A Chesapeake Bay Preservation Plan

The City recognizes the importance of preserving its valuable water resources for future generations and the need to protect them from the adverse effects of pollution generated by urban land uses. The City also recognizes that land use activities adversely affecting City streams also impact the health and viability of downstream resources, the most important of which is the Chesapeake Bay. The Chesapeake Bay is an economic, social, and ecological resource whose continued health is of benefit to all citizens of the Commonwealth.

The City of Fairfax has a vested interest and a responsibility to maintain and promote a healthy environment, including the protection of local waterways from further degradation as a result of development. In addition, steps must be taken to improve currently degraded resources to ensure the long-term health of both the City's resources and the Chesapeake Bay. The City has risen to the challenge of natural resources and water quality protection and is committed to implementing the Chesapeake Bay Preservation Area Designation and Management Regulations as manifest by the Chesapeake Bay Preservation Act of 1988. These regulations apply to all localities within Tidewater Virginia; however, the individual jurisdictions are responsible for identifying and implementing Chesapeake Bay preservation strategies.

The City has made progress towards maintaining and promoting a healthy environment; nonetheless, significant environmental issues still need to be addressed. This Chesapeake Bay Preservation component to the City's Comprehensive Plan serves as a planning tool for the City Council, the Planning Commission, City agencies, and citizens to help guide the City in its protection of the Chesapeake Bay and the City's natural resources.

Contents

Section 1. Introduction, Purpose, and Legal Authority

Recognizing the economic and social importance of long-term viability of State waters, and in particular the Chesapeake Bay and its tributaries, the Virginia General Assembly enacted the Chesapeake Bay Preservation Act of 1988. The Chesapeake Bay Preservation Area Designation and Management Regulations as adopted in 1989 and amended in 1991, 2001, and in 2012, state that local programs shall contain "a comprehensive plan or revision that incorporates the protection of Chesapeake Bay Preservation Areas and of the quality of state waters, in accordance with criteria set forth in Part V (9VAC25-830-160 et seq.)."

The waters of the Chesapeake Bay have been degraded significantly by many sources of pollution, including nonpoint source pollution from land uses and development. Existing high-quality waters are worthy of protection from degradation to guard against further pollution. Certain lands that are proximate to shorelines have intrinsic water quality value due to the ecological and biological processes that they perform. Other lands have severe development constraints as a result of flooding, erosion, and soil limitations. With proper management, they offer significant ecological benefits by providing water quality maintenance and pollution control, as well as flood and shoreline erosion control.

To achieve these ends, the City Council and the Planning Commission have, in accordance with the Chesapeake Bay Preservation Area Designation and Management Regulations (9VAC25-830), developed a Chesapeake Bay preservation program which is centered around the City's Chesapeake Bay Preservation regulation of the Zoning Ordinance. This Chesapeake Bay Preservation component to the City's Comprehensive Plan builds upon the City's regulation and is designed to protect those qualities of life held important by the citizens of the Commonwealth and the City and to encourage future development that enhances and compliments the growth of the City as well as protects it natural resources.

Section 2. Water Resources Protection Programs and Regulations

The City has made substantial progress towards ensuring the protection and balanced management of its natural resources through the implementation of various City regulations and water quality protection and pollution prevention programs. While the Chesapeake Bay Preservation regulation is the City's primary tool for protecting water resources within the City, water quality and natural resources protection requires an integrated approach.

This involves not only regulation but also citizen participation through the use of public education and volunteer programs. Enforcement of the City's Chesapeake Bay Preservation regulation must be coupled with a comprehensive examination of how the City's various land use regulations, including its Zoning and Subdivision ordinances, may be better utilized to protect the natural environment.

The following is an overview of the City's existing regulations and programs related to water quality and natural resources protection. These regulations and programs are then reexamined and options are presented for their improvement in light of an analysis of the City's water resources (Section 3), existing and potential sources of pollution (Section 4), and constraints to development (Section 5).

2.1. Chesapeake Bay Preservation Regulation

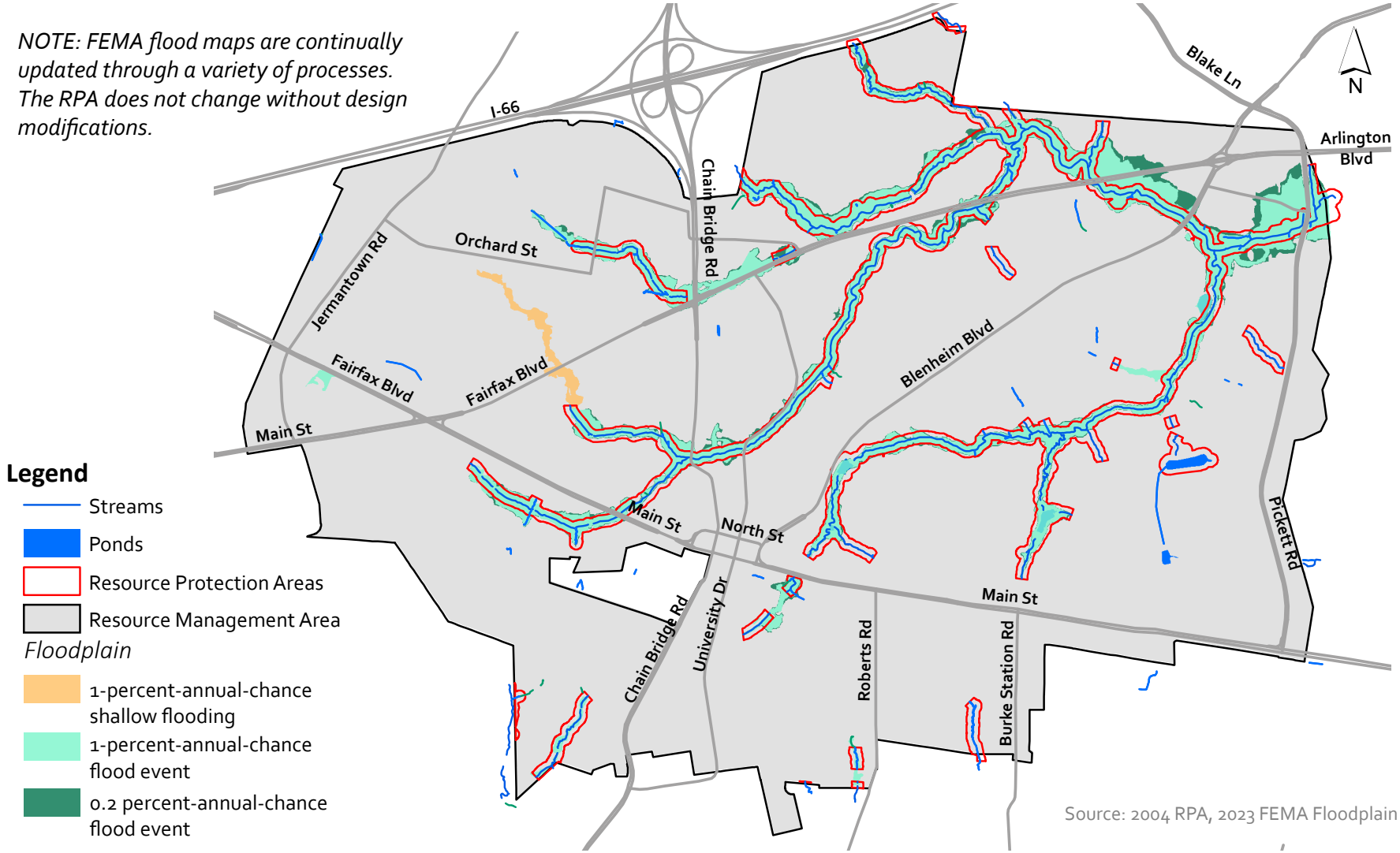
The Chesapeake Bay Preservation Act (Chapter 3.1 of Title 62.1 of the Code of Virginia) establishes a program to protect environmentally sensitive features which, when disturbed or developed incorrectly, lead to reductions in water quality in the Chesapeake Bay. The Act provides a framework for local government to identify these sensitive areas and to enact regulations to better plan land use activities on and around them. Under the regulations, the City of Fairfax is called to promote the following:

- Protection of existing high quality State waters and restoration of all other State waters to a condition or quality that will permit all reasonable public uses, and will support the propagation and growth of all aquatic life which might reasonably be expected to inhabit them;
- Safeguarding the clean waters of the Commonwealth from pollution;
- Prevention of any increase in pollution;
- Reduction of existing pollution; and,
- Promotion of water resource conservation in order to provide for the health, safety, and welfare of the present and future citizens of the Commonwealth.

In accordance with State guidelines, Chesapeake Bay Preservation Areas (CBPAs) were mapped for the City and the City adopted a Chesapeake Bay preservation area map as part of the City's Zoning Ordinance in October, 1990 and was most recently amended in March, 2015 (§4.18. et seq.). The Chesapeake Bay Preservation Areas were delineated for the city according to criteria established by the State Department of Conservation and Recreation. Figure A1 presents the City's Floodplain and Chesapeake Bay Preservation Area Map.

FIGURE A1 FLOODPLAIN AND CHESAPEAKE BAY PRESERVATION AREA MAP

NOTE: FEMA flood maps are continually updated through a variety of processes. The RPA does not change without design modifications.



The resource protection area (RPA) includes (1) tidal wetlands; (2) nontidal wetlands connected by surface flow and contiguous to tidal wetlands or water bodies with perennial flow; (3) tidal shores; (4) intermittent streams that remain largely in a natural condition and that have not been significantly impacted by adjacent development; (5) water bodies with perennial flow; and (6) a 100-foot vegetated buffer area located adjacent to and landward of the components listed above, and expanded to include noncontiguous wetlands within the floodplain that are partially located within the buffer, along both sides of any water body with perennial flow.

In general, development within the RPA is limited to water dependent uses, passive recreational uses, utilities and public facilities, and certain types of redevelopment so long as the proposed land use is carried out in accordance with the provisions of the City's Zoning Ordinance.

The resource management area (RMA) includes all lands in the city that are not designated as an RPA. All development or redevelopment within a Chesapeake Bay preservation area exceeding 2,500 square feet of disturbed land area shall be subject to the general performance standards in §4.18.7 of the Zoning Ordinance as well as the development review procedures of §6.13 of the Zoning Ordinance.

The performance standards establish the means to minimize erosion and sedimentation potential, reduce land application of nutrients and toxics, and maximize rainwater infiltration. Natural ground cover, especially woody vegetation, is most effective in holding soil in place and preventing site erosion. Indigenous vegetation, with its adaptability to local conditions without the use of harmful fertilizers or pesticides, filters stormwater runoff. Minimizing impervious cover enhances rainwater infiltration and effectively reduces stormwater runoff potential.

The performance standards are intended to prevent a net increase in nonpoint source pollution from new development and to achieve a 10 percent reduction in nonpoint source pollution from redevelopment.

2.2. Erosion and Sediment Control Regulation

The purpose of the City's Erosion and Sediment Control Regulation is to prevent the degradation of properties, stream channels, waters, and other natural resources by providing that adequate soil erosion and sediment control measures are taken before, during, and after the period of site clearance, development, and construction. The Erosion and Sediment Control Ordinance implements the Virginia Erosion and Sediment Control Law (§ 62.1-44.15:51 et seq of the Code of Virginia (2013)) as well as the Chesapeake Bay Preservation Act.

Under this ordinance, land owners proposing a nonexempt regulated land disturbing activity of greater than 2,500 square feet must first submit an erosion and sediment control plan to the City Department of Public Works. The City's erosion and sediment control requirements are detailed in Erosion and Sediment Control section of the Zoning Ordinance (§4.17).

2.3. Landscaping Regulation

The City's landscaping regulations are intended to encourage the planting and proper care of vegetation and trees throughout the City, to enhance tree canopy, and to provide for appropriate screening. These actions are intended to contribute to the health, safety, and welfare of the city by enhancing pedestrian facilities, decreasing flooding, soil erosion, air pollution and noise, and improving aesthetics.

The regulation controls the removal of trees from public and private property and establishes standards limiting tree removal and ensuring the replacement of trees sufficient to safeguard the ecological and aesthetic integrity of the community's environment. In addition, the regulation was enacted: to prevent the unnecessary clearing and disturbing of land so as to preserve, insofar as is practicable, the natural and existing growth of vegetation; to replace the removed trees with new trees or large shrubs on the same property and in the same general location; to provide protective regulations against hazardous trees and diseased trees or shrubs; to control activities related to trees and plantings upon the streets or public properties of the City; and to establish a permit procedure for tree contractors. The City's landscaping requirements are detailed in the landscape section of the Zoning Ordinance (§4.5).

Tree cover has long been recognized as serving to protect water quality. Tree canopy provides a buffer between precipitation and the soil by slowing the rate and velocity of rainfall.

Tree roots serve to keep soil particles in place and from washing away due to rainfall. Vegetation of all types also extract nutrients from water for use in plant tissues. In addition, tree cover in riparian areas serves to protect aquatic habitat by lowering and stabilizing stream temperature.

2.4. Floodplain Regulation

In 1981, the Federal Emergency Management Agency (FEMA) investigated the existence and severity of flood hazards in the City of Fairfax to aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. The study was also meant to be used by local and regional planners in their efforts to promote sound floodplain management. To these ends, the City established a floodplain district as part of the City's Zoning Ordinance in 1982, which has been continually updated. The current Floodplain regulation was adopted by the City in March 2015.

The purpose of the City's floodplain regulation is to prevent the loss of life and property, the creation of health and safety hazards, the disruption of commerce and governmental services and the extraordinary and unnecessary expenditure of public funds for flood protection and relief, and the impairment of the tax base by:

- Regulating uses, activities, and development which, alone or in combination with their existing or future uses, activities, and development, will cause unacceptable increases in flood heights, velocities, and frequencies.
- Restricting or prohibiting certain uses, activities, and development from locating within districts subject to flooding.
- Requiring all those uses, activities, and developments that do occur in flood-prone districts to be protected and/or flood proofed against flooding and flood damage.
- Protecting individuals from buying land and structures which are unsuited for intended purposes because of flood hazards.

In addition to protecting life and property, the floodplain regulation serves to protect water quality by decreasing the potential for stream bank erosion and by providing, in many instances, vegetated stream buffer areas which filter runoff from surrounding impervious areas. Figure A1 on page 3 depicts areas of Fairfax that have been designated as flood prone (the one-hundred year floodplain) for which the City's regulation applies. The City's floodplain regulations are detailed in §4.15 of the Zoning Ordinance.

2.5. Zoning and Subdivision Ordinances

The City's Zoning and Subdivision ordinances provide the City with valuable tools for natural resources protection through better development and redevelopment practices. Many of the City's water quality protection regulations, including the City's Chesapeake Bay Preservation regulation and Floodplain regulation are contained within the City's Zoning Ordinance as overlay districts. Protection of water resources may be accomplished through the application of Zoning Ordinance provisions which relate to impervious coverage requirements, land use densities, etc. For instance, creative parking requirements to minimize impervious areas, including cooperative parking arrangements between businesses, may be used to minimize impervious cover.

2.6. City Source Control Programs

The control of pollutants before they enter stormwater or groundwater is recognized as the most cost effective and environmentally sound method of environmental protection. While the effectiveness of source control programs are difficult to ascertain due to their heavy reliance on human behavior modification, they are nevertheless integral components of the Commonwealth's Chesapeake Bay preservation effort. The City has addressed source control on a number of fronts, many of which are specifically geared at water quality protection and some of which have water quality protection as direct benefit. Among the City's source control programs which benefit water quality are its street sweeping program, curbside leaf and brush pickup service, and recycling program.

Street sweeping is effective in removing harmful pollutants, particularly litter and sand from deicing and snow removal activities. Under the City's street sweeping program, main streets are swept once a week from mid-March through mid-November and subdivision streets are swept three times a year. In order for the City's program to have a more substantial effect on water quality, more frequent and concentrated street sweeping would need to be implemented. Specifically, more intense street sweeping efforts in downtown areas, where nutrients and other pollutants tend to accumulate at higher rates, may be of direct benefit to water quality.

In addition to street sweeping, the City conducts a curbside leaf and brush pickup service which discourages those whose properties lie within a RPA from dumping yard waste near streams where it can kill vegetation. This practice can result in erosion and the leaching of excess nutrients into the local stream. In conducting its program, the City should take care to make sure that leaves are not placed directly in the gutter where they can be washed into the local stream course.

The City has an extensive recycling program which has collections for most recycling materials including plastics, glass, metals, etc. The City also collects potentially hazardous substances such as used oil, oil filters, rechargeable batteries, and car batteries at the Property Yard Recycling Center. The City advertises its recycling program in the Public Works Department's insert to the City's monthly newsletter several times a year. New

homeowners are provided with a packet of information on recycling requirements and facilities within the City.

In addition to City source control efforts, the Department of Environmental Quality (DEQ), Water Division, works directly with owners of underground storage tanks (USTs) to ensure that these tanks do not impact on groundwater quality. The DEQ, Water Division, has an extensive monitoring program to detect and mitigate any leaking USTs before substantial groundwater quality degradation can occur.

2.7. Local and Regional Watershed Management Efforts

For many years, the City's stormwater drainage system has been under considerable stress as the result of a rapid increase in the City's jurisdiction-wide imperviousness. Several types of stormwater system problems have been identified within the Accotink Creek watershed including streambank and streambed erosion, sedimentation, localized flooding, deteriorated drainage facilities, limited capacity of the drainage system as originally designed, and finally, pollutants affecting water quality.

In the last few decades, several water quality related regulations, as summarized below, have been enacted that has made it necessary for the City to investigate and address these problems on a watershed-wide basis.

- **National Pollution Discharge Elimination System:** Established by the United States Environmental Protection Agency (EPA) in 1987 as an amendment to the Clean Water Act, the National Pollution Discharge Elimination System requires permits for discharges from municipal separate storm sewer systems to limit pollutant discharges into streams, rivers, and bays. The DEQ administers the program as the Virginia Pollutant Discharge Elimination System.
- **Chesapeake Bay Preservation Act:** Established by the DEQ in 1988 to improve water quality in the Chesapeake Bay. Localities are required to adopt programs to protect water quality in the Chesapeake Bay from excessive nutrients caused by stormwater runoff from impervious surfaces.
- **Virginia Stormwater Management Program:** These regulations were established by the DEQ and include requirements for erosion and sediment control during the construction process and for the installation of BMPs to address stormwater runoff post-construction.
- **MS4 Permits:** Issued by the DEQ and EPA, these regulatory permits require local governments to implement a variety of programs (ranging from detection and correction of illicit discharges to public outreach and education) to lessen the volume of pollutants carried by their municipal stormwater conveyance systems. These permits require consistency with the pollution budgets of applicable total maximum daily loads (TMDLs); and have been issued over time.
- **Local TMDL:** Established by the DEQ and EPA, these TMDLs set target reductions for pollutants (nutrients, sediment, bacteria, trash, and PCBs) in a number of waters in the region that have been designated as 'impaired'.

- **Chesapeake Bay TMDL:** Established by the EPA in December 2010, this historic and comprehensive "pollution diet" requires reductions in nutrient (nitrogen and phosphorus) and sediment pollution throughout the Chesapeake Bay watershed and for major tributaries such as the Potomac River.

To determine how the City will face its watershed challenges, the City completed a Watershed Management Plan in July 2005. The plan evaluated watershed conditions and included recommendations on how to improve watershed health. The City also completed an Accotink Creek Stream Stability Assessment and Prioritization Plan in October 2007 and a supplement report for Daniels Run in October 2008. These reports captured the scale and extent of stream bank erosion in the Accotink Creek watershed and included a prioritization plan for future restoration activities based upon observed conditions.

The City has been continually implementing the recommendations identified in these reports. For example, the City has made significant efforts to stabilize the stream banks to handle the urban stormwater runoff and flows by implementing stream restoration and stabilization improvements at numerous locations on Accotink Creek.

The City also participates in regional efforts by being a member of the Chesapeake Bay Policy Committee, which was established by the MWCOG Board of Directors. Elected officials and staff from MWCOG's member governments, and water and wastewater utilities comprise the committee's membership. The Committee tracks developments under the federal-state Chesapeake Bay Program for implications to local governments and recommends Bay-related policies to the Board.

On June 16, 2014, the Chesapeake Bay Watershed Agreement was signed. Signatories include representatives from the entire watershed, including the Commonwealth of Virginia, committing for the first time the Chesapeake Bay's headwater states to full partnership in the Chesapeake Bay Program. This plan for collaboration across the Bay's political boundaries establishes goals and outcomes for the restoration of the Bay, its tributaries and the lands that surround them.

Section 3. Inventory of Existing Water Resources

The City contains a wealth of natural resources which benefit both residents and businesses within the City. Of its natural resources, the City's water resources are among the most important from an economic, social, and ecological point of view, as well as the most sensitive. Land uses and development, air pollution, and human carelessness all contribute to the degradation of water resources.

The City has been able to protect many stream corridors through the expansion of its public park system and the preservation of vegetative buffers. However, as the population grew from only 1,946 in 1950 to 24,097 in 2017, development pressures resulted in a dramatic increase in the City's impervious acreage and a loss of natural vegetation. While past responses to the pressures of development have resulted in the implementation of erosion and sediment control measures, stormwater quantity measures to control flooding, and floodplain protection, only recently have the post-development effects of urbanization on water quality been fully appreciated and addressed.

With the adoption of the City's Chesapeake Bay Preservation regulation in 1990, the City committed itself to a comprehensive and integrated approach to water quality protection. In order to better plan for future development and redevelopment within the City and to identify ways to enhance the quality of life through the preservation and restoration of the City's water resources, it is important to understand the resources which exist within the City. The following section presents an inventory of the water resources within the City including watersheds and streams, water supplies, water supply protection, and groundwater.

3.1. Streams and Watersheds

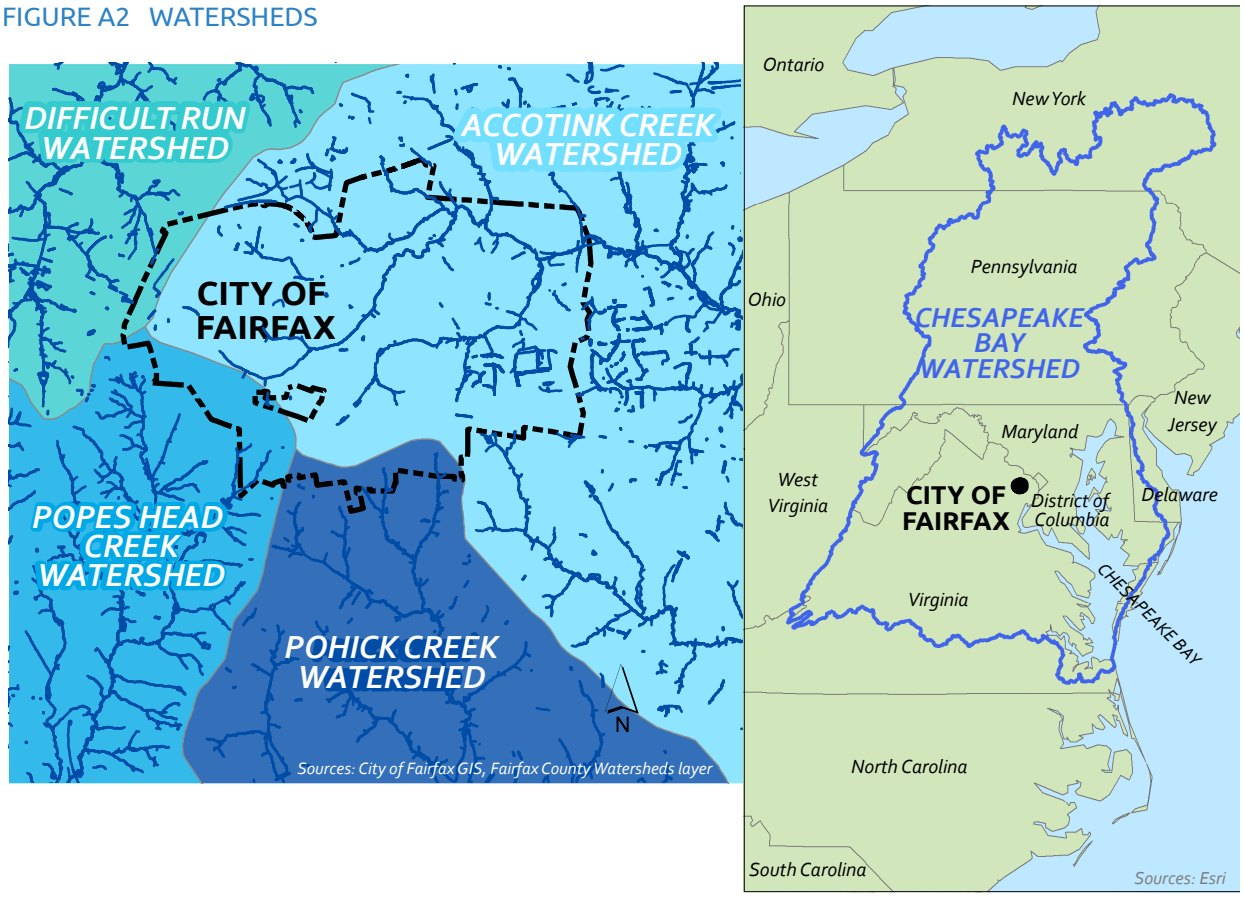
The City is located at the confluence of four major drainage divides and includes portions of the Accotink Creek, Pohick Creek, Popes Head Creek, and Difficult Run watersheds. As a unique consequence, practically all watercourses within the City (with the exception of a few tributaries to Accotink Creek in the northeastern portion of the City) originate within its boundaries and are not directly affected by activities from neighboring jurisdictions. This provides a considerable level of control to the City over the water quality of its streams. Major perennial streams which flow through the City include Accotink Creek (north and central forks) and Daniels Run (also known as the south fork of Accotink Creek), which drains to Accotink Creek within the City. Many smaller tributaries drain to Accotink Creek and Daniels Run in a roughly dendritic (branched) pattern which has been substantially modified by development and channelization.

The City contains the headwaters of Accotink Creek, which flows through southern Fairfax County and empties into Accotink Bay and Gunston Cove and then into the Potomac River. Within the City, Accotink Creek is primarily a gravelly bottomed fast flowing stream. However, in some wide, shallow, or slower moving areas, particularly in areas upstream of culverts, thick layers of sediments have been deposited over the gravel as a result of excessive erosion and both natural and man-made stream course blockage. Throughout much of the City, Accotink Creek is only five to ten feet wide and relatively shallow. However, the creek widens to ten to twenty-five feet and is several feet deep where it exits

the northeastern edge of the City near the intersection of Pickett Road and Old Pickett Road in Thaiss Park.

According to the Division of Soil and Water Conservation's Hydrologic Units Map of Northern Virginia, the City lies primarily within the Accotink Creek watershed (HUC Code: 020700100402) which drains approximately 90% of the City. The Pohick Creek watershed (HUC Code: 020700100401), which drains the southeastern portion of the City covers approximately 3% of the City. The Difficult Run watershed (HUC Code: 02070081004), which drains the area west of Jermantown Road, covers approximately 3% of the City while the Popes Head Creek watershed (HUC Code: 020700100705), which drains the southwestern portion of the City, covers approximately 4% of the City. Popes Head Creek flows through south-central Fairfax County, bisecting the Town of Clifton, and eventually empties into the Occoquan Reservoir. This is significant due to the fact that the Occoquan serves as a primary drinking water supply for a large percentage Northern Virginians. Figure A2 presents a schematic of the City's major watersheds. Figure A3 presents a schematic of the major streams within the City.

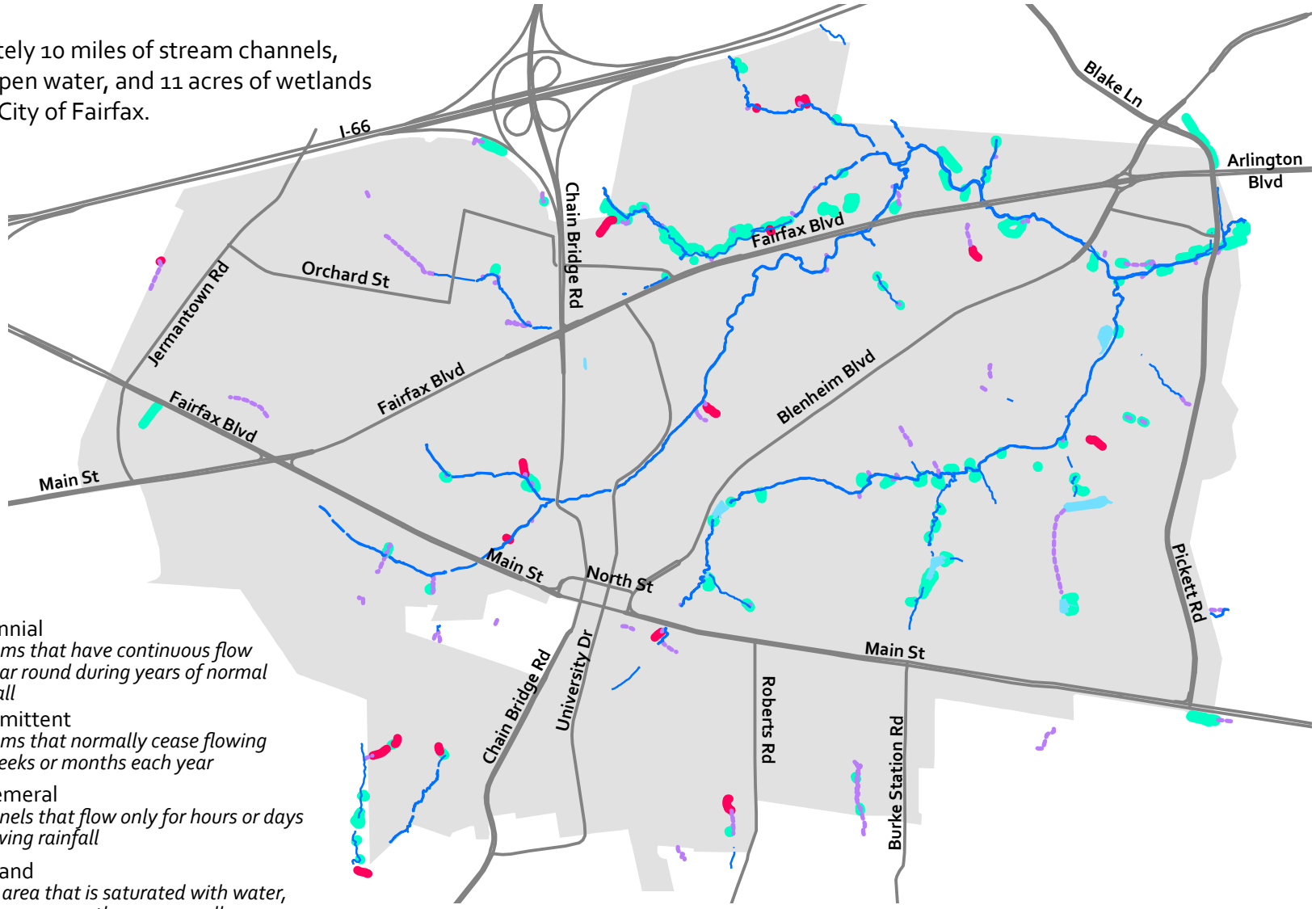
FIGURE A2 WATERSHEDS



Tributary streams within the City are subject to runoff from shopping centers, garages, parking lots, and other potentially high pollution areas. Storm drains feed the majority of the streams passing through the City and have been implicated as sources of pollution from improperly disposed petroleum products. Although many tributaries have been cleared to their banks, or have been modified to enhance drainage capacity, only a relatively small proportion of the City's perennial streams have actually been piped or channelized with concrete. The implications that the City's land uses, impervious cover, and human activities have on water quality are further detailed in Section 4.

FIGURE A3 WATER RESOURCES

Approximately 10 miles of stream channels, 9 acres of open water, and 11 acres of wetlands exist in the City of Fairfax.



Legend

- Perennial
  Streams that have continuous flow all year round during years of normal rainfall
- Intermittent
  Streams that normally cease flowing for weeks or months each year
- Ephemeral
  Channels that flow only for hours or days following rainfall
- Wetland
  Land area that is saturated with water, either permanently or seasonally
- Pond
  A body of standing water (either natural or artificial)

Source: City of Fairfax GIS , Watershed Management Plan, July 2005 and the Accotink Creek Stream Stability Assessment and Prioritization Plan, 2008; Stream Assessment/Mapping and Chesapeake Bay Preservation Area Mapping Project, 2003

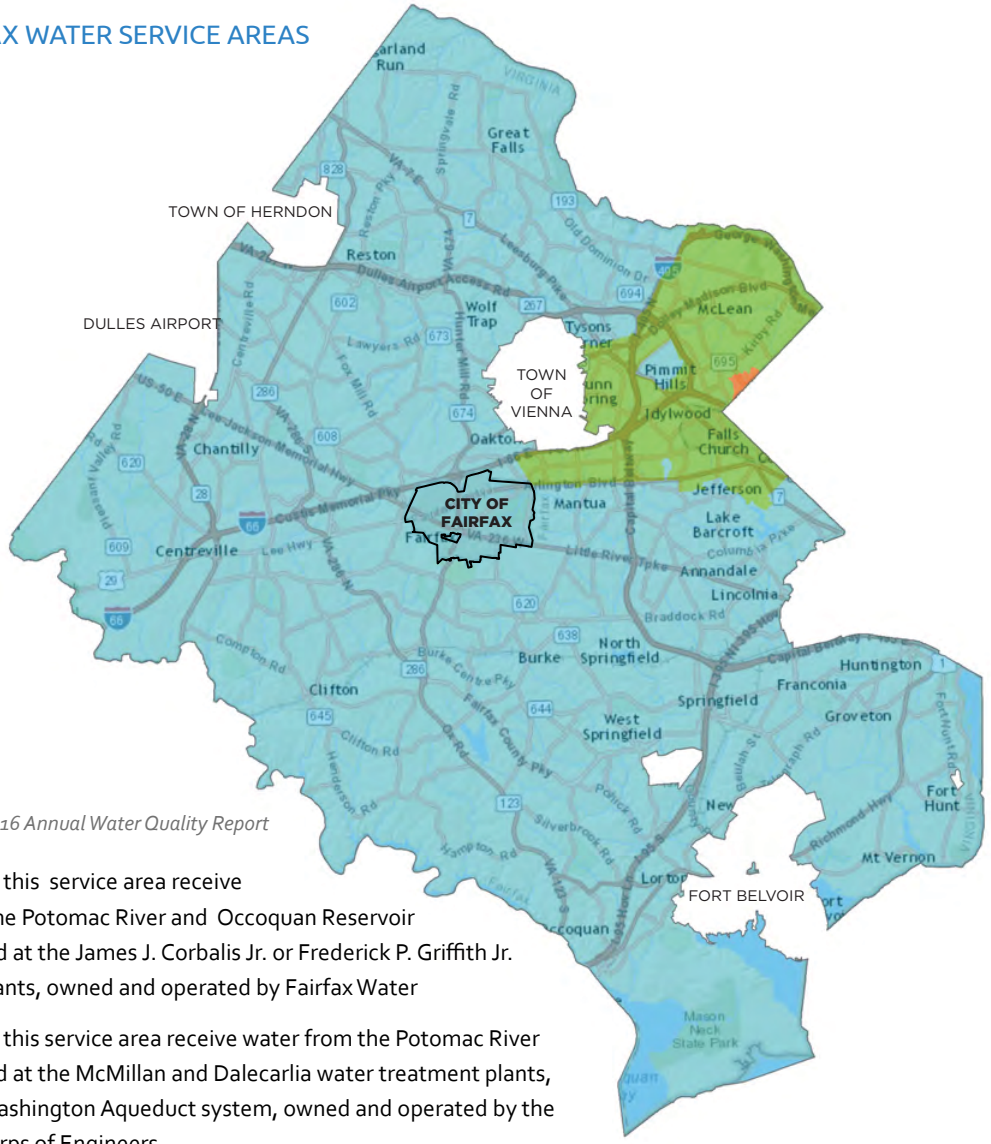
3.2. Water Supply

The City sold its water system to Fairfax Water on January 2, 2014. Since that sale, Fairfax Water has been providing water services to the City as presented on Figure A4.

Per the Fairfax Water Strategic Plan 2020, "Fairfax Water owns and operates the two largest water treatment facilities in Virginia with an average daily water production of 163 million gallons and combined maximum capacity of 376 million gallons per day. The James J. Corbalis Jr. treatment plant is at the northern tip of Fairfax County and the Frederick P. Griffith Jr. treatment plant is on the southern border of Fairfax County. Fairfax Water also purchases water from the McMillan and Dalecarlia treatment plants in Washington DC. They are part of the Washington Aqueduct, owned and operated by the U.S. Army Corps of Engineers. Fairfax Water draws raw water from two primary sources: the Potomac River and the Occoquan Reservoir, which is fed by the Occoquan River."

The principal source of potable water for the City is the Potomac River and Occoquan Reservoir that is treated at the James J. Corbalis Jr. or Frederick P. Griffith Jr. treatment plants. Fairfax Water continually works to reliably meet the needs of present and future

FIGURE A4 FAIRFAX WATER SERVICE AREAS



Source: Fairfax Water 2016 Annual Water Quality Report

Customers in this service area receive water from the Potomac River and Occoquan Reservoir that is treated at the James J. Corbalis Jr. or Frederick P. Griffith Jr. treatment plants, owned and operated by Fairfax Water

Customers in this service area receive water from the Potomac River that is treated at the McMillan and Dalecarlia water treatment plants, part of the Washington Aqueduct system, owned and operated by the U.S. Army Corps of Engineers

Customers in this service area receive water from the Potomac River that is treated at the Dalecarlia water treatment plant, part of the Washington Aqueduct system, owned and operated by the U.S. Army Corps of Engineers

customers. The City will continue to work with Fairfax Water to ensure the City has access to safe and reliable drinking water.

In compliance with federal Safe Drinking Water Act, the Virginia Department of Health (VDH) conducts source-water assessments, which consist of figures of the evaluated watershed area, an inventory of known land-use activities, and documentation of known source-water contamination. The Potomac River and the Occoquan Reservoir were determined to be of high susceptibility to contamination.

In addition to protecting the City's water supply from pollution, water conservation practices help conserve and protect it from depletion. Conservation also reduces the amount of potable water that reaches the City's sanitary sewer system and reduces the potential that landscape irrigation and car washing will result in water pollution. The City should develop a program to encourage City residents on a more regular basis to practice water conservation, including the voluntary replacement of water-intensive (or leaky) fixtures in the home with new low consumption fixtures. Incorporation of water conservation into the school curriculum is also an effective approach and has been used elsewhere in Northern Virginia, including Arlington County.

3.3. Water Quality Monitoring

Protecting the quality of surface water resources is a concern for many urban jurisdictions. The removal of tree canopy cover, which serves to stabilize and cool stream temperatures, as well as increased imperviousness of surrounding areas, which increases the volume and velocity of stormwater runoff into local streams, have a generally negative effect on stream water quality. Water quality may be decreased as a result of pesticide and fertilizer-laden runoff from adjacent lawns or by runoff from parking lots which may contain nutrients, heavy metals, and hydrocarbons. Eroding stream banks contribute to urban water quality problems by choking local streams with sediment. Illegal dumping into storm sewers, trash and litter, animal and pet wastes, and leaking above ground and underground storage tanks also take their toll on urban water quality.

The City's established Water Quality Monitoring Program (WQMP) helps the City meet the requirements contained in Section I.B.2.e of the City's Municipal Separate Storm Sewer System (MS4) permit, and Item 9 in the City of Fairfax's DEQ approved TMDL Action Plans. It was designed to assist in assessing the effectiveness of all the City's Local TMDL Action Plans. Under the program, the City collects water quality samples which are analyzed for water quality parameters including Total Suspended Solids (TSS), Bacteria (E. coli), temperature, specific conductance, Dissolved Oxygen (DO), pH, turbidity, nitrate + nitrite, total phosphorus, and volatile suspended solids. Samples are collected twice a year from six representative MS4 outfalls located within the drainage sheds of the impaired reaches of Difficult Run, Accotink Creek, and Popes Head Creek.

The City utilizes the water quality sampling data to address multiple objectives including: screening for potential sources of the pollutants of concern discharging into the City's MS4; targeting locations within the MS4 permit area for implementation of BMPs; educating the public on the potential water quality impacts of their actions and behavior within the MS4 drainage area; and ultimately to aid in assessing the overall effectiveness of the Action Plan in reducing the discharge of the pollutants of concern from the City's MS4.

At the end of each MS4 permit reporting period, the City prepares annual Water Quality Monitoring Reports, which are included with the City's MS4 Annual Report. Once appropriate amounts of sampling data have

been collected under the WQMP, the City will analyze the results to determine the next steps to take with the MS4 Permit Program and local TMDL Action Plans.

3.4. Groundwater Resources

While the City no longer relies on groundwater resources for its potable water supply, groundwater is nonetheless an important water resource. An investigation of the groundwater resources of the City is important because groundwater is intimately connected with the ecosystem as it provides the base flow to many rivers, streams, ponds, lakes, and wetlands. Groundwater is also an issue of regional importance due to its dynamic nature, as was shown when a leaking oil storage tank at the Fairfax Tank Farm formed a plume which spread from the eastern edge of the City into the Mantua neighborhood of Fairfax County. Because the City no longer relies on groundwater for its potable water supply, recent data on City-wide groundwater dynamics and quality is not available.

Section 4. Existing and Potential Sources of Water Pollution

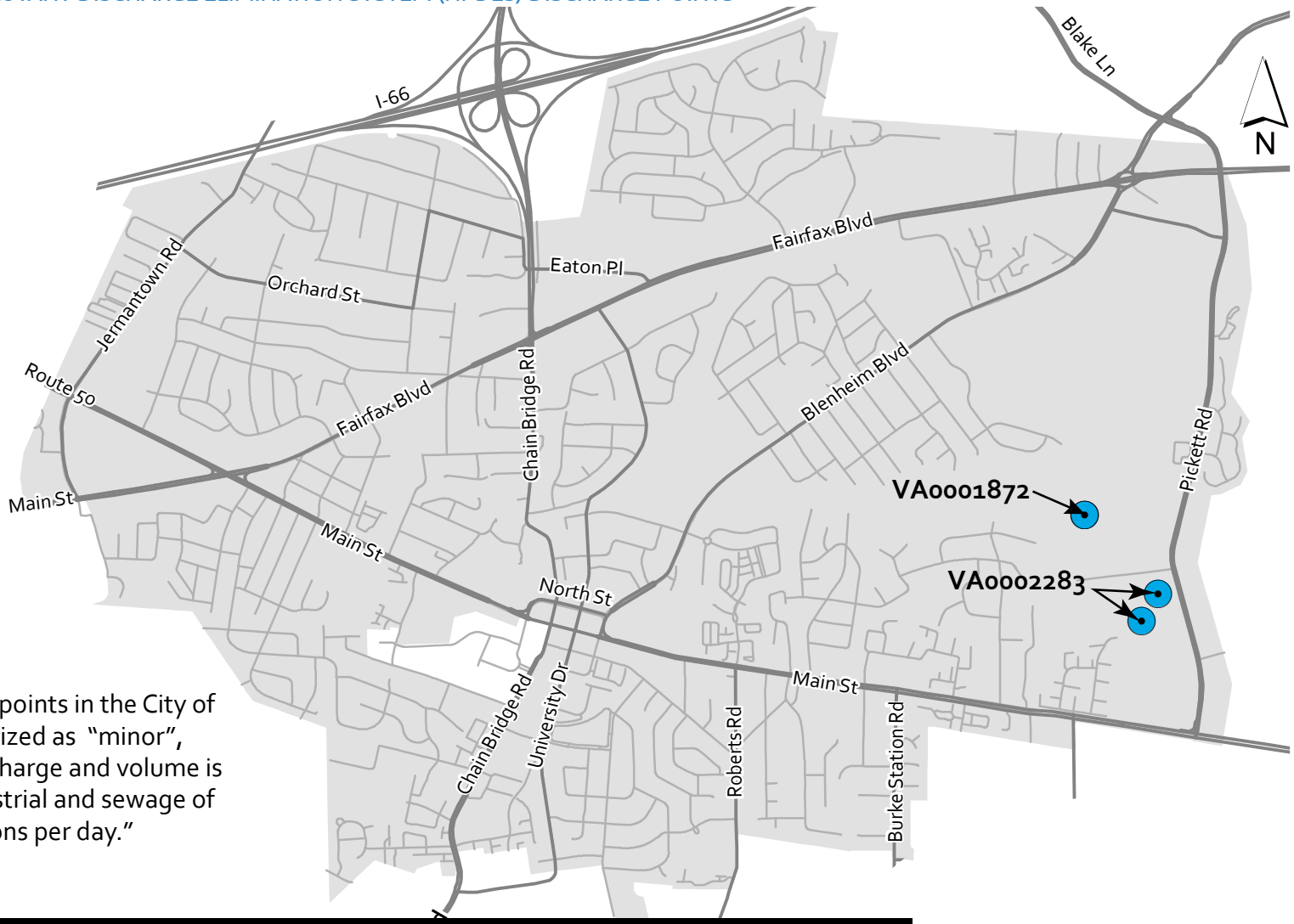
While some level of environmental pollution resulting from human activity may be inevitable, the cost of pollution and its effects on quality of life should not be ignored. Unmanaged pollution can result in surface and groundwater contamination, poor air quality, aesthetic degradation of the landscape, and the destruction of important ecological habitats, all of which detract from the City's basic character. The most cost-effective approach to the problem of pollution is to prevent it at its source. A number of tools are available to the City to aid in pollution prevention, including public education and awareness programs, water conservation, lawn care programs, and recycling efforts, to name only a few. The cost to the City once environmental damage is done includes not only short term clean-up costs, but long-term costs including decreased property values and loss of tax base. The following section describes the City's existing sources of pollution as well as potential sources of pollution which the City may face as it grows and develops.

4.1. Point Source Pollution

Point source pollution is pollution which can be attributed to a specific outfall and is therefore often the most easily recognizable and regulatable form of pollution. Industries and municipalities, under the federal Clean Water Act, National Pollution Discharge Elimination System, are required to report pollution discharges to water courses above a certain threshold, and to the maximum extent practicable, mitigate the effects of the pollution on the environment. The DEQ, Water Division, maintains records on these sources of pollution and is charged with ensuring that environmental regulations are enforced.

There are two National Pollution Discharge Elimination System discharge points located within the City (VA0001872 and VA0002283), both of which drain to tributaries of Accotink Creek (see Figure A5). The discharge points are associated with ongoing activities at the Fairfax Tank Farm Terminal Complex located on Colonial Avenue. The City's water quality is not affected by any upstream point source discharges from surrounding Fairfax County or other jurisdictions. There are currently no municipal discharge points on property owned by the City which fall under the National Pollution Discharge Elimination System

FIGURE A5 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) DISCHARGE POINTS



There are two discharge points in the City of Fairfax. Both are categorized as "minor", meaning the type of discharge and volume is "commercial, small industrial and sewage of less than 1.0 million gallons per day."

Permit Number	Facility	Address	Permit Expiration
VA0001872	Joint Basin Corporation - Fairfax Terminal Complex	9601 Colonial Ave	11/30/2025
VA0002283	Motiva Enterprises LLC - Fairfax	3800 Pickett Rd	12/31/2028

1 inch = 2,500 feet

Source: Virginia Department of Environmental Quality (DEQ) Virginia Environmental Geographic Systems (VEGIS), Accessed September 11, 2024

regulations. Stormwater runoff, which is considered nonpoint source pollution, unless piped, is further discussed under Section 4.2.

4.2. Nonpoint Source Pollution

Nonpoint source pollution is pollution which cannot be attributed to a single source but is the result of many diffuse sources. Considered singularly, each small source would not constitute a problem, but together these nonpoint sources constitute a substantial threat to water quality. Most commonly, nonpoint source pollution is caused by rainfall running off roadways, parking lots, roof tops, and other urban land uses. Urbanization increases the imperviousness of a land area, thereby increasing the amount and velocity of stormwater runoff delivered to nearby streams. Pollutants which would normally settle out or infiltrate through the soil are carried directly to local waterways. On a per acre basis, urban land use including residential development generally produces higher annual nonpoint source pollutant loadings of nutrients, heavy metals, and oxygen-depleting substances than do rural agricultural uses. Oil contamination, sediments, pesticides, metals, and other toxic substances can kill fish and destroy bottom life. In addition to transporting pollution, increased runoff also increases instream flow during and immediately after periods of precipitation. This results in increased soil erosion and the destruction of wildlife habitat.

The effect on local waterways is a general degradation of water quality and a phenomenon known as eutrophication. Eutrophic conditions, caused by excessive nutrients in the water, are characterized by low dissolved oxygen levels and high algal growth. The primary detrimental effect on water resources, particularly on large bodies of water such as the Potomac River and the Chesapeake Bay, is algal blooms, which block sunlight from aquatic life and deplete the dissolved oxygen content during decay. Eutrophication also destroys the recreational use of water resources and results in strong odor and undesirable taste.

Because the City lies within the Tidewater area of Virginia, which has a significant impact on the health of the Chesapeake Bay, controlling nonpoint source pollution is an important aspect of the City's environmental protection efforts. The Virginia Division of Soil and Water Conservation has designated the control of nonpoint source pollution as a high priority for all watersheds within the City.

Nonpoint source pollution from urban areas can be controlled by minimizing impervious areas from new development, reducing impervious areas through redevelopment, utilizing open space and preserving indigenous vegetation, restoring denuded vegetative stream buffers, and by employing the use of structural or nonstructural best management practices (BMPs), which operate by trapping stormwater runoff and detaining it until unwanted nutrients, sediment, and other harmful pollutants are allowed to settle out or be filtered through the underlying soil. The City's Chesapeake Bay Preservation regulation requires the achievement of certain performance standards for any development which takes place in designated Chesapeake Bay Preservation Areas.

A useful analysis tool in nonpoint source pollution mitigation is to examine where highly impervious areas of the City are in relation to the City's water resources. In this way, various nonpoint source pollution control efforts, from educational programs to redevelopment, can be concentrated on those areas most likely to produce the greatest impact on the quality of City water. Since the City is largely built out, these figures are helpful when considering where to concentrate redevelopment or retrofit to improve water quality. It is also

useful in deciding where and what types of public education programs may be beneficial. The City consists of approximately 42.7% impervious land areas and 57.3% pervious land areas (Figure A6).

The City's nonpoint source pollution control program also includes the City's Erosion and Sediment Control Ordinance. This ordinance requires that stormwater management facilities be installed during construction to help control increased stormwater runoff created by development thereby reducing the possibility of downstream flooding and erosion.

4.3. Streambank Erosion and Sedimentation

While streambank and land erosion is a natural process, land development has greatly accelerated this process. As large areas of once forested land have been replaced with impervious land cover, a greater quantity of stormwater is directly piped into local waterways at a much higher velocity. Signs of stormwater erosion include undercut streams and fallen banks, felled bushes and trees which once lined the banks, and exposed sewer and other utility pipes. Suspended sediments choke and muddy local waterways making them uninhabitable to local species of aquatic

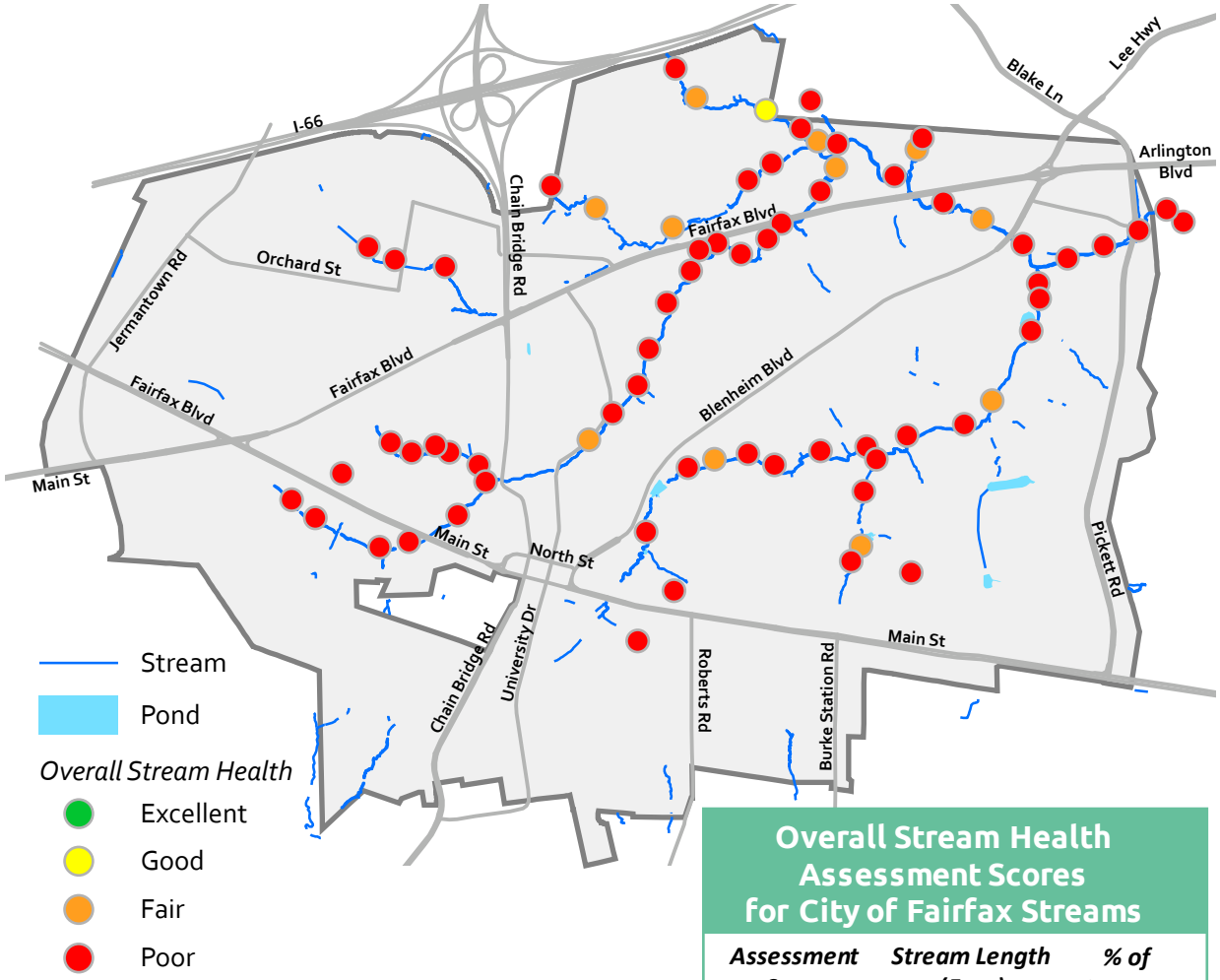
FIGURE A6 PERVIOUS AND IMPERVIOUS AREAS

life. In addition, nutrients and other pollutants attach themselves to sediment particles and contribute to eutrophic conditions in the Potomac River and the Chesapeake Bay. Eventually, suspended sediments are deposited in slower moving portions of the stream course, causing buildup, destruction of benthic life forms, and a decreased stream capacity for floodwaters, thus resulting in greater potential for further erosion and property damage.

Completed in 2005, the City's Watershed Management Plan found that overall stream health to be fair to poor in the majority of the City (Figure A7); erosion potential remains at a very high level; there is evidence of sediment deposition which can cause water quality degradation and have negative impacts on aquatic life; and down-cutting streams threaten City utilities and surrounding property.

A bank erosion hazard index (BEHI) assessment was conducted on Accotink Creek (Figure A8) and Daniels Run (Figure A9). The BEHI is a methodology used to assess and predict stream bank erosion potential. Based on the BEHI results, over 90% of studied stream reach length had at least a high potential for stream bank degradation and over half of all stream

FIGURE A7 OVERALL STREAM HEALTH



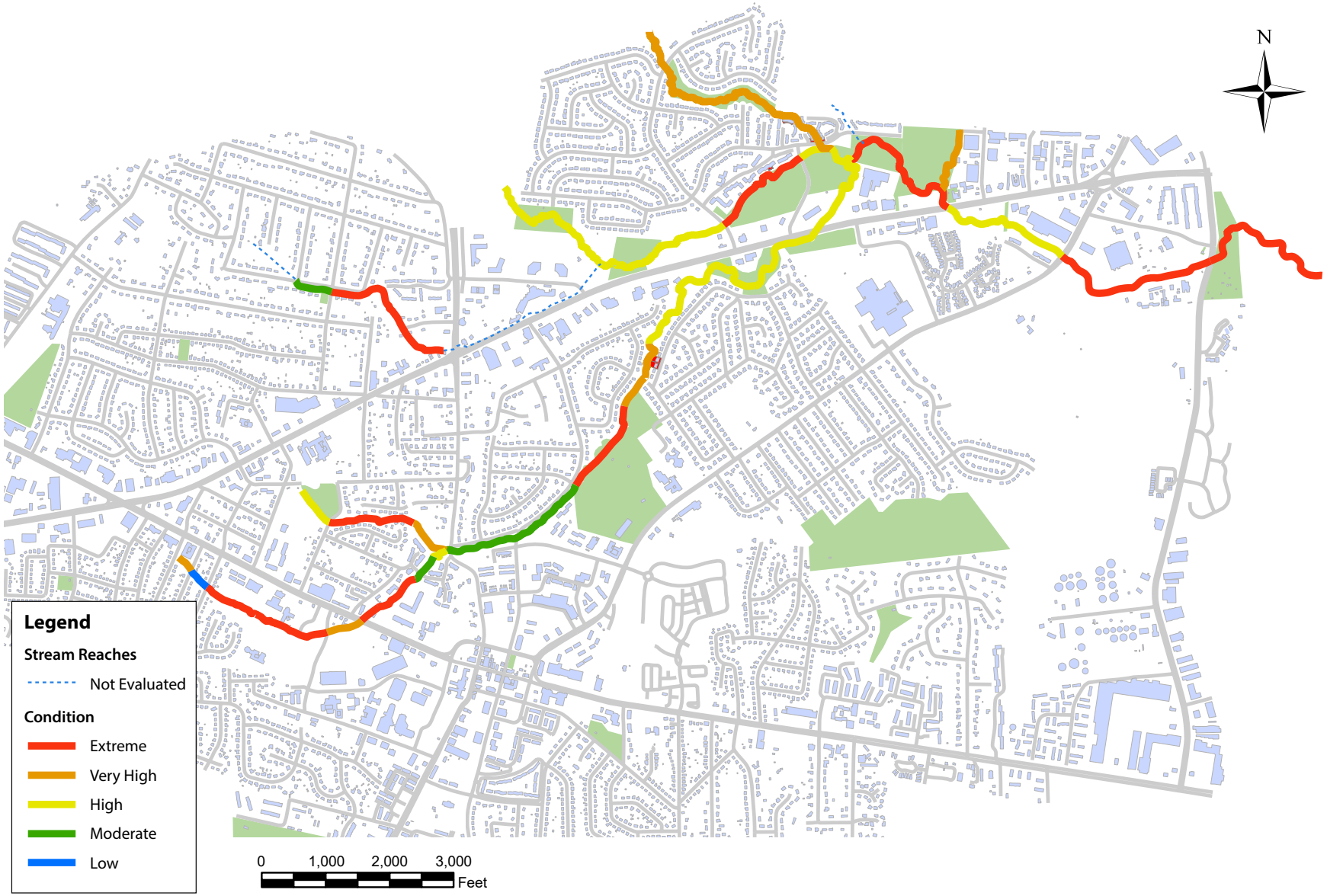
1 inch = 3,200 feet

Source: City of Fairfax GIS , Stream Assessment/Mapping and Chesapeake Bay Preservation Area Mapping Project, 2003; Accotink Creek Stream Stability Assessment and Prioritization Plan Supplemental Report for Daniels Run, 2008

Overall Stream Health Assessment Scores for City of Fairfax Streams

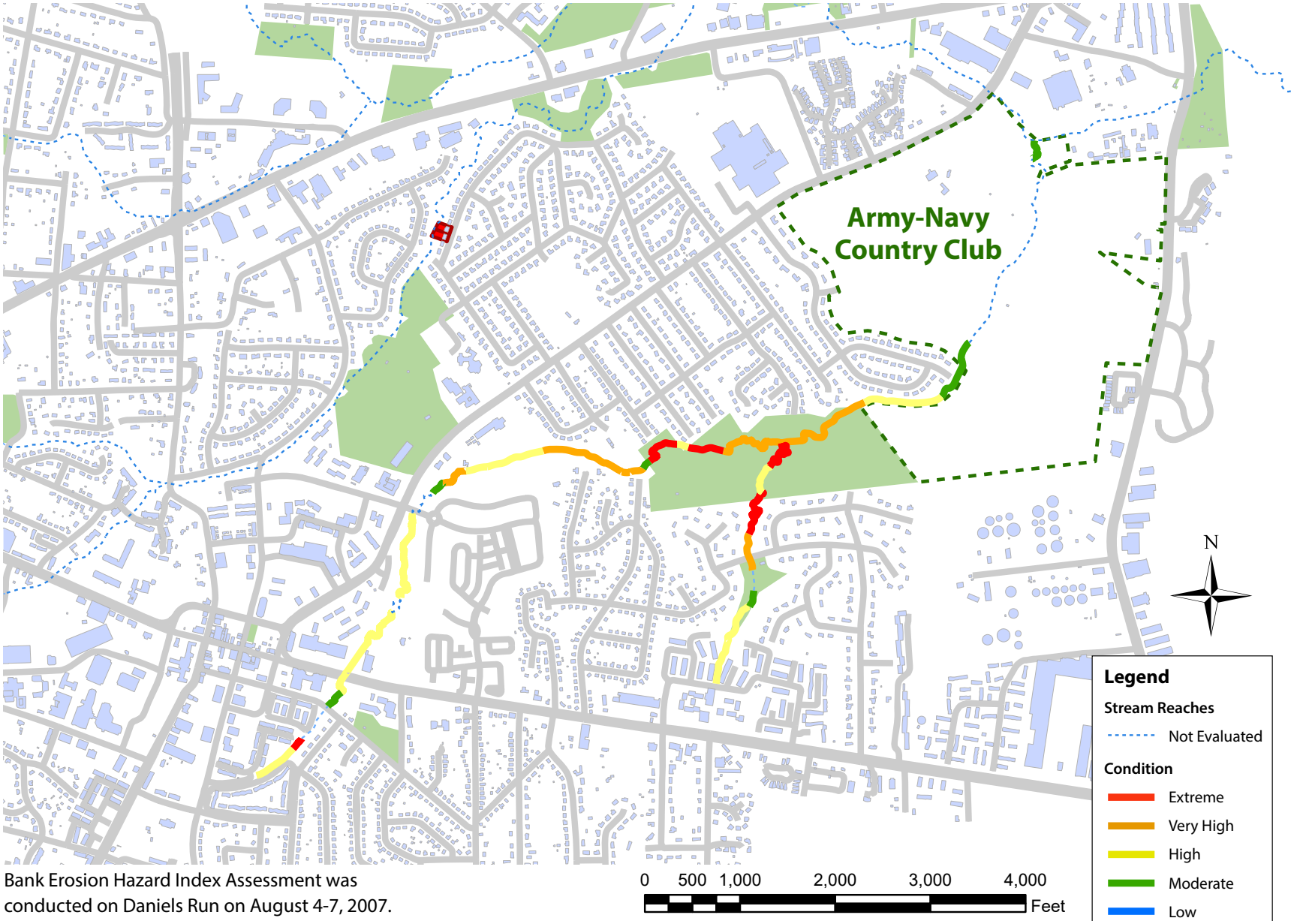
Assessment Score	*Stream Length (Feet)*	*% of Streams*
Excellent	0	0
Good	1,350	3
Fair	10,900	20
Poor	41,360	77

FIGURE A8 BANK EROSION HAZARD INDEX ASSESSMENT RESULTS FOR ACCOTINK CREEK



Bank Erosion Hazard Index Assessment was conducted on Accotink Creek on January 16-19, 2007.

FIGURE A9 BANK EROSION HAZARD INDEX ASSESSMENT RESULTS FOR DANIELS RUN



Bank Erosion Hazard Index Assessment was conducted on Daniels Run on August 4-7, 2007.

reaches were found to be at a very high or extreme risk for stream bank degradation. It is evident from these results that stream bank erosion is a major impact on the stability and overall health of the City's streams

4.4. Malfunctioning Water Quality BMPs

In response to the water quality requirements of the Chesapeake Bay Preservation Act, many development sites within the City will be called upon to establish water quality best management practices (BMPs). These BMPs are designed to detain polluted stormwater runoff until harmful pollutants have had a chance to settle, at which time the stormwater is slowly released. However, BMPs, like most other structural facilities, will deteriorate over time and require regular maintenance. Adequate maintenance will prolong the expected lifespan of a facility, therefore saving considerable money in the long-run. Further, while a properly functioning facility enhances downstream environments by mitigating the environmental impacts of land development, pollutant removal efficiencies will decline over time if regular maintenance is not performed.

Pursuant to the BMP Maintenance and Monitoring Agreement, Erosion and Sediment Control Plan, or Site Plan governing the facilities throughout the City, it is responsibility of the owner(s) to maintain the BMP facility in good working order. The maintenance agreement, Erosion and Sediment Control plan or Site Plan, provides the City of Fairfax with authority to conduct inspections of BMPs and Stormwater Management Facilities.

The City conducts a Citywide assessment to ensure all facilities are in working order on an annual basis. A representative from the City or an authorized consultant visits the property (or HOA property) to conduct an inspection of the stormwater control measures and BMPs in place to ensure proper maintenance is being performed in accordance with the suggested maintenance schedule for each facility.

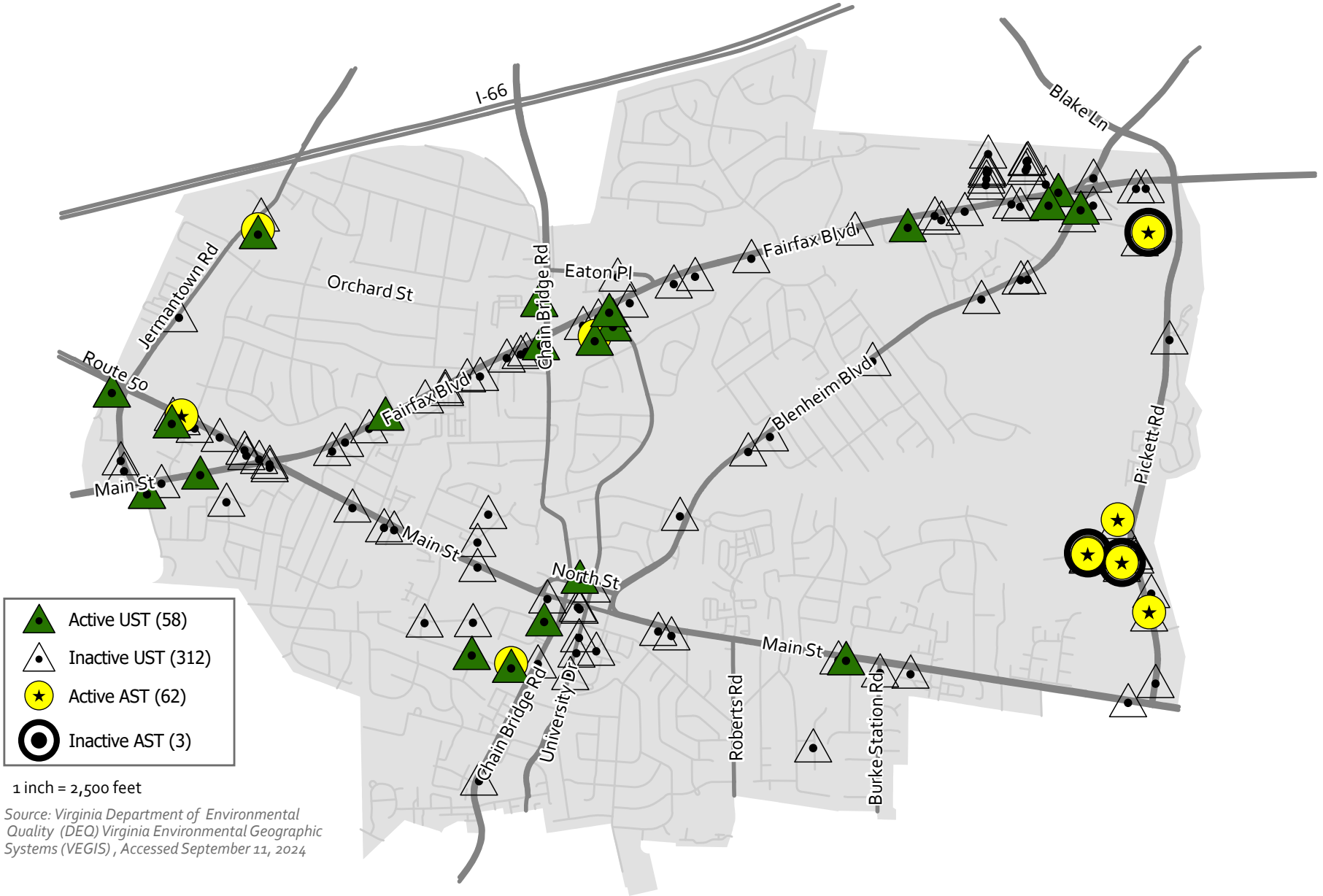
4.5. Underground Storage Tanks

The Virginia Department of Environmental Quality (DEQ), Water Division, is responsible for permitting and tracking underground storage tanks (USTs). Within the City limits, there are approximately 370 USTs of varying capacity at 114 street addresses. Of these USTs, only 58 are still active. The USTs are currently being used to store gasoline, diesel, used oil, heating oil, and other substances. Due to the fact that the City is a major commercial and transportation corridor, the City has a relatively high concentration of USTs for its land area. Underground storage tanks are concentrated along the City's commercial and industrial corridors including lower Pickett Road, Old Town Fairfax, the Kamp Washington area, the intersection of Chain Bridge Road and Fairfax Boulevard, and the Fairfax Circle area (Figure A8).

When properly maintained, underground storage tanks are safe, save space, and are a more aesthetically pleasing alternative than above ground storage tanks. However, leaking tanks are a major source of soil and groundwater contamination. Leaking USTs also have the potential to affect surface waters since many streams are fed by groundwater aquifers. Underground storage tanks often pose a greater threat than other sources of pollution because a leak or spill may not be detected until it has already created extensive damage. Further, there exist many underground storage tanks which were installed before more stringent regulations were applied. The location and condition of these tanks are often unknown.

Another important factor affecting the incidence of leaking tanks is the age of the tanks. Particularly in an area such as Fairfax where soils tend to be acid, older tanks are more likely to be subject to leakage than

FIGURE A10 LOCATION OF UNDERGROUND AND ABOVE GROUND STORAGE TANKS (USTS & ASTS)



Source: Virginia Department of Environmental Quality (DEQ) Virginia Environmental Geographic Systems (VEGIS) , Accessed September 11, 2024

newer tanks designed to counter acid soil. Areas where age may be a factor are scattered throughout the City which should be a consideration when targeting areas for further investigation or for public/business education. Another factor to consider is the proximity of USTs to stream sites. Streams which are located near USTs of above average age may be at particular risk to contamination. Most of the commercial areas of the City directly impact on at least one perennial stream.

The City has and will continue to work with the owners of leaking underground storage tanks and the DEQ to ensure that any existing or future contamination is properly addressed and corrected.

4.6. Above Ground Storage Tanks

The Virginia State Water Control Board in 1998 adopted the regulation, 9 VAC 25-91-10 et seq., which consolidated three repealed regulations, that is, (i) Oil Discharge Contingency Plans and Administrative Fees, 9 VAC 25-90-10 et seq. (ii) Facility and Aboveground Storage Tank Registration Requirements, 9 VAC 25-130-10 et seq., and (iii) Aboveground Storage Tanks Pollution Prevention Requirements, 9 VAC 25-140-10 et seq.

The AST regulations were revised primarily to incorporate new performance standards for certain aboveground storage tanks (1 million gallon or more AST facilities) located in the City as mandated by the 2011 General Assembly (CH 884 of the 2011 Acts of Assembly). By July 1, 2021, the impacted facilities must satisfy specific requirements for strength testing, and release prevention barriers.

Individual tanks with a capacity of less than 660 gallons or multiple tanks with an aggregate capacity of less than 1,320 gallons are not currently regulated by the State or the federal government. Within the City limits, there are 70 regulated ASTs of varying capacity at 6 street addresses (Figure A 8). Of these ASTs, 66 are currently active. Most home fuel oil tanks are only 200 to 660 gallons. It is therefore the responsibility of the individual owner to ensure that leaks and spills do not occur. While individual household tanks do not pose a significant risk to the environment, the aggregate of tanks may pose a serious threat if small problems are not taken seriously. Releases from individual tanks may occur as a result of overfill or the tipping over of the tank. To reduce the risk of accidental spill, the homeowner or fuel company should inspect a tank before filling to ensure that it is sturdy and does not exhibit signs of corrosion. An owner should also have the capacity of the tank clearly marked on the tank and specifically indicate the filling cap location.

4.7. Illegal Dumping of Petroleum and Litter

The reported presence of petroleum products in City streams is a major water quality concern. Petroleum can severely damage the ecosystem by destroying plant life and killing aquatic lifeforms. While some petroleum products in the water may be attributable to leaking automobiles on nearby parking areas or leaking underground storage tanks, the most common source of petroleum is illegal dumping by do-it-yourself (DIY) automotive maintenance activities. A DIY is an individual who removes used oil from a motor vehicle, utility engine, or other piece of equipment that he or she operates as opposed to someone who takes the equipment to a lube shop or auto mechanic.

There is a risk that DIYers may pour the oil down a storm drain or throw it out in the trash, resulting in a release of oil into the environment. For areas such as the City of Fairfax, where streams are primarily fed by residential storm drains, only a few careless instances can result in a significant degradation

in water quality.

The City provides and advertises for the collection of used oil and oil filters at its Property Yard Recycling Center, implements a storm drain marking program, and works with local civic organizations and volunteers to install storm drain markers, which state "Only rain down the storm drain." These markers are used to educate residents that the storm drain eventually empties to the Chesapeake Bay watershed and to prevent the amount of pollution that reaches local creeks and rivers. The City may wish to consider the implementation of a public education program which not only informs residents what to do with used oil, but also tells them what to do if he/she witnesses a neighbor pouring oil down a storm drain.

4.8. Pet and Animal Wastes

Fecal coliform is a pollutant of concern in the City of Fairfax. While there are several potential sources of fecal coliforms, the most likely source is from pet waste, and particularly dog waste, which is not disposed of properly. City paths and walkways along streams (or near storm drains) provide for public access and scenic areas to walk, run, and bicycle. However, these public areas are also used by some pet owners who leave pet wastes which are then easily transported by the next storm directly into the water course.

Fecal coliform can severely impact on the viability of the City's water resources. Control mechanisms include enforcing local animal waste control provisions, BMPs, and natural stream buffers. While BMPs and natural buffers are established as part of the City's overall Chesapeake Bay Program, the most effective manner of control is through public education and better enforcement of the City's animal waste control regulation. Better enforcement and education can reduce the levels of fecal coliforms and nutrients in stormwater runoff.

The City will continue to promote and maintain the dog waste disposal stations along the park trail. The City will also add brochure holders to each waste station that contain public education / outreach materials related to the water quality impacts of dog waste.

4.9. Air Quality as it Relates to Water Quality

Recent evidence suggests that atmospheric deposition, as a result of poor air quality, has a greater impact on water quality than previously assumed. According to the EPA, air sources contribute about one-third of the total nitrogen loads to the Chesapeake Bay by depositing onto the tidal surface waters of the Bay and Bay watershed. Direct deposition to the Bay's tidal surface waters is estimated to be six to eight percent of the total (air and non-air) nitrogen load delivered to the Bay. Nitrogen deposited onto the land surface of the Bay's watershed and subsequently transported to the Bay is approximately 25 to 28 percent of the total nitrogen load delivered to the Bay.

The Clean Air Act requires significant air quality planning and implementation at local, State, and regional levels. The Clean Air Act regulations and programs are expected to achieve significant decreases in air deposition of nitrogen by 2020.

Nitrogen is the primary pollutant of concern for brackish waterbodies such as the Chesapeake Bay. While very little atmospheric deposition will fall directly into the City's streams, pollutants deposited on impervious surfaces, which make up approximately 42.7% of the City's land area, will be washed into local waterways via curbs, gutters, and storm drains during storm events. This has the potential to contribute significantly to water quality problems within the City and beyond.

The City has already contributed to improving air quality through the establishment of pedestrian and bicycle trails in accordance with the Comprehensive Plan and by keeping CUE bus fares low to encourage ridership. The City also continues to work with George Mason University and Fairfax County to encourage alternative forms of transportation.

Many approaches to improving air quality from mobile source emissions will be implemented at the State and regional levels through transportation control measures such as increased public transportation and high occupancy vehicle lanes. Technological advances such as alternative fuel vehicles and tighter tailpipe standards are other measures whose widespread application is expected. The City continues to contribute to these regional efforts through participation on the Metropolitan Washington Council of Government's Air Quality Committee and The Climate, Energy and Environment Policy Committee (CEEPC).

The City seeks to continue its commitment to clean air by expanding its efforts and adopting policies to increase public awareness of the environmental problems associated with air pollution.

Section 5. Environmentally Sensitive Features and Constraints on Development

Land use planning that takes into account sensitive natural features and water resources has the dual benefit of enhancing quality of life through protecting the environment from degradation as well as protecting businesses and homeowners from potentially harmful environmental hazards. Although land use patterns within much of the City are well established, a few vacant parcels still have development potential. These properties deserve special consideration and should be developed in a manner which integrates the man-made and natural environments.

Most development within the City, however, will take place as a result of redevelopment. Development prior to the late 1980s took place without the benefit of many environmental protection constraints; therefore some existing development is not sensitive to the potential for water quality degradation that development brings. With recent concern raised over environmental degradation, and particularly the effects of increased stormwater runoff on the City's streams, the City has begun to reevaluate past practices. Good planning now prescribes that when possible, development should avoid sensitive environmental features. The following section provides an overview of the sensitive natural resources within the City of Fairfax and an analysis of how these resources are currently being managed and additional management options.

5.1. Floodplains

The relatively flat or low land area adjoining a river, stream, or water course which is subject to partial or complete inundation is known as a floodplain. Encroachment on floodplains, such as artificial fill, reduces a stream's flood-carrying capacity, increases flood heights, and increases flood hazards in areas beyond the encroachment itself. In addition, floodplain soils are often unsuitable for development due to high water table, shrink-swell potential, and highly permeable and hydric soil conditions. Floodplains also provide important habitat for a range of vegetative and animal species.

In 1974, the Federal Emergency Management Agency (FEMA) conducted a study of flooding

potential and hazards in the City as part of its national flood insurance program. The plan was also meant to be used as a tool to assist local governments in effective floodplain management. As a result of the study, the City adopted a Floodplain regulation which establishes an overlay as part of the Zoning Ordinance in 1993. As discussed in Section 2.4, the current Floodplain regulation was adopted by the City in March, 2015. The overlay district severely limits the type and location of any development in the floodplain district. The floodplain district includes areas subject to inundation by waters of the one-hundred year flood. The one-hundred year floodplain within the City is associated with areas along the north and central forks of Accotink Creek, Daniels Run, and some major tributaries. A denuded or improperly developed floodplain can result in erosion and a significant reduction in water quality and reduce the effectiveness of the RPA. Figure A1 delineates the approximate extent of the one-hundred year floodplain (1 percent annual chance flood event) in the City.

5.2. Geologic and Sensitive Soil Conditions

It is difficult to overemphasize the importance of geology and soils characteristics when planning for new development and redevelopment. Development should be guided away from sensitive or unstable areas in order to protect the safety of residents, the structural soundness of buildings, and the water quality of Accotink Creek, Pohick Creek, Popes Head Creek, Difficult Run, and eventually the Potomac River and the Chesapeake Bay.

Common constraints placed by geologic conditions or sensitive soils include but are not limited to hydric conditions, shrink-swell potential, wetness, flooding potential, depth to bedrock, and high water table. Proper management of soils will help maintain clean water and will provide areas to recharge groundwater. However, poor management of soils will choke local waterways with silt and sediments and result in the erosion of valuable topsoil as well as spoil the landscape.

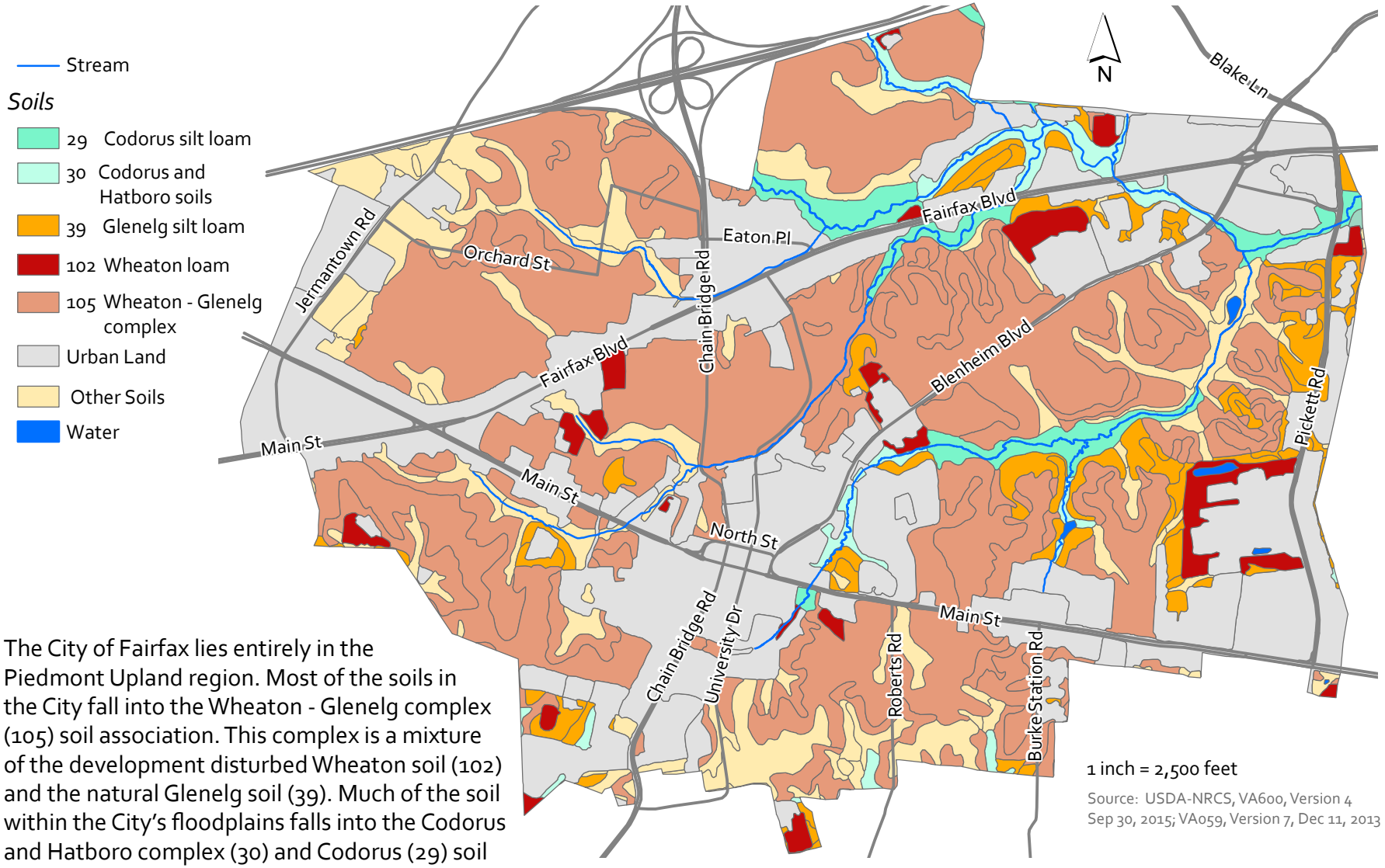
According to the USDA Natural Resources Conservation Service soil survey data (2015), most of the City falls into the Wheaton-Glenelg complex soil association. This complex is a mixture of the development disturbed Wheaton soil and the natural Glenelg soil which is well suited for development. Much of the soil within the City's floodplains falls into the Codorus and Hatboro complex and Codorus silt loam soil associations. These soils are poorly drained, subject to flooding, and not suitable for urban development. Figure A 9 presents the distribution of soil associations in the City.

The underlying geology of the City, along with climate, determines soils characteristics, which offers both constraints and opportunities for development. In order to promote soil conservation and protect water quality, as well as safeguard residents and businesses from potential hazards, including hazards such as radon, it is imperative that future development within the City takes geologic constraints into consideration. Most areas of the City are generally suitable for development purposes if a site is properly engineered. A discussion of the engineering capacity of underlying geology is inappropriate for this Plan due to its technical and detailed nature. Developers must refer to the City's Department of Public Works for more information and recommended resources.

5.3. Vegetative Buffers and Areas with Mature Tree Canopy Cover

To the maximum extent possible, the City wishes to maintain and enhance its urban tree cover. During development, provisions must be made to protect existing trees and replace trees when they are damaged or removed.

FIGURE A11 SOILS



The City of Fairfax lies entirely in the Piedmont Upland region. Most of the soils in the City fall into the Wheaton - Glenelg complex (105) soil association. This complex is a mixture of the development disturbed Wheaton soil (102) and the natural Glenelg soil (39). Much of the soil within the City's floodplains falls into the Codorus and Hatboro complex (30) and Codorus (29) soil associations.

The City's Chesapeake Bay Preservation regulation also requires that a 100-foot buffer area along perennial streams be maintained or established during development or redevelopment in order to protect streams from the adverse effects of increased impervious surfaces and resultant runoff.

Since the City is almost entirely developed, few significant vegetation stands remain. Those that still exist deserve special protection so that their aesthetic and ecological benefits to the City are not lost. The largest City-owned vegetation stand is located at Daniels Run Park. The park covers 48 acres, most of which is in a natural state. It contains deciduous vegetation with an oak canopy and a beech understory. Other tree types found there are hickory, sycamore, tulip poplar, and holly. The 20-acre Van Dyck Park is partially wooded as is the 10-acre Ranger Road Park. The 20-acre Providence Park is largely wooded, and contains many of these same tree types.

The City's concern for trees is reflected in its Arbor Day tree planting activities and its designation every year starting in 1987 as a Tree City by the National Arbor Day Foundation.

5.4. Non-Tidal Wetlands

Wetlands provide a variety of environmental and socio-economical benefits and also serve as important fish and wildlife habitat. Wetlands enhance water quality by filtering water as it passes through, thereby reducing sediments, nutrients, and chemical and organic pollutants flowing to open water. Wetlands also assist with flood control and serve as groundwater discharge and recharge areas. The U.S. Fish and Wildlife Service estimates that up to 43% of the threatened and endangered species rely directly or indirectly on wetlands for their survival.

The City has a total of 11 acres of wetlands. Figure A2 presents the City's water resources, including wetland areas. There are 8.6 acres of woody wetlands, which consist of areas where forest or shrubland vegetation accounts for 25-100 percent of the cover and the soil or substrate is periodically saturated with or covered with water. The remaining 2.4 acres of wetlands are classified as emergent herbaceous wetlands, which consist of areas where perennial herbaceous vegetation accounts for 75-100 percent of the cover and the soil or substrate is periodically saturated with or covered with water.

Pertinent law protecting non-tidal wetlands includes Section 404 of the federal Clean Water Act, which addresses dredge and fill operations and is administered through the Army Corps of Engineers, and the Virginia Water Protection Permit Act. Other programs, such as those under the Virginia Endangered Species Act and various floodplain management regulations, also serve to protect non-tidal wetlands.

Under the City's Chesapeake Bay Preservation regulation, non-tidal wetlands connected by surface flow and contiguous to tidal wetlands or water bodies with perennial flow are designated as RPAs. All other non-tidal wetlands are protected as part of the RMA. Most wetlands within the City are located contiguous to a tributary stream and within the confines of the floodplain.

5.5. Topography

Poorly designed and constructed developments on steep slopes frequently result in substantial costs to the public, either for repairs or for protective measures to prevent further damage. Increased runoff and sedimentation from denuded hillsides require increased public expenditures for flood control and stormwater management. Further, improperly planned development of hillsides affects the equilibrium of vegetation, geology, slope, and soil.

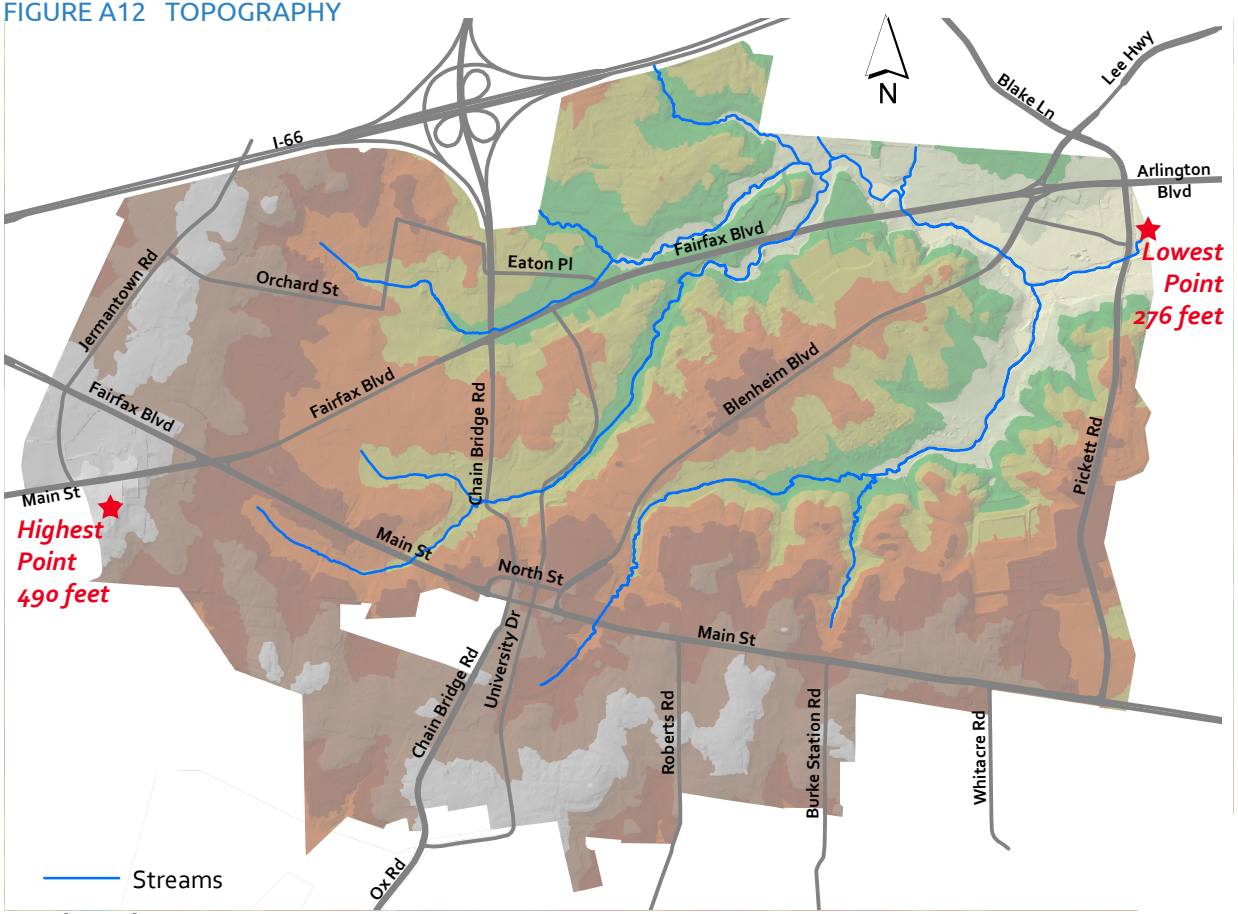
While the City is largely built out, any redevelopment within the City must take topographic constraints into consideration for the following reasons:

- Disturbance of hillsides can result in soil instability and increased erosion.
- Disturbances of hillside can increase runoff.
- Disturbance of hillsides can destroy a community's aesthetic resources.

Steep slopes in excess of 15 percent and slopes located along streams are susceptible to erosion; therefore, particular care must be taken when planning to develop a site with this characteristic. In some instances, special engineering may be required to stabilize slopes. Figure A10 presents a topographic map of the City.

Only a very small portion of the City's land area has slopes of over 15%. These areas are primarily associated with reaches of Accotink Creek and Daniels Run and lie within the City-owned Van Dyck and Daniels Run Parks and in the Army Navy Country Club Property.

FIGURE A12 TOPOGRAPHY



5.6. Groundwater Protection

The importance of groundwater protection was recognized by the Commonwealth of Virginia when the General Assembly enacted the Groundwater Act of 1973 and the Groundwater Management Act of 1992. The Groundwater Management Act reads "... unrestricted usage of groundwater is contributing and will contribute to pollution and shortage of groundwater, thereby jeopardizing the public welfare, safety, and health."

Although the City now receives a treated water supply from the Potomac River and Occoquan Reservoir, protection of the City's groundwater must be a consideration during development and redevelopment. When development occurs, it affects the natural balance of the groundwater flow. Increased imperviousness as a result of development reduces the potential for groundwater recharge and should be taken into consideration when designing a site plan. Generally, high topographic areas are groundwater recharge areas and impervious surface areas in defined groundwater recharge areas should be minimized. By providing recharge areas for stormwater, groundwater equilibrium can be maintained. If recharge areas are not taken into consideration, wells may go dry, base flow to streams is reduced, and wetlands may shrink.

Once contaminated, the usefulness of an aquifer as a resource may be limited or destroyed depending on the toxicity of the contamination and the effort, time, and money involved in clean-up. In most cases it is impractical and sometimes impossible to restore a contaminated aquifer to its original level of purity. Common sources of groundwater contamination include but are not limited to leaking underground storage tanks, antiquated sewer lines, septic systems situated on improper soils, and improperly capped wells. In addition, improperly maintained water quality best management practices may present a groundwater threat. In the City, the most common source of groundwater contamination on record with the DEQ, Water Division, is from petroleum leaks and spills. More stringent underground tank standards enacted in recent years should reduce the level of contamination from these sources.

Recommendations

The City recognizes the importance of the Chesapeake Bay as an economic and social resource and is committed to its protection through the implementation of the Chesapeake Bay Preservation Area Designation and Management Regulations. The following provides the background information and analysis necessary for the City to arrive at informed and proactive policies and goals which address the issue of water quality protection in City streams and the Chesapeake Bay.

These recommendations approach water quality protection from the viewpoint that environmental regulations and healthy economic development are not mutually exclusive, but rather that both may be accomplished simultaneously, and that the result is a better quality of life for all City residents.

Recommendation 1: Protect the quality of the City's surface water resources, the Potomac Estuary, and the Chesapeake Bay from the avoidable impacts of land development.

- **Enforce the provisions of the City's Chesapeake Bay Preservation regulation.**

  The Chesapeake Bay Preservation regulation is the City's primary water quality protection tool. The regulation is designed to protect the overall quality of the City's water resources and the health of the Chesapeake Bay as it relates to impacts from existing and new development.

- **Enforce the City's Erosion and Sediment Control Ordinance.**

  The Erosion and Sediment Control Ordinance serves to protect City streams during site development by minimizing erosion and sedimentation.

- **Maintain strong City oversight of private BMP maintenance programs.**

  Review the effectiveness of the City's current BMP maintenance program and determine whether stronger inspection and maintenance measures are warranted. Make recommendations for how to improve the City's maintenance program, if necessary.

- **Continue implementation of stream restoration and improvement efforts.**

  Continue efforts to stabilize the physical conditions and restore the stream habitat to enable the natural restoration of the streams' biological integrity. The City should continue to prioritize the worst stream reaches, and coordinate improvements with overall watershed strategy.

- **Ensure that development avoids where possible, or minimizes, disturbance of sensitive environmental features, including problem soils.**

  Improper development of sensitive environmental features, and particularly soils, may result not only in structural damage to buildings, but also to a loss of soil to erosion, a decrease in local water quality, and the loss of important habitat and aesthetic resources.

Recommendation 2: Ensure the adequacy of the City's future stormwater management system while emphasizing the need to protect tributary streams and water quality.

- **Improve the City's ability to identify sensitive environmental features.**

  Readily available information concerning environmentally sensitive features will help the City to better plan for and avoid negative environmental impacts resulting from land disturbing activities. The development and redevelopment processes often result in the generation of substantial information on environmental features. During the development process, the City should take the opportunity to collect information, generated from site plans, reports, etc. on sensitive environmental areas, and particularly on soils.

  The City should arrange a protocol to compile this information to create an overlay map identifying environmentally sensitive features within the City including steep slopes, soils, wetlands, floodplains, undisturbed natural areas, and features that are unique or integral to the City's character.

- **Continue to conduct and implement watershed management plans to allow for a holistic approach to local water resource protection.**

  The City should continue to conduct watershed studies and planning to evaluate conditions and identify actions that would improve watershed health. The City should also continue to assess the effectiveness of capital projects and examine long-term trends in the City's water quality.

- **Minimize exposure of the City's natural floodplains to new development.**

  Natural floodplains are essential to the conveyance of stormwater in that they provide extra holding capacity during storms. Floodplains left in their natural condition form a filter for polluted runoff from surrounding land uses. Protection of the City's floodplain is achieved through enforcement of the City's Floodplain regulation.

- **Encourage the use of shared or regional stormwater control measures during development and redevelopment.**

  The implementation of a large number of small, site-specific stormwater quality/quantity management facilities increases maintenance costs and consumes valuable land. The City should seek to facilitate cooperative agreements among developers to encourage the establishment of shared or regional stormwater management facilities.

- **Continue to allocate dedicated and sustainable funding to guarantee the stormwater program's continued viability.**

  Provide the funds necessary to meet MS4 permit and TMDL requirements and to address other stormwater infrastructure needs, such as ensuring adequate capacity for flood control, replacing aging infrastructure, and performing preventive maintenance on all City stormwater management facilities.

  Reassess the Stormwater Fund on a regular basis to ensure that revenue generated adequately covers program needs.

Recommendation 3: Reduce existing sources and prevent potential sources of point and nonpoint source pollution resulting from residential, commercial, and industrial activities within the City.

- **Continue implementation of the City's Water Quality Monitoring Program.**

  At the end of each MS4 permit reporting period, the City prepares annual Water Quality Monitoring Reports, which are included with the City's MS4 Annual Report. Once appropriate amounts of sampling data have been collected under the Water Quality Monitoring Program, the City will analyze the results to determine the next steps (e.g. potentially pinpoint areas that could to be targeted for pollution prevention or source control programs).

- **Encourage the use of green stormwater infrastructure and low impact design on private and public property.**

  Enhance zoning regulations and support initiatives that encourage the use of green stormwater infrastructure and low impact design on private and public property. Consider providing incentives for developers to incorporate green infrastructure and low impact design in their plans.

- **Continue efforts to improve the region's air quality.**

  The City should continue to pursue measures to improve air quality through support of pedestrian access and mass transportation. Since air quality is a regional concern, continued participation on the Metropolitan Washington Air Quality Committee is necessary to achieve many air quality goals.

- **Improve the City's ability to respond to the potential hazards of leaking underground and above ground storage tanks and pipelines.**

  The City should continue to work closely with the DEQ, Water Division, to monitor and enforce clean-up of underground storage tanks.

  The City should support programs to educate residents on how to safely manage above ground storage tanks and should promote policies aimed at providing opportunities to reduce reliance on above ground storage tanks through conversion to alternative forms of fuel.

- **Expand public education and outreach programs.**

  Continue to develop and implement education and outreach programs to improve awareness and encourage the community to protect and improve the quality of area waters. The City will include appropriate public involvement and participation to meet MS4 requirements and satisfy other watershed objectives.

- **Continue to improve upon the City's strong recycling program.**

  A well-publicized recycling program will decrease illegal disposal of materials, and particularly of oil, into the City's storm sewer system.

Recommendation 4: Protect the quality of the City's potable water supply and safeguard the City's groundwater resources against contamination that may adversely affect the ecosystem.

- **Work with the Department of Environmental Quality's Water Division to protect groundwater from contamination from underground storage tanks.**

  The primary threat to the City's groundwater is contamination from underground storage tanks. While the City has no legal authority to regulate underground storage tanks, it should work closely with the DEQ's Water Division to identify areas with high contamination potential and to quickly remediate areas where contamination has already occurred.