friendly mix of uses that promote economic stability.⁶ The County has designated the *Woodlawn Community Business Center* and adjacent suburban neighborhoods from the intersection of Mount Vernon Memorial Highway and U.S. Route 1 to commercial areas in the vicinity of Woodlawn Court.

Fairfax County is in the process of updating the *Transportation Component* of its Comprehensive Plan. The plan calls for widening of Telegraph Road to 4 lanes, between Beulah Street and Hayfield Road. (In fact, it calls for 4 lanes the entire distance to Franconia Road, where Telegraph Road already is 4 lanes.) The comprehensive plan also depicts aligning Old Mill Road with Mount Vernon Highway. The plan acknowledges the closure of Beulah Street and Woodlawn Roads and other former means of public access within and through Fort Belvoir and includes a new 4-lane connector facility between U.S. Route 1 and Telegraph Road, namely this project.

3.1.3 Zoning

Fairfax County has a zoning ordinance to manage development. The County has designated Fort Belvoir and the adjacent HEC property as Residential Conservation. To the north, east and south of the boundaries of the Post and HEC of Telegraph Road, the zoning is nearly all Residential. Land north of Telegraph Road between Beulah Street and the Hayfield subdivision, is largely zoned as Residential or Planned Development Housing, with small pockets of Commercial and Industrial. Zoning along U.S. Route 1 is largely Commercial, with Residential zoning extending along Mount Vernon Memorial Highway, except at the U.S. Route 1 intersection.

Additionally, Fairfax County has two overlay districts within the study area. One is an historic overlay district⁷, encompassing the Woodlawn Historic District (see Cultural Resources) and extending 1,000 feet in all directions beyond the various property limits. The historic overlay places specific conditions on development. The other overlay district is a natural resources overlay district, which is located north of Telegraph Road near Beulah Street. The county created Natural Resource Overlay districts for the sand and gravel industries (and their associated products) to allow such continued uses.⁸ Currently, the Hilltop landfill operates north of Telegraph Road within that zone.

3.1.4 Force Protection

As a military installation, Fort Belvoir enforces guidelines to reduce human casualties as well as damage to critical infrastructure around military structures and housing in the event of a terrorist attack. These guidelines are known as "Force Protection Standards". There are several structures within the Connector Road study area, both on Fort Belvoir and HEC, which require specific standoff distances and/or associated threat-protection reduction measures.

Fort Belvoir and HEC apply the DoD's *Unified Facilities Criteria 4-010-01; Antiterrorism Standards for Buildings*. The DoD criteria recommends minimum standoff distances of 45

⁶ Fairfax County, 2004d, pg. 3

⁷ From Fairfax County Zoning Ordinance, Article 7, Overlay and Commercial Revitalization District Regulations, Part 2, 7-200 Historic Overlay Districts.

⁸ *Ibid.*, Part 3, 7-300 Natural Resource Overlay District.

meters (148 feet) for new and existing buildings as a distance from public access roadways without a controlled perimeter. This standoff distance offers what DoD defines as a “low” level of protection. Other facilities, which require a higher level of protection and which have their separate controlled perimeter, seek a 400-meter standoff distance. HEC is currently re-evaluating force protection criteria for sensitive areas.

3.1.5 Visual Environment

The visual characteristics of a transportation facility can strongly influence viewer responses—both positive and negative. The visual environment can be affected for both views from a road (for drivers) and views to a road (surrounding residences and businesses, for example). Research has shown that people will consistently identify visual environments of both high and low quality. This section summarizes the existing visual environment within the study area.

3.1.5.1 Views to the Road

The most distinctive aesthetic and visual features in the study area are associated with the Woodlawn Historic District, with particular focus to Woodlawn Plantation in the southeastern portion of the study area. The Plantation residence, discussed later in this chapter, is a National Historic Landmark (NHL). The 1803 residence of George Washington’s step-granddaughter lies on top of a hill. The Plantation’s viewshed offers an unobstructed view for several miles to the east and southeast towards Mount Vernon and the Potomac River. The Pope-Leighey house is also located on the Woodlawn Plantation National Historic Landmark property approximately 375 feet south of Old Mill Road. Trees and vegetation mostly obscure views to the road from the Pope-Leighey house during the spring, summer and fall. The stables and pasture located across U.S. Route 1 from the residence contribute to the vista. Both parcels are listed on the National Register of Historic Places. Trees, vegetation and other landscaping obscure Richmond Highway and the Richmond Highway intersections with Old Mill Road and Mount Vernon Highway from the viewshed. As mentioned under zoning above, some of the study area lies within an historic overlay district which provides certain aesthetic guidelines, such as the use of landscaping for screening commercial activities.

Other viewsheds exist on Fort Belvoir property, at certain points along the Post’s golf course, but this area is restricted from public access.

3.1.5.2 Views from the Road

For drivers, there are four distinctive roadway corridors in the study area:

- Mount Vernon Memorial Highway (MVMH), Route 235, at the southeastern edge of the study area,
- Telegraph Road (VA 611) along the northwestern edge of the study area,
- U.S. Route 1 (Richmond Highway) along the south, and
- Fairfax County Parkway along the southwest.
- Old Mill Road (from Pole Road to U.S. Route 1)

(a) Mount Vernon Memorial Highway

The MVMH is a two lane roadway, except at occasional intersections where turning lanes are provided. It connects to the George Washington Memorial Parkway at Mount Vernon, about 8 miles to the east. The MVMH is a facility of the Commonwealth of Virginia and maintained

by VDOT. It has controlled access. Other than at the U.S. Route 1 intersection, it offers a pleasant drive along suburban residences and parks.

(b) Telegraph Road

Telegraph Road in the study area has three typical sections, one of which is reminiscent of a "country two-lane roadway." Motorists can observe hardwood forest along the DCEETA and HEC properties. Beyond HEC towards Hayfield Road, the pavement is wide enough to accommodate 4 travel lanes, and has the high school and elementary school on either side. From Beulah Street towards the Fairfax County Parkway, the typical section is a recently constructed 4-lane divided facility with grassed median and bike lanes.

(c) U.S. Route 1

U.S. Route 1 is an uncoordinated mix of office buildings, fast food restaurants, strip malls, gas stations and motels encroaching on the views of the Woodlawn Plantation's boundaries at Mount Vernon Memorial Highway and Old Mill Road. However, as U.S. Route 1 traverses the Woodlawn Plantation, the driver enjoys a vista of a horse pastures on the Woodlawn Stables property and a lawn/meadow on the Woodlawn Plantation NHL property.

Near Woodlawn Road, on opposite sides of U.S. Route 1, there is a church, cemetery, and Woodlawn Friends Meeting House. The meeting house is adjacent to the expansive parade grounds opposite Pence Gate. However, since the closure of Woodlawn Road to the public, the Army has erected a tent and other security features, which detract from the otherwise previously pleasant visual connection between the Woodlawn Plantation and the Woodlawn Friends Meeting property.

(d) Fairfax County Parkway

Fairfax County Parkway presents an edge of the study area, traveling from U.S. Route 1 to I-95 along a wide right-of-way. It is a recently constructed 4-lane divided controlled access facility, mostly with grade separations. A multi-purpose path skirts one side.

(e) Old Mill Road

Old Mill Road is presently a 2-lane undivided roadway from Pole Road to the intersection of U.S. Route 1. Views from the road include forested areas of Woodlawn Plantation on one side of the road, and a mix of multi-unit residential complexes on the other side (opposite to the Woodlawn Plantation NHL property). The Pope-Leighey House is not visible from Old Mill Road most times during the year. The approach to the intersection of Old Mill Road and U.S. Route 1 is typical of development in the area, an uncoordinated mix of commercial and retail uses.

3.1.6 Coastal Zone Management

The Coastal Zone Management Act (CZMA) of 1972 (16 USC § 1451, et seq., as amended) provides assistance to states, in cooperation with federal and local agencies, for developing land and water use programs in coastal zones. The Commonwealth of Virginia developed a Coastal Zone Management Program (CZMP) in 1986. Section 307(c)(1) of the CZMA Reauthorization Amendment (CZMARA) stipulates that federal projects that affect land uses, water uses, or coastal resources of a state's coastal zone must be consistent to the

maximum extent practicable with the enforceable policies of that state's federally-approved coastal management plan.

The Virginia Department of Environmental Quality (DEQ) is the lead agency for administering the regulatory and advisory reviews. All of Fairfax County, and thus projects in the study area, is covered under Virginia's Coastal Resources Management Program (CRMP). As part of the NEPA process, the project will be submitted to the DEQ to determine the consistency of the project with CRMP goals. Areas where a project is evaluated for CRMP consistency by the DEQ include:

- Fisheries Management
- The State Tributyltin (TBT) Regulatory Program
- Subaqueous Lands Management
- Wetlands Management
- Dunes Management
- Non-Point Source Pollution Control
- Point Source Pollution Control
- Shoreline Sanitation
- Air Pollution Control

3.2 Natural Resources

The project is located in the Washington D.C. metropolitan area, which is recently and rapidly changing from undeveloped natural areas to developed land uses. Specifically, in this urbanized area, Fort Belvoir and HEC offer significant tracts of native vegetation with diversity and proximity to other large undisturbed tracts such as Pohick Bay Regional Park, Huntley Meadows Park and Mason Neck National Wildlife Refuge. To preserve its ecological significance, Fort Belvoir actively manages and conserves natural resources within its boundaries. External to the federal facilities, other natural features occur in the study area.

Fort Belvoir's *Integrated Natural Resources Management Plan* (INRMP) is also a useful reference if further information on the Post's natural resources is needed.

3.2.1 Physiography

Physiographic features include soils, groundwater, and topography, as well as an area's unique physical features. From this information, FHWA can determine suitability of soils for construction, slope stability, erosion potential and other factors.

The entire area east of Interstate 95 in the County lies within the Coastal Plain, including all of the study area. The study area lies along the Fall Zone, a physiographic delineation that separates the Coastal Plain Physiographic Province from the Piedmont Physiographic Province. The Coastal Plain Province is comprised of both unconsolidated and partially consolidated sediments and sedimentary rocks that regionally form an eastward thickening wedge. Sediments within the province are generally representative of multiple marine transgressive and regressive depositional sequences.

3.2.1.1 Topography

The study area primarily consists of rolling terrain. Surface features range from smooth uplands to bluffs and ravines; there are well-to-moderately drained uplands as well as poorly drained lowlands. Generally, the topography of the study area ranges from flat areas to areas defined by steep slopes containing a mixture of uplands and lowlands. Elevations in the study area range from about 25 feet above mean sea level (MSL) along Dogue Creek and Huntley Meadows Park, to about 230 feet MSL near Beulah Street and Telegraph Road. Richmond Highway at Mt. Vernon Highway is less than 30 feet MSL.

Severe slopes exist in the center and western portions of the study area. Slope percentages in these areas range from 10 to greater than 40 percent. Slopes in the eastern and southern portions of the study area are not as severe, at generally less than 10 percent. For the entire Fort Belvoir North Post, about 40 percent of the land consists of uplands and plateaus, 40 percent lowlands, with the remaining 20 percent as steep slopes.⁹ (See **Figure 3-2**, Steep Slopes and Poor Soils.)

3.2.1.2 Geology and Soils

The Coastal Plain is generally composed of soft, sedimentary rocks: unconsolidated sand, silt, and clay underlain by residual soil and weathered crystalline rocks. Most of the sediments in the study area, specifically identified at Fort Belvoir, belong to the Potomac Formation. Lens-shaped (lenticular) deposits of interbedded sand, silt, clay and gravel underlain by residual soil and weathered crystalline rocks characterize the Potomac Formation. Most notable of the Coastal Plain deposits are that these are unconsolidated sediments deposited during successive periods of building and receding shorelines.

Soils in the study area are largely two types: Dragston fine sandy loam and Lunt silt loam. Some of these are designated as Class 'A' soils. The problems associated with these soils include unstable slopes and land slippage, high shrink-swell clays, poor foundation support, and high water table conditions. Some of the soils are designated Marine Clay. Fairfax County has designated Marine Clays as a problem soil because of their high "shrink-swell" characteristics; with some areas identified as slippage-prone soils. The County comprehensive plan further advises that any development in areas with these conditions should apply the latest technologies for stabilizing marine clays from soil slippage. See Figure 3-2 for the locations of poor soil.

3.2.2 Water Resources

Water resources are essential to maintaining human health, fish and wildlife habitat, and vegetation. These resources can be affected by roadway projects because increased impervious surfaces can lead to changes in hydrology, degrade the surface waters that drain to streams and, thereby, affect natural habitats. These changes can also influence flooding effects and groundwater recharge.

Information on water resources in the study area was collected from a U.S. Geological Survey study for Fairfax County, and Ft. Belvoir's *Integrated Natural Resources Management Plan (INRMP)*. Surface and ground water resources in the study area are discussed below.

⁹ U.S. Army Garrison, Fort Belvoir, Virginia, *Environmental Assessment, Defense Communications-Electronics Evaluation and Testing Activity (DCEETA), Construction of Remote Delivery Facility and Perimeter Road Widening*, August 2005, p.3-6.

3.2.2.1 Groundwater

Three main groundwater aquifers underlay Fairfax County: Bacon's Castle Formation, and the Lower and Middle Potomac Formations. Groundwater in the Connector Road study area is primarily located within confined aquifers of the Lower Potomac Formation. The Lower Potomac Formation is characterized by a system of sandy aquifers separated by silt and clay¹⁰. Groundwater in this aquifer flows to the southeast. Recharge occurs by precipitation in the north and west of the study area, starting near the fall line with Piedmont physiographic province.

While the water from the aquifer is potable, neither the federal installations nor local residents in the study area use wells for drinking water. The Post continues to use about five wells for irrigation purposes (to service the golf course, for example). The County's 2003 Comprehensive Plan indicates that these aquifers are not a key source of drinking water for residents¹¹. The Fairfax County Water Authority supplies potable water to the area.

Water tables in the study area vary for a variety of reasons including localized soil characteristics, proximity to streams, precipitation and evapotranspiration. The Coastal Plain is characterized by a water table with typical depths of 10 to 35 feet.

3.2.2.2 Surface Water

Fairfax County contains fourteen watersheds groups and the study area contains parts of two of these groups; The Dogue Creek and Accotink Creek Watersheds (See **Figure 3-3**, Watersheds). The Accotink Creek Watershed is a distinct watershed, while Dogue Creek is part of the Lower Potomac Watershed Group which includes Dogue Creek, Little Hunting Creek, and Belle Haven watersheds. All watersheds in this region are part of the larger Potomac River Basin, which feed the Potomac River and ultimately to the Chesapeake Bay and Atlantic Ocean. The Potomac River Basin is a large watershed area of 14,670 square miles extending across four states (Virginia, West Virginia, Pennsylvania, and Maryland) and the District of Columbia.

(a) Dogue Creek Watershed

The Dogue Creek watershed is located in the eastern portion of the study area, roughly bisecting the study area at Woodlawn Road. The watershed contains fifteen sub-watersheds, including the Jackson Miles Abbott Wetland Refuge (JMAWR). Tributaries to Dogue Creek include Piney Run that crosses Telegraph Road in the northeastern part of the study area and travels southeasterly through the JMAWR, Dogue Creek park, and under U.S. Route 1.

(b) Accotink Creek Watershed

The Accotink Creek watershed is located within the western part of the study area, roughly bisecting the study area along Woodlawn Road.

Additional information on the watersheds is included below in the Water Quality section.

¹⁰ USGS, *Fairfax County Stream Protection Baseline Study*, 1989, pg. 5

¹¹ Fairfax County Department of Planning and Zoning, Fairfax County, Virginia, *Fairfax County Comprehensive Plan, 2003 Edition, Chesapeake Bay Supplement, Policy Plan*, Adopted 11-15-2004, p. 41, Retrieved from: <http://www.fairfaxcounty.gov/dpz/comprehensiveplan/policyplan/chesapeakebay/waterfactors.pdf>. Note: Aquifer may provide potable water to jurisdictions outside of Fairfax County.

3.2.2.3 Water Quality

The U.S. Environmental Protection Agency (EPA) has water quality management regulations requiring states to list waters that do not meet state defined numeric and/or narrative water quality standards or criteria. The criteria used to evaluate impaired waters evaluate whether those waters either partially support or do not support one or more of five designated uses. (i.e. aquatic life, fish consumption, shellfish consumption, swimming, and drinking water.) The most current *Impaired Waters List* was developed by the Virginia Department of Environmental Quality (DEQ) with assistance from the Virginia Department of Conservation and Recreation (DCR).

Section 303(d) of the Clean Water Act and the EPA regulation 40 CFR Section 130.7(d) (1) promulgated in July, 1992, requires each state to submit a Total Maximum Daily Load (TMDL) Priority List to EPA in even numbered years. The *303(d) Impaired Waters List* is a compilation of those waters in the Commonwealth of Virginia that are designated water quality limited. These waters are defined as impaired. None of the waterbodies identified in the study area are included on Virginia's *2004 303(d) List of Impaired Waters*.

Fort Belvoir has also assessed stream conditions on the garrison.¹² Stream erosion and poor conditions exist, but the Post has implemented a program of a number of corrective measures. Additionally, Fort Belvoir conducted analyses¹³ of baseline conditions for all on-Post perennial streams in Spring 1998 and Spring 1999, including samples from Accotink Creek and Dogue Creek. Water samples were tested for nutrients, pesticides, metals, and total petroleum hydrocarbons. Sediments were not analyzed. The tests concluded that most EPA chronic aquatic life or human health criteria were not exceeded (except for iron, manganese, and aluminum). The levels for iron and manganese did not exceed levels that would be considered for toxicological effects. The levels measured for aluminum were reported to be typical of natural waters which frequently exceed criteria measures for aluminum.

Fairfax County also conducts water quality analysis for waterbodies within the county¹⁴. The analysis was conducted for individual watersheds and respective sub-watersheds. Sub-watersheds to the Dogue Creek watershed are located within the northeastern part of the study area. These sub-watersheds — on the main stem (above the north fork) of the creek and the “Barnyard Run” area of the river — are characterized as high quality streams by the County. Both sub-watersheds are in proximity to the JMAWR and are classified as *Watershed Management Areas*.

Part of Dogue Creek's watershed also crosses U.S. Route 1, before emptying into the Potomac River. This sub-watershed is characterized by stream degradation and is classified by the Fairfax County Department of Public Works and Environmental Services as a *Watershed Restoration Area Level II*. This classification is used for a sub-watershed where water quality conditions were determined to be poor. The management strategy for this

¹² U. S. Army Garrison Fort Belvoir, March 1, 1999, “*Watershed Delineation Project and Problem Site Descriptions... Volume II: Dogue Creek Watershed...*”

¹³ U.S. Army Garrison Fort Belvoir, Fort Belvoir, Virginia, Environmental and Natural Resources Division — Directorate of Installation Support, March 2001, *Fort Belvoir Integrated Natural Resources Management Plan, Chapter 7.0 Water Resources*, from: <http://www.belvoir.army.mil/bea.asp?id=inrmp>, pg. 7-26

¹⁴ Fairfax County Department of Public Works and Environmental Services, Fairfax County, VA, *Fairfax County Stream Protection Baseline Study*, January 2001, Retrieved from: http://www.fairfax.va.us/dpwes/environmental/SPS_pdf.htm, pg. 3-66

section of the creek involves the most comprehensive set of activities to improve watershed quality.

The Accotink Creek watershed is also classified as a *Watershed Restoration Area Level II* by Fairfax County within the study area. Water quality measures were classified as poor within the sub-watershed, requiring the most comprehensive activities to improve water quality¹⁵.

3.2.3 Floodplains

Executive Order 11988, Floodplain Management, defines the term floodplain as “the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year.” Fairfax County defines *floodplains* as areas that “are periodically subject to inundation by water as a result of rainfall and/or snow melt events causing streams and rivers to spill over their banks. The 100-year floodplain is the area that would be expected to be flooded by the rainfall event that is expected to occur, on average, once every 100 years.”¹⁶ The Federal Emergency Management Agency (FEMA) regulates construction in floodplains to protect the constructed facility and to protect existing upstream and/or downstream facilities/properties from increased flooding. Floodplain Management, Executive Order 11988, issued 24 May 1977, directs all Federal agencies to avoid development in the 100-year floodplain, when possible.

FEMA flood insurance rate maps (FIRMs) indicate that the 100-year floodplain along Dogue Creek is located only in the easternmost edge of the study area. South and west of the Fairfax County Parkway is the Accotink Creek 100-year floodplain. **Figure 3-4** shows the 100-year floodplains as mapped by the County and Fort Belvoir. The figure also shows area wetlands.

3.2.4 Natural Environmentally Sensitive Areas

While this chapter presents information on numerous natural, physical and socio-economic resources, the study area contains some specific locales, which warrant particular mention due to their environmental sensitivity. Some of these naturally sensitive areas provide protection for native plant and animal communities, or provide unique opportunities for the public. Fort Belvoir’s *Integrated Natural Resources Management Plan* (INRMP) is also a useful reference if more information on the Post’s environmentally sensitive areas is needed. These areas are briefly described below, and illustrated in **Figure 3-5**.

3.2.4.1 Forest and Wildlife Corridor

The Fort Belvoir Forest and Wildlife Corridor was established in 1993 to offset the ecological impacts of habitat fragmentation caused by several major construction projects on Fort Belvoir. The Forest and Wildlife Corridor was a mitigation measure resulting from Fort Belvoir’s previous *1993 Long Range Component of the Real Property Master Plan* and *1988 Base Realignment/Closure (BRAC)*. An Environmental Impact Statement (EIS) was prepared in 1991 for the BRAC recommendations. That EIS proposed the Forest and Wildlife Corridor, originally envisioned as a “wildlife genetic or green” corridor recognized by both Fairfax County and the U.S. Fish and Wildlife Service for its importance in maintaining species

¹⁵ Ibid, pg. 3-74

¹⁶ Fairfax County Department of Planning and Zoning, *Fairfax County Comprehensive Plan, 2003 Edition, Chesapeake Bay Supplement, Adopted 11-15-2004*, p. 27

survival. The Corridor includes wetlands; riparian forest buffers; habitat for the state-listed wood turtle and several high priority breeding bird species listed with Partners in Flight (PIF); and waterways for passage of, and spawning habitats for anadromous fish. The corridor connects on- and off-post forested areas of wildlife habitat and allows animal movement between the larger forested areas, thus maintaining a diverse gene pool and helping ensure species survival.

The Corridor (i.e., the Forest and Wildlife Corridor) is comprised of a continuous band of forest and wetland habitats that cross the installation and connect with similar habitats in Huntley Meadows County Park (to the northeast) and on Mason Neck peninsula (e.g., Pohick Bay Regional Park, Gunston Hall Plantation, Mason Neck State Park and Mason Neck National Wildlife Refuge) (to the southwest). The corridor was identified in the early 1980's and has been documented by long-term biological studies. The corridor protects wildlife habitat and maintains a continuous area of natural forest habitat between JMAWR on the North Post and the Accotink Bay Wildlife Refuge (ABWR) on the South Post (southwest of the study area). The corridor is approximately 15 miles long with a minimum width of 250 meters. The Forest and Wildlife Corridor is not open to the public except for events that have been authorized by Fort Belvoir.

To help protect and manage the Corridor, the *Fort Belvoir Forest and Wildlife Corridor Management Plan* was developed in 1993. This Plan summarizes the history of the Corridor, documents its ecological function and importance, and prescribes management actions which include:

- Align roads to minimize the extent of encroachment on the corridor.
- Keep the cleared roadway as narrow as possible and minimize tree cutting.
- Keep utility right of way as narrow as possible
- Eliminate overhead utility and communication lines.
- Install appropriate animal crossings as part of each road construction project
- Accomplish aggressive erosion and sedimentation control during construction
- Include post-construction replantings to improve disturbed area recovery.

A new Real Property Master Plan (RPMP) was also developed in 1993. The RPMP designates the Forest and Wildlife Corridor as an environmental land use, and designates it as "severely constrained to development" The Environmental Assessment (EA) for the RPMP addresses implementation of the Corridor as a land use designation. The Finding of No Significant Impact (FONSI) for the RPMP EA (1993) states that Fort Belvoir will mitigate for the environmental impacts of projects developed under the RPMP by, among other things, following the requirements of the Forest and Wildlife Corridor Management Plan.

In 2001 Fort Belvoir developed an Integrated Natural Resources Management Plan (INRMP). The INRMP validates the corridor as a "Special Natural Area" under Department of Defense (DoD) Conservation Policy (DoD Instruction 4715.3. Among other actions, the INRMP calls for continuing "to prohibit land clearing and development within the corridor" (with the understanding that some clearing, such as utility line installation and maintenance and road

widening, will be unavoidable) and recommends expanding the limits of the designated Corridor.

If unavoidable activities such as road widening or construction are required in the Corridor area, mitigation measures are to be used that restore connectivity such as the use of oversized box culverts to serve as wildlife crossing structures.

3.2.4.2 Chesapeake Bay Preservation Areas

The Commonwealth of Virginia Chesapeake Bay Preservation Act of 1988 requires communities that are located along tidal portions of rivers that drain into the Chesapeake Bay to establish water quality protection measures. In response, Fairfax County enacted a Chesapeake Bay Ordinance that regulates the kinds of development that can occur in buffer areas along streams that drain to the Potomac River and eventually into Chesapeake Bay.

These buffer areas are known as Resource Protection Areas (RPAs). As established in accordance with Chapter 118 of The Fairfax County Code¹⁷, RPAs are defined as:

“A component of the Chesapeake Bay Preservation Area of the County comprised of lands adjacent to water bodies with perennial flow that have an intrinsic water quality value due to the ecological and biological processes they perform or are sensitive to impacts which may result in significant degradation of the quality of state waters. In their natural condition, these lands provide for the removal, reduction, or assimilation of sediments, nutrients, and potentially harmful or toxic substances from runoff entering the Bay and its tributaries, and minimize the adverse effects of human activities on state waters and aquatic resources.”

As illustrated in **Figure 3-5**, RPAs in the project study area extend largely along the stream banks of Dogue Creek, Piney Run, and Accotink Creek. This figure illustrates RPAs and streams that have been identified by both Fairfax County and Fort Belvoir. Although public transportation projects are exempt from the Fairfax County Chesapeake Bay Preservation Ordinance, VDOT attempts to avoid or minimize impacts to RPAs where possible.

As environmentally sensitive land corridors that lie along or near streams, rivers and other waterways, RPAs are important for many reasons. These include: water quality enhancement, stormwater and floodwater management, stream bank and shoreline stabilization, water temperature modification, wildlife habitat protection, and pollutant absorption.

Fairfax County's Environmental Quality Corridor (EQC) policy also provides guidance on water quality protection through the preservation of environmentally sensitive areas, such as RPA's. This policy is consistent with the County's Chesapeake Bay Preservation Ordinance, but it is not a regulation. The policy is primarily relevant to the county zoning process in the granting of special exceptions, special permits, and rezonings (as it relates to negotiations with developers for example). The EQC system seeks to protect and restore open space systems that link and preserve natural resource areas and provide passive recreation. The EQC policy recommends protection and restoration of environmentally sensitive lands,

¹⁷ Fairfax County, Virginia, *Code of the County of Fairfax, Virginia, Chapter 118, Chesapeake Bay Preservation Ordinance*, Accessed at:
<http://www.fairfaxcounty.gov/offsite/?pg=http://www.municode.com/resources/gateway.asp?pid=10051&sid=46>

including 100-year floodplains, steep slopes (gradient of 15 percent or greater) in stream valleys, minimum buffer areas, and upland habitats that augment the habitats and buffers provided by stream valleys.

3.2.4.3 Jackson Miles Abbott Wetland Refuge

The Jackson Miles Abbott Wetland Refuge (JMAWR) is a 146-acre wetland refuge established in 1988. JMAWR was designated a *Special Natural Area* by the Department of Defense (DoD) and Department of Army (DA) under DA Policy 13.1. Special Natural Areas are defined as areas on military installations such as refuges, scenic and/or wildlife areas where the DA focuses on conservation management. The Special Natural Area Policy is described as follows in the Fort Belvoir's INRMP:

“DA's natural resources management policy is contained within AR 200-3, Natural Resources Land, Forest and Wildlife Management. This regulation establishes the Army's requirements for managing and using land and water resources in accordance with the principles of ecosystem management, and institutes the Army's commitment to conserve, protect, and sustain biological diversity, and to restore degraded ecosystems. AR 200-3 acknowledges the need to set aside for conservation installation areas having significant natural resources, and the necessity of providing the public with opportunities to access these resources for education, scientific research and study, and recreation, consistent with ecosystem management goals. “

The Department of the Army established JMAWR to protect the wetlands along Dogue Creek and to provide public access to an important bird watching area. It is open 365 days a year to the public. JMAWR contains several amenities including a 0.6-mile hiking trail (a portion of which is handicapped accessible), three fishing piers (handicapped accessible) at the 1.5-acre manmade Mulligan Pond, a wildlife viewing area, parking, and an information kiosk at the Meeres Road entrance. Use surveys by Fort Belvoir indicate that major recreation activities in JMAWR include nature walking, dog walking, fishing, bird watching and wildlife observation.

JMAWR supports several state-listed rare animal species. JMAWR includes wetlands; riparian forest buffers; habitats for the state-listed wood turtle and state-listed rare plant species; and Partners in Flight (PIF) high-priority breeding sites. Its contiguous forest provides migratory corridors for wildlife. The northeastern boundary of JMAWR abuts Huntley Meadows Park.

3.2.4.4 Huntley Meadows Park

Huntley Meadows Park is located at the periphery of the study area, in the northeast corner abutting the HEC and the JMAWR, and extending northeasterly. The Federal Government donated land for Huntley Meadows Park to Fairfax County in 1975. It is the largest park¹⁸ in Fairfax County and contains 1,425 acres of diverse habitats including wetlands, meadows and mature forest. There are trails and a boardwalk, and an interpretive center. The land transfer agreement from the U.S. Department of Interior protects the park in perpetuity.

Two parcels belonging to the Fairfax County Park Authority (FCPA) or the Army provide additional habitat in the same sub-watersheds. One (the Berman-Gerber Tract) is a 28 acre

¹⁸ <http://www.fairfaxcounty.gov/parks/nature.htm>

parcel, transferred by the Fairfax County to federal ownership (Department of the Army) in 2003; it lies adjacent to Pole Road next to Fort Belvoir housing. The other (Pole Road Park) is a 49 acre tract providing a continued natural setting contiguous to JMAWR.

3.2.5 Wetlands

Wetlands serve many critical functions to the environment. They can help moderate stormwater flow, reduce flooding severity, and act as filters for substances such as dirt and oil. Wetlands also provide vital habitat for plant and animal species.

Wetlands are defined as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, and similar areas¹⁹. In most cases, three wetland parameters must be present in order for an area to be considered a wetland by U.S. Army Corps of Engineers (USACE) and VDEQ. These parameters include hydrophytic vegetation, hydric soil, and wetland hydrology.

In 1972, Congress passed the Federal Water Pollution Control Act Amendments, known as the Clean Water Act (CWA), to “restore and maintain the chemical, physical, and biological integrity” of the nation’s waters. (33 U.S.C. §1251 et. Seq.). Section 404 of the CWA gives the USACE authority to regulate the discharge of dredged or fill material in all waters of the U.S., including wetlands.

Executive Order 11990, “Protection of Wetlands” requires federal agencies to avoid and minimize harm to wetlands. This project must avoid wetlands unless there is “no practicable alternative.” If a federal project uses wetlands, it must undergo “all possible planning to minimize harm to wetlands.”

3.2.5.1 Study Area Wetland Features

The regional wetland patterns located within the study area are typical of the upper Coastal Plain and Piedmont physiographic provinces. Wetlands within these provinces are generally associated with drainage networks. See **Figure 3-4** for a map illustrating wetland features in the study area.

Virginia’s Department of Conservation and Recreation (VDNR) identifies portions of the study area as located within the Dogue Creek Wetlands Conservation Site²⁰. Conservation sites are tools for representing key areas of the landscape that warrant further review for possible conservation action because of the natural heritage resources and habitat they support. Natural heritage resources of concern in this conservation site include a Coastal Plain/Piedmont Acidic Seepage Swamp and an animal species, the Wood turtle (*Clemmys insculpta*).

The Acidic Seepage Swamp is a unique type of wetland found along steep-sloped areas of the Potomac River and its tributaries. These wetlands are limited in their extent and confined to a northern and southeastern portion of the study area along Dogue Creek within the Jackson Miles Abbott Wetland Refuge. These wetlands are generally described as saturated deciduous or mixed forests of small headwaters stream bottoms and seeping toe-slopes with

¹⁹ USACE , 2003

²⁰ Munson, 2005

acidic, nutrient-poor soils.²¹ The vegetation in these seep areas is relatively dense, however plant diversity is relatively low. The tree canopy is comprised of common coastal plain bottomland hardwood species such as red maple, sweet gum, willow oak, green ash, pin oak, American elm, and silver maple. The shrub layer is dominated by *Viburnum* species such as black haw, with some ironwood, highbush blueberry, and red maple also present. The herbaceous layer is almost completely dominated by skunk cabbage, with lizard's tail and several species of sedges and arrow-leaf also occurring.

Other types of wetlands located in the study area include: palustrine forested (PFO), palustrine emergent (PEM), palustrine scrub/shrub (PSS) and palustrine open water (POW). The palustrine forested wetlands are primarily located along the floodplains of the creeks. They are classified as Coastal Plain/Piedmont Bottomland Hardwood Forest. The forest canopy includes red maple, sweet gum, willow oak, green ash, American sycamore, pin oak, American elm, silver maple, and box elder. Common understory saplings and shrubs include ironwood, red maple, American elm, sweet gum, black haw, and highbush blueberry. The herbaceous layer in the stream floodplains is diverse, with sparse areas under deep forest canopy near the creeks themselves, and dense areas in openings along utility lines. The sparse herbaceous layer immediately adjacent to the creeks commonly had poison ivy, Jack-in-the-pulpit, Virginia creeper, Japanese honeysuckle, *Microstegium*, May apple, and netted chain fern, with scattered other plants in low densities.

Within the study area, the palustrine emergent and palustrine scrub/shrub wetlands are concentrated in utility right-of-way openings. Here eastern burreed, soft rush, rice cutgrass, cattail, and many sedges dominate the vegetation, forming a dense layer. Also commonly observed in these areas are dewberry, jewelweed, panic grasses, and numerous fern species such as cinnamon fern, netted chain fern, and royal fern. Sweet gum is the most common invading woody plant in these linear canopy openings along the utility lines, and is one of the dominant plants in the palustrine scrub/shrub areas. Other common shrub dominants include green ash, black haw *Viburnum*, ironwood, highbush blueberry, and red maple. Functions of these types of wetlands, and wetlands in general, include sediment trapping, flood-flow and nutrient reduction, and wildlife habitat. PFOs are the predominant wetland type in the study area.

3.2.6 Vegetation and Wildlife Habitats

Wildlife presence within a densely populated suburban environment depends on the availability of suitable habitat. Habitat loss and fragmentation is a primary reason for species decline in urban and suburban environments. Human infringement on habitat can also influence the presence and abundance of wildlife in suburban environments.

Biological resources evaluated for the report include native or introduced plants and animals and their habitats. The resources discussed in this section include aquatic habitat, terrestrial habitat, plant and animal species, as well as the federal and state designated threatened and endangered species that may be present within the study area.

Information on biological resources was obtained in part from Fort Belvoir's *Integrated Natural Resources Management Plan* (INRMP), and was supplemented through HDR field surveys. Several habitats are presented in **Figure 3-6**, with many overlapping with designated features such as JMAWR.

²¹ Munson, 2005

3.2.6.1 Aquatic Habitat

Aquatic resources include fisheries and aquatic habitat located within the study area. The INRMP identifies 60 species of inland fishes collected at Fort Belvoir. These species may occur in the study area. Aquatic habitat in the study area includes the Dogue and Accotink Creek watersheds which are discussed in further detail in the water resources section. Fairfax County's 2001 *Stream Protection Strategy Baseline Study* analyzed aquatic habitat in both watersheds.

Within the Dogue Creek watershed portion of the study area, aquatic habitat quality varied by location. The sub-watershed in proximity to the JMAWR had a site condition rating of "good," while the habitat was rated as "fair." Aquatic habitat in the study area was ranked on ten criteria observed at each monitoring site. The study noted that sediment deposition in the streams of the watershed affect aquatic habitat quality. At the time, 15 individual fish species were observed in the watershed. Anadromous fish migrate up Dogue Creek only as far as U.S. Route 1, where a pipe restricts their further progression towards JMAWR or Huntley Meadows Park.

The County's Baseline Study rated the aquatic habitat quality as "poor" within the Accotink Creek watershed portion of the study area. Individual monitoring sites observed low numbers of fish species overall. The condition of stream banks was also observed to be poor with areas of erosion and sedimentation which have a negative effect on habitat.

3.2.6.2 Terrestrial Habitat

The study area provides habitat for numerous wildlife species. These habitats include floodplain forest, mixed hardwood forests, pine forests, urban/open fields and wetlands. The floodplain, forest and wetland habitats were described previously. The terrestrial habitat is primarily upland habitat, and is comprised of three primary community types – mesic mixed hardwood forest, xeric pine forest, and low elevation dry mixed oak/heath forest.

The mesic mixed hardwood forests generally occur adjacent to the alluvial wetlands, and common canopy species observed here include tulip tree, willow oak, American beech, sweet gum, red oak, and black gum. Common understory species observed in this community included ironwood, red maple, pawpaw, American holly, and American beech. The herbaceous layer is variable in density, with some areas exhibiting nearly complete groundcover, while other areas exhibited almost no groundcover. Areas with dense groundcover are dominated by Japanese honeysuckle, poison ivy, ground pine, *Microstegium*, and Virginia creeper, while more sparsely covered areas are occupied by greenbrier, partridgeberry, spotted wintergreen, downy rattlesnake plantain, and lowbush blueberry. In areas where canopy openings allow more light to reach the forest floor and along the forest edges, large patches of wineberry and trumpet creeper occur.

The xeric pine forest is located on ridges and side slopes of rock outcrop areas. The canopy is dominated by Virginia pine, and the understory is typically sparse, with scattered ericaceous shrubs most commonly encountered. Where wind throw had downed trees and opened the forest floor to more sunlight, plants such as wineberry and blackberry are commonly observed, though not in patches as dense as those occurring in the mesic forest.

The low elevation dry mixed oak/heath forest is located on submesic to xeric infertile upland sites. This community is located on exposed ridgetops where a thin layer of nutrient poor soil

overlies the bedrock. Virginia pine and black oak are codominants in the canopy of this community. The understory is generally sparse, but commonly included black oak saplings, sassafras, black cherry, lowbush blueberry, huckleberry, and several other low-growing ericaceous shrub species. Occasional large patches of pink lady's slipper orchids can be observed growing on these ridgetop communities, but little other herbaceous cover exists in this community.

3.2.6.3 Wildlife

The diversity of habitats found on Fort Belvoir support many species of wildlife. Fort Belvoir's INRMP identifies 43 species of mammals as occurring or potentially occurring at Fort Belvoir. In addition, the INRMP identifies 263 species of birds, 33 species of reptiles and 27 species of amphibians. All of these species may occur in the study area either as permanent residents or as transient migrants.

Some of the wildlife occurring in the study area consists of species managed as game species by the Virginia Department of Game and Inland Fisheries (VDGIF) and/or the U. S. Fish and Wildlife Service (USFWS). These include the white-tailed deer, wild turkey, gray squirrel, bobwhite quail, and migratory waterfowl such as ducks and geese.

The majority of the wildlife species found in the study area are not game species, however. The large contiguous tracts of deciduous forests provide foraging and breeding habitat for many species of birds, especially neo-tropical migrants. The riparian wetlands of Dogue Creek and tidal wetlands of Accotink Bay provide important foraging and breeding habitat for a variety of resident and migratory waterfowl and shorebirds.

3.2.6.4 Threatened and Endangered Species

The diversity of habitats found at Fort Belvoir support some rare species, including some that are listed as threatened or endangered. Three sources were used to identify threatened and endangered species and species of concern that occur or potentially could occur within the study area:

- USFWS
- Virginia Department of Conservation and Recreation (VDCR), and;
- VDGIF

The VDGIF maintains a database of federal and state listed threatened and endangered species within Virginia. The VDCR Natural Heritage Program also rates species and communities with resource conservation rankings, and maintains a database of this information.

The Endangered Species Act of 1973 is jointly administered by the USFWS of the U.S. Department of Interior and the National Oceanographic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. Other threatened and endangered species are identified and protected by the Commonwealth through Article 6 (§[29.1-563](#) et seq.) of Chapter 5 of Title 29.1 of the Code of Virginia.

The Bald eagle (*Haliaeetus leucocephalus*) and the small whorled pogonia (*Isotria medeoloides*) are the only known federally-listed threatened species to occur within the study area. The Fort Belvoir INRMP states that the shoreline of Dogue Creek is used by the Bald

eagle for foraging and loafing habitats. The Accotink Bay Wildlife Refuge, located outside of the study area to the southwest, supports a majority of the Bald eagle habitat in the area. The Fort Belvoir LRC, reports that small whorled pogonia has been encountered or recorded on Fort Belvoir or in Fairfax County. A survey in 2005 by qualified specialists along the original corridor alignment failed to locate any within the corridor, however potential habitat was observed. (See Chapter 4 for more discussion.) A second survey was conducted in 2006 of potential habitat that had been identified previously, however this survey also failed to locate any specimens of the plant.

The VDGIF and VDCR list the bald eagle as state threatened and the small whorled pogonia as state endangered. The only other state-listed threatened or endangered species that are known or suspected to occur at Fort Belvoir are the wood turtle and the peregrine falcon (*Falco peregrinus*). The bald eagle is known to forage in the study area, but most of the documented bald eagle habitat is located off base in the Accotink Bay Wildlife Refuge. One single individual of small whorled pogonia has been located previously (summer 2005) on the EPG section of Fort Belvoir, but none have been found to date east of I-95. Wood turtle habitat is located along several of the creek drainages and in the adjacent floodplain forests and acidic seep swamps. No known peregrine falcon breeding habitat occurs on Fort Belvoir, however, peregrine falcons have been observed migrating through the area, and may use area tidal creeks and bays as foraging areas while hunting. See **Figure 3-6** for Wood Turtle Habitat.

Numerous other rare species of plants and animals are known or suspected to occur in the study area, but these are not listed as threatened or endangered at the federal or state level, and therefore do not require the same levels of protection. The USFWS identifies the Cerulean warbler (*Dendroica cerulean*) and Yellow lampmussell (*Lampsilis cariosa*) as federal species of concern known to occur in the study area. The Yellow lampmussell is also listed as a state species of concern. The yellow lampmussell is found in fast flowing medium-sized rivers and medium to large creeks. At least five bird species listed by the VDGIF as state species of concern are also known from the study area. These species are the Great egret (*Ardea alba egretta*), Yellow-crowned night-heron (*Nyctanassa violacea violacea*), Brown creeper (*Certhia americana*), Winter wren (*Troglodytes troglodytes*), and Purple finch (*Carpodacus purpureus*). The Great egret and Yellow-crowned night heron are wading birds which may be encountered around the area's tidal creeks, marshes, and shallow bays. The Cerulean warbler, Brown creeper and Winter wren are birds that may be found in interior forests, while the Purple finch is a bird that prefers the edges of humid coastal forests.

The Fort Belvoir *Long Range Component* (LRC) reports that Fort Belvoir is the only known location in the world of a groundwater-dwelling amphipod (a type of small water crustacean) known as the Northern Virginia well amphipod (*Stygobromus phreaticus*). This species is not currently listed as threatened or endangered at the state or federal level. Its status is listed by the DCR-NHP as globally rare (G1) and state rare (S1). Fort Belvoir staff report that the Northern Virginia well amphipod has been encountered in groundwater seeps along a steeply sloped area of the installation. This species may be listed in the future as threatened or endangered, but currently requires no legal protection.

3.3 Cultural Resources

Numerous cultural resources have been identified in the project study area. The study area contains a wide variety of cultural resource types, including prehistoric and historic-period archaeological sites and standing structures from the late eighteenth to the twentieth century. The National Register of Historic Places (NRHP)-eligible Woodlawn Historic District and the Woodlawn Plantation National Historic Landmark (NHL) are located in the southeast part of the study area. Prehistoric archaeological sites and historic period cultural resources associated with George Washington's settlement at nearby Mount Vernon have been documented near the study area.

Over the past 30 years, Fort Belvoir has sponsored cultural resources identification surveys and identified hundreds of historic structures and archaeological resources within the boundaries of Fort Belvoir. These resources range from single prehistoric archaeological sites to historic districts comprised of post-WWII military housing associated with the modern occupation of Fort Belvoir.

Federal agencies, in order to comply with Section 106 of the National Historic Preservation Act (NHPA) 36 CFR 800, as amended, must consider impacts of proposed projects on cultural resources that are listed or eligible for listing on the NRHP. In addition, Section 110(f) of the NHPA requires that federal agencies minimize impacts to National Historic Landmarks (NHL) and afford the Advisory Council on Historic Preservation an opportunity to comment on federally proposed projects affecting properties of NHL designation. See **Figure 3-7** for a map of historic and cultural resources in the study area, and **Figure 3-8** for a map of the Woodlawn Historic District.

3.3.1 Methodology

Qualified architectural historians reviewed records from the Virginia Department of Historic Resources (VDHR) Data Sharing System (DSS) for the study area. The locations of archaeological sites and historic structures were cross-referenced with archival materials on file at VDHR. Specific geographic information system (GIS) data layers from both Fairfax County and Fort Belvoir were also utilized for research. Records on file with Fairfax County were consulted with regard to the Woodlawn Historic Overlay District. Previous studies conducted by the Virginia Department of Transportation (VDOT) and its professional historian consultants were also reviewed.

3.3.2 Historic Resources

The VDHR shows twelve inventoried architectural properties in the study area. One NRHP-eligible historic district, the Woodlawn Historic District, is within the study area and consists of a NHL and individually NRHP eligible, ineligible, and unevaluated properties. In addition, other properties are within the study area, as described below, including two properties within the boundaries of Fort Belvoir. The notable resources on Fort Belvoir, namely those contributing to the Fort Belvoir Historic District, are located on the South Post outside of the study area.

Several properties are associated with the Woodlawn Historic District and the immediate vicinity. The contiguous Woodlawn Historic District (029-5181) was determined eligible for listing in the NRHP in 2001. The District embraces a number of historic resources in the immediate vicinity, including:

1. *029-0056, Woodlawn Plantation* — This designation applies to the 1800s house, outbuildings, and landscaping associated with the Lewis family, relatives of George and Martha Washington. Since 1951, the National Trust for Historic Preservation has administered the 126-acre Woodlawn Plantation property, which includes two parcels, one on each side of U.S. Route 1. The property has multiple preservation-related designations, including listing in the NRHP in 1976. The parcel (opposite Woodlawn Stables) on U.S. Route 1 was designated as a NHL in 1998 and includes archaeological deposits designated as 44FX1146 (see below). The Woodlawn Stables parcel (off U.S. Route 1) is not part of the NHL designation. The entire NRHP-listed Woodlawn Plantation property, on both sides of U.S. Route 1, contributes to the Woodlawn Historic District.
2. *029-0058, Pope-Leighey House* — This designation applies to the single story home designed by Frank Lloyd Wright and moved to this location in 1964. It was individually listed in the NRHP in 1970 and while not itself a contributing property to the Woodlawn Historic District, it is situated within the woods of the Woodlawn Plantation and is entirely contained within the NHL property and historic district boundary.
3. *029-0062, Grand View House* — This designation applies to the single story dwelling constructed in the 1850s. It has not been individually evaluated for NRHP eligibility but is included within the boundaries of the NRHP-listed Woodlawn Plantation property (029-0056); in addition, it contributes to the Woodlawn NHL and the Woodlawn Historic District.
4. *029-0070, Woodlawn Baptist Church* — The early 1870s church burned and no longer exists; it was associated with a cemetery remaining on site, along with the modern church. The site has been recommended Not Eligible for individual listing in the NRHP, but is considered a contributing property to the Woodlawn Historic District.
5. *029-0172, Woodlawn Society of Friends Meeting House* — The Alexandria Monthly Meeting of the Religious Society of Friends at Woodlawn (Woodlawn Friends Meeting) Meeting House was constructed in the early 1850s and is associated with a horse stable and cemetery. It has been recommended Not Eligible for individual listing in the NRHP, but is considered a contributing property to the Woodlawn Historic District.²³
6. *029-0330, George Washington Grist Mill (State Historical Park)* — Listed on the NRHP in 2003, the property also contributes to the Woodlawn Historic District.

The district also includes a portion of Fort Belvoir between the Woodlawn Plantation NHL property and the Woodlawn Friends Meeting House. This parcel has not been individually inventoried in the DSS. Portions of the transportation routes within the contiguous District, namely U.S. Route 1 and Mount Vernon Memorial Highway, both operated and maintained by VDOT, are not contributing properties to the District.

In 1971 Fairfax County designated the Woodlawn Historic Overlay District around what is essentially the NRHP-eligible Woodlawn Historic District. The core of the overlay district includes the Woodlawn Plantation, the Pope-Leighey House, the Grand View House, the Woodlawn Friends Meeting House, and the George Washington Grist Mill; the Woodlawn Baptist Church property is not included in the core of the County overlay district but is within the district boundaries. As a feature typical of County overlay districts, an enveloping buffer

²³ The Woodlawn Friends Meeting are seeking re-evaluation of their property's eligibility status for listing in the NRHP as of May 30, 2006.

is included around the core properties of the district to provide development ordinances that protect the historic character of the core properties and their setting.

Five additional properties are within the NEPA study area and have no association with the Woodlawn Historic District or its contributing properties. One of these properties, U.S. Route 1 Bridge No. 1001 (029-0479), has been recommended Not Eligible for listing on the NRHP. Four of these properties have not been formally evaluated for NRHP eligibility, namely:

- 029-0269 – Single family residence (ca. 1930s) on Beulah Street.
- 029-0451 – Single family residence (ca. 1920s) on Telegraph Road.
- 029-0452 – Single family residence (ca. 1910s) on Telegraph Road.
- 029-5010 – Undefined bridge type associated with the operation of the Fort Belvoir Military Railroad.

3.3.3 Archaeological Resources

Review of the DSS records identified over 70 known archaeological sites in the overall study area, 24 that are potentially eligible for listing in the NRHP. These potentially eligible properties were identified both within and outside the boundaries of Fort Belvoir. Four of the sites contain exclusively prehistoric cultural materials from Archaic and Woodland contexts and eight are associated with the historic period. Nine sites contain archaeological materials from both prehistoric and historic period contexts. Cultural materials from historic sites represent late eighteenth century agricultural and industrial occupations to twentieth century domestic and military activities.

The 24 potentially eligible sites, for which no formal NRHP eligibility evaluations have been completed, are briefly described in the table below. Due to the sensitive nature of archaeological site location information and the protection of this information under the law, a location map is not included in the study. **Table 3-1** presents information on each site.

Table 3-1: Potentially Eligible NRHP Archeological Sites

Site Number	Comment
44FX0351	Historic period archaeological site associated with a 16-sided barn constructed by George Washington.
44FX0459	Multiple component site consisting of the Telegraph Road Cemetery (also known as Potter's Hill), historic-period archaeological deposits, and a limited prehistoric artifact assemblage. Historic deposits with good integrity appear to date from the first half of the nineteenth century. Prehistoric artifacts include two lithic flakes.
44FX0460	Historic period archaeological site comprised of a scatter of late 19th and 20th century domestic artifacts and brick and concrete structural remains.
44FX0461	Multiple component archaeological site consisting of a domestic agricultural occupation and military occupation. Trenches represent rifle pits associated with military activities on the reservation.
44FX0462	Historic period archaeological site comprised of a scatter of 19th and 20th century (and possible 18th century) domestic artifacts (namely ceramic wares) surrounding a stone and brick hearth.
44FX0463	Historic archaeological site comprising a surface scatter of ceramic fragments that may represent a nineteenth century domestic or agricultural occupation.
44FX0637	Prehistoric (probably Archaic period) archaeological site consisting of three lithic artifacts.
44FX0669	Historic archaeological site comprising an undefined brick-lined vertical shaft and

	associated brick fragments.
44FX0739	Multiple component site consisting of a historic cemetery and twentieth century agricultural debris. Prehistoric artifacts include two lithic flakes.
44FX1146	Historic period archaeological site associated with the eighteenth and nineteenth century occupation of the area now designated as Woodlawn Plantation (029-0056). This archaeological property is included in the NHL designation of Woodlawn.
44FX1211	Historic period site at the parcel on which rests the Woodlawn Society of Friends Meeting House. Grounds immediately around meeting house may require additional investigation.
44FX1212	Multiple component cultural resources site consisting of a cemetery and structure associated with the Woodlawn Baptist Church. Documented during HABS ²⁴ inventory and 1980s archaeological survey.
44FX1433	Historic archaeological site associated with twentieth century brick foundations.
44FX1589	Multiple component archaeological site consisting of prehistoric and nineteenth and twentieth century artifact assemblages.
44FX1815	Multiple component archaeological site consisting of a stone foundation, historic archaeological deposits, and a limited prehistoric lithic artifact assemblage. Historic deposits appear to date from the last quarter of the nineteenth century. Prehistoric artifacts include lithic flakes and other debitage.
44FX1904	A dense and diverse assemblage of prehistoric archaeological materials. In 2002, VDHR staff recommended this site potentially eligible.
44FX1905	Historic archaeological site probably associated with a twentieth century domestic occupation. A diverse artifact assemblage has been recovered from the site, and at least two surface features are visible. In 2002, VDHR staff recommended this site potentially eligible.
44FX1914	Prehistoric archaeological site comprised of lithic materials, including fire-cracked rock, cores and flakes.
44FX1941	Historic archaeological site probably associated with a twentieth century domestic occupation.
44FX1944	Prehistoric archaeological site comprised of lithic flaking debris.
44FX1945	Prehistoric Woodland archaeological site comprised of surface and subsurface lithic and ceramic materials.
44FX1946	Multiple component archaeological site consisting of a prehistoric lithic artifact assemblage and a historic-period artifact.
44FX1947	Historic archaeological site probably associated with a nineteenth to twentieth century agricultural occupation. Surface features include several poured concrete foundations, a possible septic tank, and historic landscaping elements.
44FX2262, George Washington's Gristmill	Multiple component archaeological site comprised of Middle Archaic prehistoric and late eighteenth to early nineteenth century artifact assemblages. Historic artifacts are associated with grain milling and associated domestic occupation of the site. It is unclear whether or not this archaeological component contributes to the Woodlawn Historic District which is listed on the NHRP.

3.4 Hazardous Substances

Hazardous materials can be encountered during the construction and operation of public projects. Examples of common hazardous materials include asbestos, lead-based paint, abandoned oil drums and certain organic compounds. Without proper handling, removal, and containment, these materials can pose dangers to human health and the environment.

²⁴ Historic American Building Survey (HABS). The HABS program documents architectural, engineering and industrial sites of historical significance. The National Park Service has overseen the program since 1933.

²⁶ U.S. Bureau of Census, 2000.

Identifying known and potential contamination prior to construction is important because it can substantially reduce the possibility of exposure to people and the environment. Regulated sites within the study area include demolition landfills, sanitary landfills and other regulated facilities.

Operational and demolition testing ranges have also been identified within the study area, on Fort Belvoir and HEC property. These areas were used as practice ranges in past years. Fort Belvoir is in the process of decommissioning the ranges in proximity to the project.

Hazardous waste sites are regulated by the Resource Conservation Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986.

The project team used the services of Environmental Data Resources, Inc. (EDR) to conduct a search of available environmental records for the general study area in January 2005. The records search indicated one leaking underground storage tank (LUST), one underground storage tank (UST), and one leaking tank (LTANKS) site. In addition, 24 unmapped (orphan) sites were identified. Of the 24 orphan sites, two are identified as being located within Fort Belvoir, one in Woodlawn, six in Fairfax, and 15 in Alexandria.

3.5 Air Quality

Clean air is important to the health of the community and environment. Pollutants in the air can have negative effects on human health and cause harm to animals, plants, and materials. Emissions from cars, trucks, and buses are a major factor affecting air quality, particularly in urban areas.

Air quality in a region is measured using National Ambient Air Quality Standards (NAAQS) for different pollutants which are established by the EPA. Regions are designated as in "attainment" or "non-attainment" for different pollutants which are referred to as "criteria pollutants."

The Metropolitan Washington (MWCOC) region is designated as in attainment with National Ambient Air Quality Standards (NAAQS – see 40 CFR 50) for the criteria pollutants sulfur dioxide, (SO₂), nitrogen dioxide (NO₂), matter under ten microns in diameter (PM₁₀), and lead (Pb). See attainment status under 40 CFR 81. This study area also lies within a federally designated air quality attainment area for Carbon Monoxide (CO), in Fairfax County. The study area is within a federally designated air quality non-attainment area for Particulate Matter below 2.5 micrometers in diameter (PM_{2.5}) and is also in a moderate non-attainment area for ozone (O₃).

Measures to reduce ozone concentrations in the region are recommended in Virginia's *State Implementation Plan (SIP)* rather than at a project-specific level. The Connector Road project is included in the *2005 Update to the Financially Constrained Long-Range Transportation Plan for the National Capital Region* and the *FY 2006-2011 Transportation Improvement Program (TIP) for the Washington Metropolitan Region*. The project was also included in the analysis for the Air Quality Conformity Determination of the *2005 Long Range Plan*. Therefore, regional emissions of PM_{2.5} and ozone due to the project have previously been considered.

Federal conformity rules (40 CFR 93) and guidance have been established to help ensure that federal actions or approvals do not impede state or local agency plans to attain or maintain compliance with National Ambient Air Quality Standards (NAAQS). There are currently no EPA approved models or methodology available to analyze individual transportation projects (mobile source) for their potential to cause or contribute to PM_{2.5} and ozone concentrations.

3.6 Noise

Noise is sound that is perceived as unpleasant, unwanted, or disturbingly loud. Noise levels are a consideration in transportation projects because noise from construction activities and operation of a roadway can affect daily life. When a roadway is constructed or expanded to add vehicle capacity, noise levels generally increase, which can interfere with conversations, work and family activities, and sleep. Prolonged or heightened exposure to noise can also result in hearing loss.

In accordance with the Federal-Aid Highway Act of 1970, the Federal Highway Administration (FHWA) has established noise standards to protect public health and welfare. These standards include noise abatement criteria (NAC), which are noise levels that represent a balancing of desirable noise levels with achievable noise levels. NAC apply only to areas having regular human use and where lowered noise levels are desirable. In addition, NAC apply to the portion of the tract where the activity occurs. Noise standards established by the FHWA set a limit on traffic related noise levels, above which abatement must be considered. These noise limits are called the NAC and vary based on the types of activities at a particular site. **Table 3-2** below lists the FHWA NAC.

**Table 3-2: Federal Noise Abatement Criteria
Hourly A-Weighted Sound Level**

Activity Category	Hourly Noise Levels L _{eq} (h) dBA	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, play grounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties or activities not included in Categories A or B above.
D	—	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: 23 CFR Part 772, FHWA.

Sounds that disrupt normal activities or otherwise diminish the quality of the environment are designated as noise. Noise can be stationary or transient, intermittent or continuous. Noise is measured in decibels (dB), with a weighting of sound wave frequencies to which the human ear is particularly sensitive (termed *A weighting*); denoted as dBA. Highway traffic noise is evaluated using an “equivalent noise level” (L_{eq}), which is a single-number representation of noise that varies over time (e.g. noise generated by a stream of differing vehicle types traveling at varying speeds). The L_{eq} contains the same amount of sound energy as the varying sound level over a specified period of time (e.g. one hour). The L_{eq} may be thought of as an average noise level.

Decibel units are logarithmic instead of linear. For instance, noise level changes of 2 to 3 dBA are barely perceptible to most people whereas a change of 5 dBA is readily perceived.

3.6.1 Traffic Noise

Traffic related noise impacts would occur when noise levels approach or exceed the NAC, or substantially exceed the existing noise levels. The Virginia Department of Transportation’s (VDOT) FHWA-approved *State Noise Abatement Policy* defines “approach” as a noise level that is 1 dBA less than the NAC and “substantial increase” is defined as 10 dBA or more. Noise abatement measures must be considered in areas where potential noise impacts are identified, though they are not mandatory. Noise abatement measures include noise barriers, alignments shifts, or truck restrictions. Noise abatement measures must be determined to be feasible and reasonable based on engineering, cost, and other considerations. In addition, citizen input regarding noise abatement measures must be obtained.

Typical sources of noise in the study area would generally include vehicle traffic, air traffic associated with airline approaches into Washington, D.C., urban noise, and industrial noise from a water treatment plant and steam facility south of the study area, among other sources. Specific noise sensitive areas (NSAs) in the study area include residences, historic properties, and churches, among others.

3.6.2 Noise Monitoring

Noise measurements were taken for this project to aid in identifying the existing noise environment within the project area. The locations where data was collected generally reflect:

- Sensitive receiver locations adjacent to the existing alignment. Noise levels were collected at these points to quantify current noise adjacent to the roadway.
- Locations where existing uses could be exposed to significant changes in noise levels for the proposed alternatives.

The validation exercise gives an indication of the accuracy of the model under the existing conditions and at the validation points. Vehicle mix and speed, additional ambient noises not included in the model (such as aircraft), etc. will vary depending upon the hour monitored vs. the hour modeled. When validating the TNM model it is common practice that if predicted and measured levels are within + or – 3 dBA of one another, this is an indication that the model is within the accepted level of accuracy. If the difference between the measured and predicted levels is greater than + or – 3 dBA, a careful examination of the field-measured and

predicted data would need to be undertaken to determine the reason(s) for this margin of error.

Adding a 2.5 dBA correction factor based on only a limited number of calibration locations (4) would not be statistically supported. Additionally, noise levels are predicted using the Peak Hourly Volume, adding another conservative factor of safety into the model.

Table 3-3 describes the locations and results of each of the monitoring sites.

Table 3-3: Peak-Hour Noise Monitoring Location Summary

Measurement Location	Description	Leq (dBA)
1	≈45 feet east of outside edge of nearest lane of Old Mill Road, near Oaks of Woodlawn Apartments.	56
2	≈30 feet east of outside edge of nearest lane of Old Mill Road, near Old Mill Gardens Condominiums.	58
3	≈33 feet east of outside edge of nearest lane of Old Mill Road, near Mount Vernon Church of Christ.	59
4	≈50 feet north of outside edge of nearest lane of Telegraph Road, near Hilltop Golf Club.	65
5	≈69 feet north of outside edge of nearest lane of Telegraph Road, in Arden Hills Subdivision.	66
6	Near intersection of Telegraph Road and Beulah Street, in Hilltop Field outfield.	65
7	In parking lot of Woodlawn Plantation/Pope Leighey House.	52
8	Near U.S. Route 1, on Woodlawn Baptist Church and Cemetery grounds.	61

3.6.3 Noise Sensitive Areas

Noise sensitive receptors are defined as any property (owner occupied, rented, or leased) where frequent exterior human use occurs and where a lowered noise level would be of benefit. Noise Sensitive Areas (NSAs) in the study area include residences, historic properties, sports activity fields, and churches, among others.

3.7 Infrastructure and Utilities

Public services and utilities can be affected by the planning and construction of transportation projects. Interruptions to these services can affect residents' and businesses work schedules, daily activities, emergency services, and other routine activities. It is therefore necessary to identify potential utility and other public services in the study which have the potential to be affected by the project.

The study area, as mentioned, is located in a highly developed area of metropolitan Washington, D.C. Major public roads, water, sewer, and stormwater facilities exist in many locations of the study area. Underground pipes for gas and various fiber optics cables also criss-cross the area. Fairfax County Water Authority provides potable water to the area.

Fairfax County provides sewer service to its citizens. Fort Belvoir operates and maintains its on-post sanitary sewer system, discharging to the Fairfax County system. The county's Noman M. Cole, Jr. Pollution Control Plant serves the Accotink, Pohick, Long Branch, Little Hunting and Dogue Creek drainage basins. This plant has a rating of 67 million gallons daily (MGD).

Washington Gas owns and operates natural gas distribution in the study area, including on Fort Belvoir and HEC. Electricity is provided by Dominion Virginia Power. There is a substation located near the eastern edge of HEC. There is a powerline corridor of large overhead powerlines along the boundary of HEC and the Hayfield subdivision.

3.8 Socioeconomics

3.8.1 Demographics

Fairfax County is the most populous County in the Commonwealth of Virginia. The population of the County in 2000 was 969,749 making up 14 percent of the population of Virginia.²⁶ The study area is primarily located within two county planning districts, the Mount Vernon and Lower Potomac Planning Districts. Fairfax County projects both to grow through 2025, to 106,000 persons and 100,300 persons, respectively.

Most of the study area lies within one census tract, 4219 (it includes Fort Belvoir and HEC). A map of census tracts in the general study area is presented in **Figure 3-9**. Census tracts primarily encompassed by the study area represent 26,419 persons.²⁷ Of the five census tracts evaluated in the study area, racial minorities²⁸ account for more than 25 percent of the population in four of them.²⁹ Fort Belvoir housing generally contains nearly 40 percent minority, compared to Fairfax County's nearly 22 percent. The reported Hispanic/Latino population comprises between 3.7 and 14.5 percent among the census tracts.

Populations age 65 and over are generally lower in the study area than Fairfax County. Only census tract 4212 has a higher percentage of seniors (13.2 percent) than County and Commonwealth averages (7.9 and 11.2 percent, respectively).

3.8.2 Income and Employment

The median household income in Fairfax County in 2003 was \$80,800, compared to \$52,776 statewide. For the census tracts in the study area, the median household income ranged from \$33,266 to \$98,259. Census tract 4219 has the lowest average household income of all the census tracts in the study area, while 4212 has the highest. The average household income at Fort Belvoir in 1999 was \$39,592, also lower than the County and state averages.

Census tract 4219 had the lowest median household income in the study area in 2000. Although the median average household income in tract 4219 is the lowest in the study area, it is not below the U.S. Department of Health and Human Services (HHS) poverty guidelines.

²⁷ The analysis excluded census tracts of the Accotink Village and any south of U.S. Route 1

²⁸ Includes identified in the Census as Black or African American, American Indian and Alaska Native, Asian, and Native Hawaiian and Other Pacific Islander

²⁹ Census tract #4212 total population of 2,053 has 12.3% racial minority.

Census tract 4219 has the highest percentage of individuals below the poverty level (8.1 percent), greater than both the state and County averages. Tract 4218 has the second highest poverty level rates at 5.8 percent, compared to 2.1 and 7.0 percent, respectively for the County and the Commonwealth.

The Virginia Employment Commission reported that in December 2004, Fairfax County had a total civilian labor force of 584,880 and employment in the county was 575,620, with an unemployment rate of 1.6 percent.³⁰

3.8.3 Housing Characteristics

Housing stock inside the project area includes multi-family, townhouse, and single family homes. In 2004 the Lower Potomac Planning District contained 6,891 housing units, of which 62% were single-family or townhouse units and the remainder were apartments. The median market value (2004) for single family houses in the Lower Potomac Planning District is \$381,813 and \$213,497 for townhouses. Fort Belvoir provides 2,070 multi-family and single family housing units for military personnel, as well as housing for 808 permanent enlisted personnel and 535 visiting personnel quarters. HEC has no housing units.

Nearby affordable housing, as designated by Fairfax County, in the project area is located at Old Mill Gardens on St. Gregory's Lane (48 units) near on Old Mill Road and Pole Road; and at Belvoir Plaza (45 units) on U.S. Route 1.

3.9 Community Facilities and Services

Access to recreational and community resources are a key contributor to the quality of life for a community. Identification of these facilities and services allows for evaluation of potential impacts in Chapter 4.

3.9.1 Facilities and Services

The study area is the location of a variety of community facilities and services including fire stations, public schools, cemeteries, churches, shopping centers and a post office.

Fairfax County fire stations closest to the study area include the Woodlawn Station (No. 37) on Lukens Lane, and the Kingstowne Station (No. 24) on Telegraph Road. Fort Belvoir operates several fire stations, including Fire Station No. 63 which is located in the study area on the North Post.

Public schools in closest proximity to the study area include Hayfield High School, Hayfield Middle School, and Hayfield Elementary School. These schools are clustered together at the northeast periphery of the study area on both sides of Telegraph Road. Combined, the Hayfield Schools cluster serves approximately 3,000 students, including approximately 600 students at the elementary school, 1,700 students at the high school, and 760 students at the middle school. The Fort Belvoir Elementary School is located on Meeres Road within Fort Belvoir, and serves approximately 1,300 students in kindergarten through 6th grade. Private schools in the study area include Agape Christian Academy off Mount Vernon Memorial Highway, which serves children pre-school through 6th grade.

³⁰ U.S. Army Garrison at Fort Belvoir, DCEETA EA, *op. cit.*, p. 3-40.

There are numerous family and church cemeteries within the study area. These cemeteries are in close proximity to or within Fort Belvoir. The Triplett Family Cemetery is located on HEC. The Millan/Potter Family Cemetery is located within the boundaries of DCEETA on Fort Belvoir. Lacey's Hill Cemetery is also located within Fort Belvoir off Woodlawn Road on the North Post. Churches and church cemeteries within the study area include the Woodlawn United Methodist Church, Accotink United Methodist Church, Woodlawn Friends Meeting House and the Woodlawn Baptist Church. The Mount Vernon Church of Christ is located on Old Mill Road, in proximity to the intersection with U.S. Route 1.

Other public facilities in the southwest of the study area include several "strip" type shopping centers and the Engleside U.S. Post Office on U.S. Route 1.

Fort Belvoir provides on-Post community facilities that are not accessible to the general public, but are integral to the Army community. A community center on the North Post (on Gorgas Road) contains a post exchange, commissary, a Class IV (packaged beverage) store, convenience store, gas station, bank and the Main Post Chapel.

3.9.2 Parks and Recreation Facilities

Recreational facilities within the study area include two golf courses on Fort Belvoir (located on both the North and South Post) as well as athletic fields on the North Post. County owned public parks in the study area include Pole Road Park and the Berman-Gerber Tract (adjacent to Huntley Meadows Park) which serve environmental functions as wetlands and habitats, in addition to recreational uses. The Jackson Miles Abbott Wetland Refuge (JMAWR) offers fishing and nature trails to the public. The Grist Mill Park is associated with the Woodlawn Plantation Historic District. Both JMAWR and Huntley Meadows Park are discussed further in Section 3.2.3, Environmentally Sensitive Areas. A golf driving range is located on Telegraph Road.

3.10 Transportation and Traffic

3.10.1 Highway and Street Network

Commuter and longer distance non-commuter routes in this area of Fairfax County are along four main highways: Interstate 95, U.S. Route 1, Fairfax County Parkway (VA Route 7100) and Telegraph Road. Peak hour demands exceed capacity for much of the northern Virginia highway system, and this area of Fairfax County is no exception. See **Figure 3-10** for existing AM and PM peak-hour turning movement counts for several routes near the study area.³¹

Fort Belvoir, VDOT and others have conducted numerous studies and counts in the area. The references section lists sources of traffic data. For consistency, all of the major active studies have applied the transportation planning methodologies and models developed by Transcore, from its 2003 report for Fort Belvoir's Master Plan³².

³¹ The data is factored by 4.6 percent to account for changes in traffic volume from 2003 to 2005. The figure also notes key intersections relative to this report.

³² Fort Belvoir Comprehensive Master Plan Update, Technical Memorandum #1, Existing Transportation Conditions, Department of the Army, U.S. Army Garrison, Fort Belvoir, VA, prepared by Transcore, August 2003.

3.10.2 Traffic Analysis Methodology

Roadway networks include streets and their junctions, namely intersections or interchanges. An accepted measure to consider how well a road functions is to evaluate the Level of Service Analysis (LOS) of key signalized and unsignalized junctions. **Table 3-4** shows the criteria for LOS.

Table 3-4: Level-Of-Service Criteria for Intersections

Level of Service Designation	Signalized Intersection Criteria Average Total Delay (Seconds per Vehicle)	Unsignalized Intersection Criteria Average Total Delay (Seconds per Vehicle)
A	≤ 10.0	≤ 10.0
B	10.1 to 20.0	10.1 to 15.0
C	20.1 to 35.0	15.1 to 25.0
D	35.1 to 55.0	25.1 to 35.0
E	55.1 to 80	35.1 to 50.0
F	> 80	> 50

Source: *Highway Capacity Manual*, Transportation Research Board; Washington, DC; 2000

As illustrated by Table 5-1, a good LOS (“A” designation) consists of minimal delays, while a poor LOS (“F” designation) consists of extended delays. Delays can be correlated to the ratio between traffic volume and capacity. For example, if the volume of traffic approaching an intersection is greater than its capacity for that volume of traffic, the end result is a poor LOS. Conversely, if the volume of traffic approaching an intersection is much less than its capacity, the end result is a good LOS.³³

Traffic engineers identified 14 intersections which define the likely impacted area of the proposed Connector Road. As noted in the project Purpose and Need, motorists have no opportunity to travel between Telegraph Road and U.S. Route 1 except via the Fairfax County Parkway to the south or Kings Highway to the north. These routings can add up to five miles to current trips.

The intersections selected for analysis are generally within a triangle formed by Telegraph Road, U.S. Route 1 (Richmond Highway) and the proposed Connector Road. South and west of the study area, there are several decision points for motorists to seek options to travel between Telegraph Road and U.S. Route 1, and the analysis captures the possible changes. North and east there are no practicable alternatives until Kings Highway (which

³³ At signalized intersections, capacity is based on the amount of green time each approach receives. If the amount of green time is sufficient, then the capacity will process the volume of traffic and will result in a favorable LOS. If the amount of green time is insufficient, then the volume will begin to exceed the capacity and result in an unfavorable LOS.

At unsignalized intersections, capacity is based on acceptable gaps (i.e. an amount of time between vehicles) which provide enough time for each vehicle to commence its intended movement. Acceptable gaps are those gaps that are long enough to make the motorist comfortable with the intended movement.

becomes Telegraph Road) and U.S. Route 1 meet approximately 5 miles from the study area, which is too far to expect a significant impact from a local connector road.

3.10.3 Existing Traffic Conditions

Using HCM methodologies, traffic engineers applied a software package called Synchro (Build 612) to evaluate the 14 intersections. Except for the intersection of Kingman and Beulah, HDR obtained existing signal timing and lane controls.³⁴ **Table 3-5** and **3-6** present the LOS results for signalized and un-signalized intersections. Delay is defined as the number of seconds of delay per vehicle.

Table 3-5: Existing Level of Service Results Signalized Intersection Analysis

SIGNALIZED INTERSECTION	AM		PM	
	DELAY	LOS	DELAY	LOS
Route 1 @ Telegraph Rd	35.0	D	78.7	E
Route 1 @ Fairfax County Pkwy	27.0	C	32.3	C
Route 1 @ Backlick Rd / Pohick Rd	23.7	C	91.2	F
Route 1 @ Belvoir Rd	18.8	B	13.0	B
Route 1 @ Woodlawn Rd	7.6	A	11.7	B
Route 1 @ Old Mill Rd / Mt Vernon Mem Hwy / Woodlawn Plantation	69.4	E	70.6	E
Fairfax County Pkwy @ Kingman Rd	25.7	C	59.0	E
Kingman Rd @ Beulah St	8.2	A	6.8	A
Telegraph Rd @ Fairfax County Pkwy SB Ramp	16.6	B	18.7	B
Telegraph Rd @ Fairfax County Pkwy NB Ramp	14.6	B	66.5	E
Telegraph Rd @ Newington Rd	7.7	A	15.5	B
Telegraph Rd @ Beulah St	33.5	C	32.5	C
Telegraph Rd @ Hayfield Rd	37.5	D	48.0	D

Table 3-6: Existing Level of Service Results Unsignalized Intersection Analysis

Unsignalized Intersection	AM		PM	
	DELAY	LOS	DELAY	LOS
Telegraph Rd @ Snyder Rd:				
WB Left	10.9	B	9.7	A
NB Right	11.2	B	10.5	B

³⁴ VDOT supplied HDR with geometric data and signal timings for each of the intersections, except for that of Kingman Road and Beulah Street. Contacts with the Fort Belvoir planning or consultant personnel did not yield information on that intersection. However, because this location does not impact the general public, HDR's applied assumptions for this on-Fort location should be suitable. HDR verified VDOT data using the 2002 Urban Areas Aerial Photographs published by the USGS and distributed by Terraserver-usa.com.

During the AM peak hour all intersections operate at LOS C or better except for two intersections: U.S. Route 1 at Telegraph Road (LOS D) and the slightly-offset Old Mill/Mt. Vernon Memorial Highway/Route 1 intersection (LOS E). During the PM peak hour five of the key intersections operate at or below LOS E.

3.10.4 Crash Information

Crash rates are higher on U.S. Route 1 and Telegraph Road than they are on the other roadways within the study area. These two roadways also have crash rates greater than the statewide average rates. The other roadways discussed within the study generally have rates lower than the state wide average rates.

3.11 Energy

Specific factors affecting energy use include the number and type of vehicles using a facility and their fuel consumption, total distance traveled, the number of stops and starts required on the facility, sudden acceleration/deceleration, congestion and grade steepness.

Changes in energy use, including fuel consumption, have occurred due to the closure of Woodlawn Road and Beulah Street. The closing of public access through Fort Belvoir have caused vehicles to deviate to more circuitous routes. Route deviations affect LOS and Vehicles Miles Traveled (VMT) by diverting traffic to other roads.