THE Fairfax PLANNING HORIZONS

Chesapeake Bay Supplement

to

The Countywide Policy Element

of

The Comprehensive Plan

for Fairfax County, Virginia

2004

The Comprehensive Plan, including this Chesapeake Bay Supplement, is on the Fairfax County Internet site at:
<www.fairfaxcounty.gov/dpz/comprehensiveplan/>.

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Adopted by the Fairfax County Board of Supervisors

November 15, 2004

As Amendment No. 2003 P-03

Department of Planning and Zoning, Planning Division, Suite 730
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***NOTE: Credits represent Board of Supervisors at the time of adoption.**

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In 2003, the Chesapeake Bay Local Government Advisory Committee recertified Fairfax County as a "Gold" Chesapeake Bay Partner Community in recognition of the County's efforts to support the Chesapeake Bay Program. The County was first recognized as a "Gold" Chesapeake Bay Partner Community in 1997, which was the initial year of the certification program.

INTRODUCTION

BACKGROUND

"Healthy state and local economies and a healthy Chesapeake Bay are integrally related; balanced economic development and water quality protection are not mutually exclusive. . . ." So begins the Chesapeake Bay Preservation Act (Chapter 21 of Title 10.1 of the Code of Virginia), which was enacted in 1988 in order to establish a cooperative state-local program to protect water quality in the Chesapeake Bay and its tributaries. With a drainage area of 64,000 square miles, the Chesapeake Bay is the largest estuary in the United States. It holds more than 18 trillion gallons of water and has a drainage area that encompasses portions of six states (Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia) and all of the District of Columbia. More than 15 million people reside within the Bay's watershed. According to the Chesapeake Bay Program's Web site, the population in the Bay's watershed region is expected to grow to 18 million by the year 2020.

The continued population growth in the watershed and the related use of the watershed's land for agricultural, commercial, residential, and industrial purposes has resulted in the degradation of the water quality and habitats provided by the Bay and its tributaries. In 1983, Maryland, Virginia, Pennsylvania, the District of Columbia, the Environmental Protection Agency, and the Chesapeake Bay Commission established a broad framework for the restoration of these resources through the first Chesapeake Bay Agreement, which established the Chesapeake Bay Program. This agreement was subsequently revised in 1987 to establish goals and priority commitments in the areas of: Living Resources; Water Quality; Population Growth and Development; Public Information; Education and Participation; Public Access; and Governance. Virginia's enactment of the Chesapeake Bay Preservation Act was a direct response to many of the commitments made in this Agreement and was established in order to ensure that continued growth and economic development in the area subject to the Act would occur in a manner that would serve to protect the Bay and its tributaries from degradation.

The 1987 Chesapeake Bay Agreement was again updated through the adoption of the Chesapeake 2000 Agreement, and a number of Bay Program initiatives are under way to implement the commitments made in this Agreement. Among the many initiatives that are being pursued is the effort to develop "Tributary Strategies" in each of the Bay's major watersheds to identify the maximum pollutant loads that can be accommodated by each tributary consistent with the goal of restoring living resource habitats and to achieve reductions in pollutant loadings to attain these maximum pollutant loads. This effort is likely to produce recommendations for substantial and costly measures to reduce pollutant loadings from a wide range of sources, including agricultural runoff, urban stormwater runoff, and sewage treatment plant discharges; it can be anticipated that this effort will have considerable implications for Fairfax County, particularly regarding stormwater management measures and sewage treatment plant discharge levels. While these efforts are intended to be voluntary, there is considerable urgency in their development, implementation, and success. Because the Chesapeake Bay and many of its tidal tributaries are considered to be "impaired" under the Clean Water Act, regulatory approaches to pollutant reduction will be pursued if the voluntary Tributary Strategies effort does not succeed;

these regulatory approaches, under the "Total Maximum Daily Load (TMDL)" requirements of the Clean Water Act, are due to be put in place by 2011 if water quality goals are not attained by 2010.

While Fairfax County is only a small part of the Chesapeake Bay Watershed, the County has a long and continuing commitment to the protection and restoration of its water resources and to regional efforts to restore both the Potomac River and Chesapeake Bay. In 1997, the County's efforts were recognized by the Chesapeake Bay Program's Local Government Advisory Committee, which designated the County as a "Gold" Chesapeake Bay Partner Community. The County was recertified as a Gold Partner Community in 2003. The County has undertaken numerous efforts in support of the Bay Program (many of which are described in this report) and will continue to do so in the future; indeed, it is anticipated that there will be continued, if not enhanced, expectations for local water quality improvement efforts in light of the Tributary Strategy and TMDL programs. While the broad scope of efforts to meet Tributary Strategy and TMDL goals falls beyond the scope of this document, this Comprehensive Plan Supplement serves to support this broader effort.

PURPOSE AND INTENT

The Chesapeake Bay Preservation Act required local governments in the "Tidewater" area of the State (including Fairfax County) to designate Chesapeake Bay Preservation Areas and incorporate water quality protection measures into their zoning ordinances, subdivision ordinances, and comprehensive plans. The Act also established both the Chesapeake Bay Local Assistance Board (CBLAB) and the Chesapeake Bay Local Assistance Department (CBLAD) to develop criteria to implement the Act and to administer the program. CBLAD has since been merged into the Department of Conservation and Recreation (DCR) and has been renamed as the DCR Division of Chesapeake Bay Local Assistance. In 1990, CBLAB adopted the Chesapeake Bay Preservation Area Designation and Management Regulations (9 VAC 10-20-10 et seq., hereinafter referred to as "the Regulations"); these Regulations specified criteria for establishing Chesapeake Bay Preservation Areas as well as performance requirements applicable within these areas. The Regulations also established criteria for the incorporation of water quality protection measures into local comprehensive plans. Significant revisions to the Regulations were adopted by CBLAB in December, 2001.

On March 22, 1993, pursuant to the requirements of the Regulations, the Fairfax County Board of Supervisors adopted Chapter 118 of the Fairfax County Code (the County's Chesapeake Bay Preservation Ordinance, or "the Ordinance"). The Ordinance, which is discussed later in this document, established Chesapeake Bay Preservation Areas in Fairfax County, identified allowed uses in these areas, and established performance requirements for new development, redevelopment, on-site sewage disposal facilities, and agricultural uses in these areas. Amendments to the Zoning Ordinance (Chapter 112), Subdivision Ordinance (Chapter 101), Erosion and Sedimentation Control Ordinance (Chapter 104), and Public Facilities Manual followed shortly thereafter. Pursuant to the 2001 revisions to the Regulations, the County's Ordinance was revised significantly in 2003. Again, this is discussed in more detail later in this document.

The actions noted above have satisfied many of the mandates of the Regulations. However, they do not satisfy Comprehensive Plan requirements. On March 19, 2001, CBLAB completed its review of Fairfax County's Comprehensive Plan and found the County's Comprehensive Plan to be consistent with the Act and Regulations subject to the condition that the County undertake and complete recommendations addressing the following:

- The incorporation of the adopted map of Chesapeake Bay Preservation Areas into the Comprehensive Plan;
- The identification of conditions along the County's tidal shoreline as they relate to erosion;
- The development of policies and implementation strategies to assist the County's Wetlands Board in its review of shoreline erosion control proposals;
- The identification of waterfront access points;
- The development of policies to establish criteria for locating boating access sites;
- The identification of water pollution sources;
- The development of policies, where appropriate, to address recommendations from the Infill and Residential Development Study that affect water quality; and
- The development of policies to address redevelopment and water quality improvement.

Consistent with the recommendations noted above, this Comprehensive Plan supplement:

- Incorporates a map of the County's Chesapeake Bay Preservation Areas as part of the Comprehensive Plan;
- Presents the results of an original aerial photo-based shoreline erosion control inventory identifying areas along the tidal shoreline that are experiencing either erosion or accretion and identifying existing erosion control structures;
- Presents information regarding waterfront access sites (including boating access sites), from both existing published guidance and from an original aerial photo-based inventory of the County's tidal shoreline;
- Presents a discussion identifying water pollution sources in Fairfax County;
- References recently-adopted Plan guidance addressing issues related to watershed management planning, water quality improvement during redevelopment, shoreline erosion, and shoreline access; and
- Presents recommendations for actions to address water quality issues associated with water pollution sources, infill development, redevelopment, shoreline erosion, and shoreline access.

The purpose and intent of this Comprehensive Plan supplement and related Comprehensive Plan Objectives and Policies is to continue and enhance the County's commitment to the Chesapeake Bay Program through the satisfaction of all Comprehensive Plan requirements of the Chesapeake Bay Preservation Act and the Chesapeake Bay Preservation Area Designation and Management Regulations. This document is also intended to support the recently-adopted Board of Supervisors' Environmental Excellence 20-year Vision Plan (also known as the "Environmental Agenda"), to further the broader purpose of the Environment section of the County's Policy Plan to "provide guidance for achieving a balance between the need to protect the environment while

planning for the orderly development and redevelopment of the County," and to support the Board of Supervisors' Environmental Protection and Open Space Goals and related Objective and Policies as set forth in the County's Policy Plan. In order to accomplish this, the scope of this document is broader than that which would be required to satisfy the above-mentioned condition of consistency; rather, critical water resource issues are identified and addressed in a more comprehensive manner (with a focus on land use-related issues), and a broad range of actions needed to continue and enhance the County's commitment to its water resources is identified (again, with a general focus on land use). However, this document is not intended to provide a comprehensive assessment of all issues associated with the Environment section of the Policy Plan; rather, the scope is limited to issues associated with the relationship of development and redevelopment to the quality of the Chesapeake Bay, Potomac River, and streams and other bodies of water in Fairfax County. Further, the recommendations presented within this document do not propose any new objectives or policies; rather, the focus is on existing policies and suggested implementation. A series of new policy statements has been adopted within the Policy Plan in conjunction with this effort, and this report should be viewed as a supplement to this recent Policy Plan amendment.

In order to provide a more comprehensive focus on key water resource issues facing the County, there is a need to understand the demographic, land use planning, regulatory, and environmental contexts within which these issues must be considered. As such, the remainder of this introductory section provides a brief overview of demographic and key land use planning contexts, followed by a brief history of stormwater and water quality management in Fairfax County and a summary of the County's Chesapeake Bay Preservation Ordinance. The ensuing section of this report focuses on a broad range of water quality factors, including topography, geology, soils, wetlands, forest cover, and water usage. Included within this section is a map displaying Chesapeake Bay Preservation Areas. Per the Comprehensive Plan condition imposed by the Chesapeake Bay Local Assistance Board (CBLAB), this map is incorporated, by reference, into the County's Policy Plan.

After providing an overview of water quality factors, the document identifies key point and nonpoint sources of water pollution and provides a brief summary of current water quality conditions. The document then focuses on key considerations along the County's tidal shorelines, with a focus on shoreline erosion and access considerations. The document then provides an overview of the County's water quality policies, regulations, and initiatives. Included in this section is a discussion of the recently adopted Board of Supervisors' Environmental Excellence 20-year Vision Plan. The document concludes with a series of proposed actions to address the water quality factors and shoreline conditions identified earlier in the report and to support related policies that have been adopted by the Board of Supervisors.

This document has been prepared as a supplement to the County's Policy Plan and its goals, objectives, and policies with a more detailed consideration of water quality issues and recommended actions to address these issues. The document should be recognized as reflecting the conditions that were present during a snapshot in time during the year 2004; unlike the Policy Plan itself, it is anticipated that this document will become dated as conditions and efforts change and evolve. However, it is hoped that this Plan supplement will serve to provide a focus on the broad range of water resource issues facing the County at this time.

THE DEMOGRAPHIC AND LAND USE PLANNING CONTEXT

Fairfax County is a 395 square mile jurisdiction (including the Towns of Clifton, Herndon, and Vienna) located in the Washington, D.C. metropolitan area (Figure 1). While the County was not formally created until 1742, English settlement began in the early 1600s. During the 1700s, agricultural uses had spread throughout the County. Large tobacco plantations dominated the eastern Coastal Plain area, smaller scale farms growing both tobacco and wheat were common in the central portion of the County, and self-sufficient faming was the norm in the western third of the County. By the middle of the 19th century, smaller farm units replaced many of the large tobacco plantations and the raising of agricultural commodities such as corn, fruit, and livestock expanded throughout the County. The late 19th century saw a shift in the agricultural focus due to the increasingly dominant presence of the national capital and the creation of a regional market. The desire for dairy products was especially great and gave rise to commercial dairies, especially in the western sections of the County. The demand for livestock, poultry, and fruit was also high. This agricultural mix was dominant in the County until World War II.

In the latter half of the 20th century, the County's population grew rapidly, first as a bedroom community for Washington, D.C. and more recently as an employment destination rivaling many of the largest cities in the country. As late as 1930, there were only about 25,000 people living in Fairfax County. Population grew to approximately 98,600 in 1950, and by 1970, more than 450,000 people called Fairfax County home. Since then, the population of the County has more than doubled, and the County is now the most populous jurisdiction in the Washington metropolitan area. Fairfax County now has more residents than seven states. If Fairfax County were a city, it would rank 11th in the country in population. The number of housing units in the County has also increased substantially, and projections call for the addition of over 190,000 more people and over 70,000 new housing units in the County between 2005 and 2025 (Table 1). A variety of unit types characterize the County's housing stock; in 2002, just under half of the total number of residences were single family detached units, with townhouses and multifamily residential dwellings constituting 24.4% and 25.9% of the total number of units, respectively.

Employment in the County has increased substantially in the latter half of the 20th century as well (Table 2). More than half of the County's employed residents now work in the County. The County's large employment base is white collar in nature; the County is a base for numerous federal contractors, technology employers, venture capital firms, and telecommunications companies and is home to seven Fortune 500 company headquarters. The general increase in employment within Fairfax County is expected to continue in the future. However, heavy industrial activity involving substantial pipe discharges into County waterways is generally absent and is not anticipated to become significant in the future.

The increases in population and employment in Fairfax County have had a profound influence on land use in the County, and continued population and employment levels will influence the type, intensity, and character of land use in the future. While the substantial growth of the last half of the 20th century was generally accommodated by an abundant supply of vacant land, there is no longer a substantial amount of vacant land left within the County. As can be seen in Table 3, only 11.1% of the County's zoned land (excluding public street rights of way) remained vacant

Figure 1
Location Map
Fairfax County, Virginia and Vicinity

TABLE 1
Population and Housing Data and Projections—Fairfax County

Year	Population	Housing Units
1950	98,600	27,000
1960	248,900	69,200
1970	454,300	130,800
1980	596,900	215,600
1985	668,300	247,800
1990	818,600	302,500
1995	879,400	328,200
2000	969,700	359,000
2005	*1,042,800*	*385,400*
2010	*1,147,600*	*425,200*
2015	*1,212,800*	*448,400*
2020	*1,230,400*	*454,600*
2025	*1,236,000*	*456,600*

Notes: All numbers are rounded to the nearest hundred.
Projections are italicized.
Sources: Population figures for 1950 and 1960 were taken from Fairfax County Profile, Fairfax County Office of Research and Statistics, Research Branch, February, 1975 (1950 and 1960 data). All other data were taken from Demographic Reports, 2003, Fairfax County Department of Systems Management for Human Services.

as of 2003 (note: natural areas such as parks are not considered to be vacant), and much of this land may contain constraints to development.

Fairfax County's first attempt at regulating development occurred with the 1929 Subdivision Ordinance, which required subdivision plats to be approved by the "County Engineer" prior to recordation and that streets and alleys be a minimum width of 50 feet and 15 feet, respectively. It also required that names of subdivisions, streets, and alleys not be duplicated and that all proposed streets and alleys connect with streets and alleys in adjacent subdivisions.

A Zoning Ordinance was adopted in 1941; this document defined broad categories of land use such as "rural-residential" and "urban-commercial." The County's first Building Code was adopted in 1951. The County's first Comprehensive Plan was adopted in 1958. In 1975, following a multi-year planning effort known as the "Planning Land Use System," or "PLUS," a revised Comprehensive Plan was adopted. In 1988, the "Planning Horizons" process was initiated, resulting in the adoption of the County's Policy Plan (containing countywide goals, objectives, and policies related to specific functional elements) in 1990 and the adoption of four amended Area Plans (containing more detailed land use-related recommendations for specific Planning Districts and Community Planning Sectors) in 1991. These planning documents have

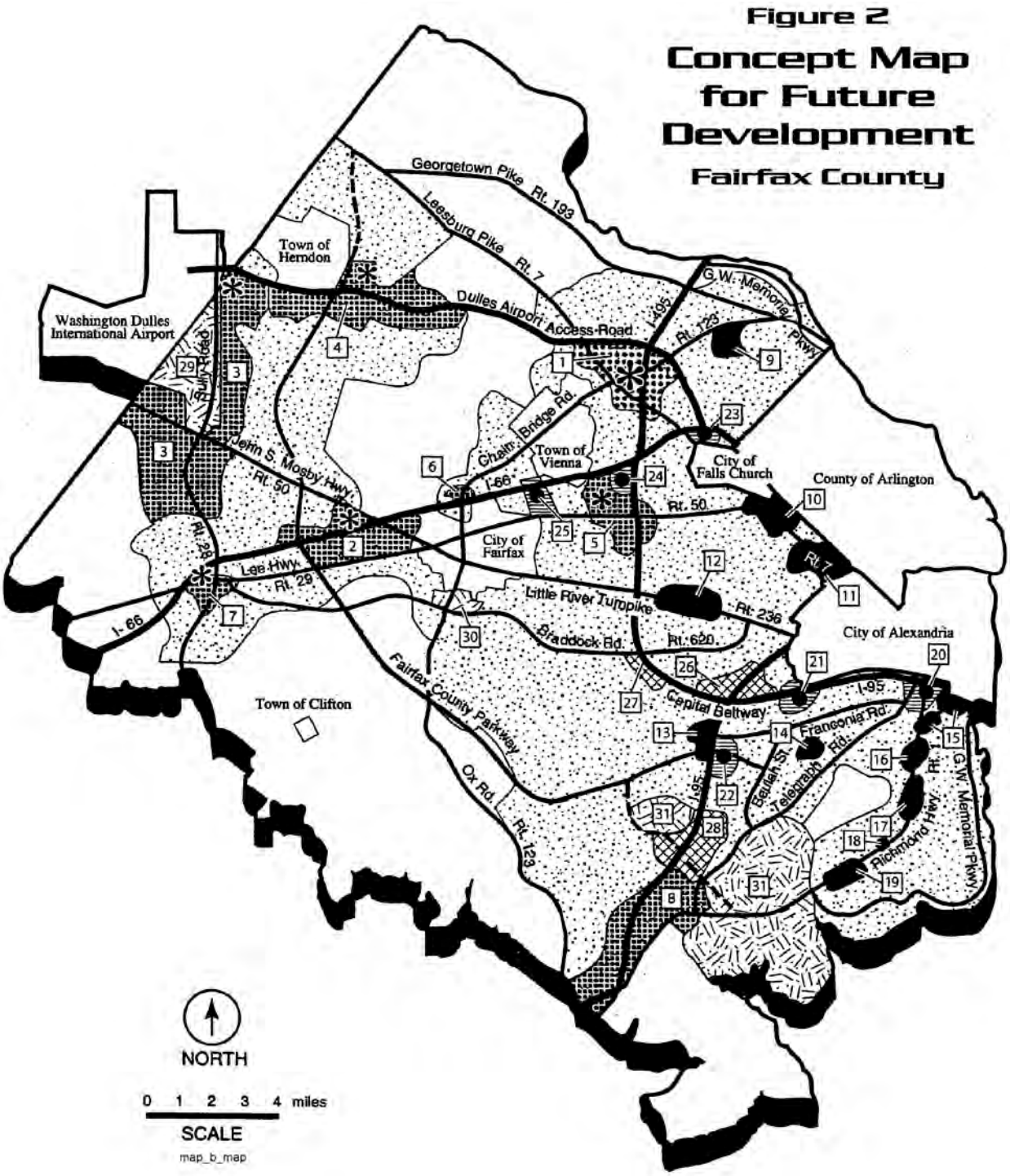


Figure 2
Concept Map for Future Development
Fairfax County
Georgetown Pike Rt. 193
Leesburg Pike Rt. 7
Town of Herndon
Washington Dulles International Airport
Dulles Airport Access Road
I-495
G.W. Memorial Pkwy.
Rt. 123
Chain Bridge Rd.
Town of Vienna
City of Falls Church
County of Arlington
John S. Mosby Hwy.
Rt. 50
I-66
City of Fairfax
Rt. 28
Lee Hwy.
Rt. 29
Little River Turnpike
Rt. 236
Braddock Rd.
Rt. 620
City of Alexandria
I-95
Fairfax County Parkway
Town of Clifton
Capital Beltway
Franconia Rd.
Beulah St.
Telegraph Rd.
Richmond Hwy.
Ox Rd.
NORTH
0 1 2 3 4 miles
SCALE
map_b_map

Legend

(For Figure 2)

LOCATIONS OF MIXED-USE CENTERS

Urban Center
1. Tysons Corner Urban Center

Suburban Centers
2. Fairfax Center
3. Dulles (Route 28 Corridor)
4. Reston-Herndon
5. Merrifield
6. Flint Hill
7. Centreville
8. Lorton-South Route 1

Community Business Centers
9. McLean
10. Seven Corners
11. Baileys Crossroads
12. Annandale
13. Springfield (West)
14. Kingstowne
15. North Gateway and Penn Daw
16. Beacon/Groveton
17. Hybla Valley/Gum Springs
18. South County Center
19. Woodlawn

Transit Station Areas
20. Huntington Metro Station
21. Van Dorn Metro Station
22. Franconia/Springfield Metro Station
23. West Falls Church Metro Station
24. Dunn Loring Metro Station
25. Vienna Metro Station

LOCATIONS OF LARGE INSTITUTIONAL AND INDUSTRIAL AREAS

Industrial Areas
26. Beltway South
27. Ravensworth
28. I-95 Corridor

Large Institutional Land Areas
29. Washington Dulles International Airport
30. George Mason University
31. Fort Belvoir (Main Post and Engineer Proving Ground

Suburban Neighborhoods (Residential density ranges defined in Area Plans; 0.15-0.25 FAR* for neighborhood-serving non-residential use)

Low Density Residential Areas (Residential density of 0.1 to 0.5 du/ac **, specific density ranges in Area Plan; Non-residential use intensity 0.05 to 0.1 FAR)

Tysons Corner Urban Center
* Core (1.0-1.65 FAR; 35-60 du/ac)
Non-Core (0.25-1.0 FAR; 8-45 du/ac)

Suburban Centers
* Core (0.3-0.8 FAR; 15-35 du/ac)
Non-Core (0.15-0.30 FAR; 5-25 du/ac)

Community Business Centers (0.20-0.50 FAR; 5-25 du/ac; if a core is designated, intensities of up to 0.70 FAR may be allowed)

Transit Station Areas (0.30-1.00 FAR; 8-45 du/ac)

Industrial Areas (0.25-0.50 FAR for Industrial Uses)

Large Institutional Land Areas

* FAR - floor area ratio
** du/ac - dwelling units per acre

map_b_legend

Source: *The Comprehensive Plan for Fairfax County,* 2003 Edition, February 10, 2003.

been amended many times since the Planning Horizons process to ensure that the County's Plan responds to the changing needs of its population.

TABLE 2
Nonagricultural Employment in Fairfax County
1950-2000

Year	Total Employment
1950	19,900
1960	39,200
1970	96,700
1980	192,400
1985	268,400
1990	371,700
1995	410,100
2000	518,800

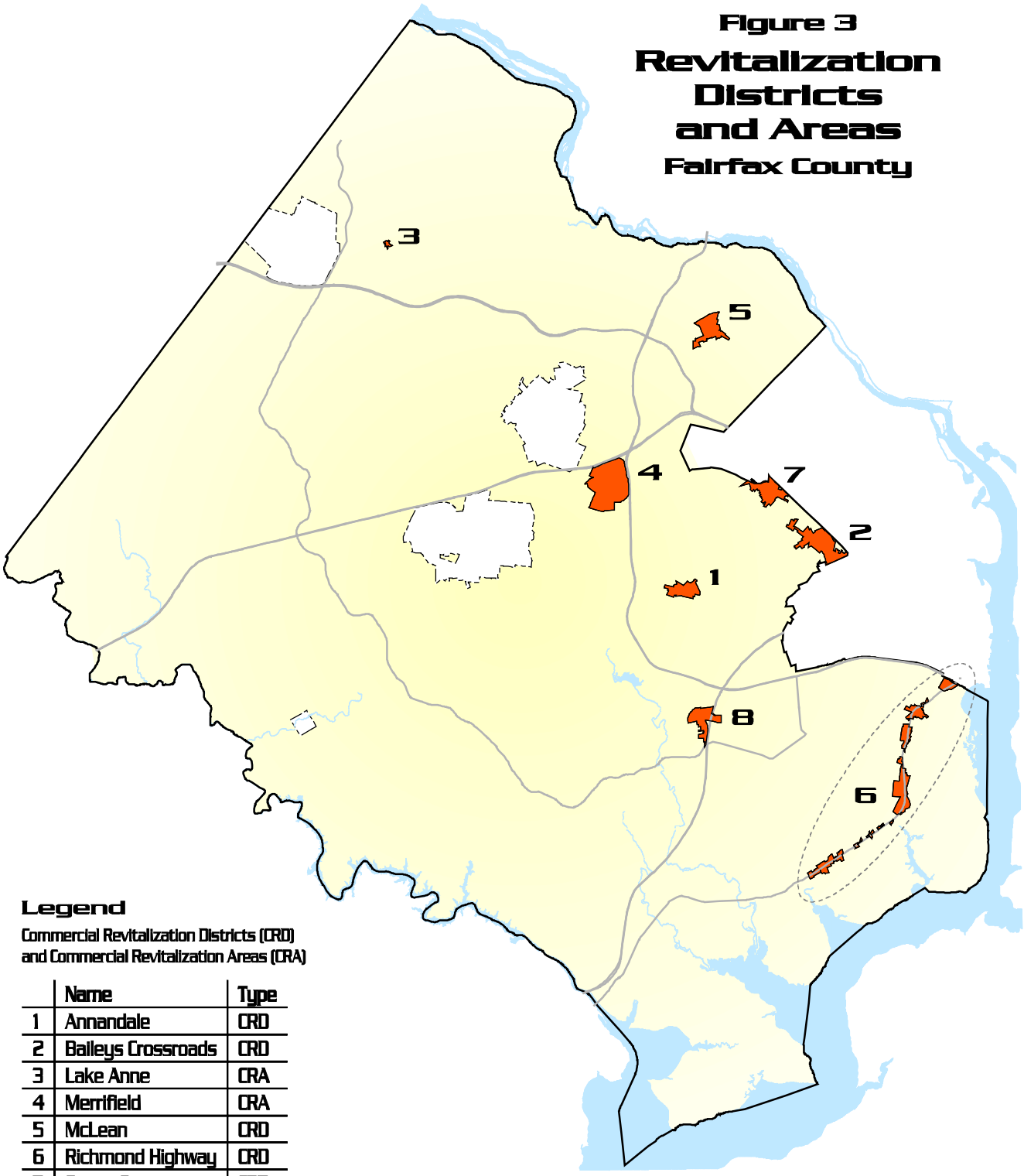
Notes: Number of people employed in Fairfax County, regardless of place of residence.
Data are as of March of each year.
All numbers are rounded to the nearest hundred.
Source: Virginia Employment Commission data as reported in several County documents.

TABLE 3
Vacant Land in Fairfax County

Year	Percent Vacant
1973	Approx. 38%
1980	32.2%
1985	29.2%
1990	19.5%
1995	16.1%
2003	11.1%

Note: Figures represent the percentage of zoned land that is vacant. "Underutilized" parcels are not included. Natural areas such as parks are not considered to be vacant.
Source: Various editions of Demographic Reports and Standard Reports, Fairfax County Department of Systems Management for Human Services (preceded by the Fairfax County Office of Research and Statistics)

The Area Plan volumes of the County's Comprehensive Plan, in conjunction with the adopted Plan map, serve to implement a "Concept for Future Development and Land Classification System," which was introduced in 1990 (Figure 2). This concept stresses the concentration of new employment in mixed use, pedestrian-oriented, high density core areas and the protection and enhancement of stable residential neighborhoods. The Concept for Future Development has been incorporated into each adopted Area Plan to provide a context, framework, and broader vision for the land use recommendations in the Comprehensive Plan.



Legend

Commercial Revitalization Districts (CRD) and Commercial Revitalization Areas (CRA)

	Name	Type
1	Annandale	CRD
2	Baileys Crossroads	CRD
3	Lake Anne	CRA
4	Merrifield	CRA
5	McLean	CRD
6	Richmond Highway	CRD
7	Seven Corners	CRD
8	Springfield	CRD

Source: Planning Division (PD), Department of Planning & Zoning (DPZ). Information is not provided for the cities of Alexandria, Fairfax, and Falls Church, or for the towns of Clifton, Herndon, and Vienna. Prepared by DPZ - PD using Fairfax County GIS.

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With the expansion of development throughout most of the County, the character of development in the County has changed significantly. Where new development once tended to occur on large tracts of land that may have been relatively isolated, there are few large tracts of vacant or underdeveloped land remaining in the County, and much of the development that is now occurring is of an infill or redevelopment character. Such development has generated a suite of issues and concerns that are quite different from issues associated with the type of development that was once more common in the County. In addition, the County's developed areas have aged, and there has been the recognition of a need to revitalize many of the County's older commercial areas in order to sustain the economic vitality and quality of life of these areas. In recognition of these issues, the County has recently pursued major planning and zoning initiatives to address infill development and revitalization issues.

In 1998, the Fairfax County Board of Supervisors designated five Commercial Revitalization Districts (CRDs) and two Commercial Revitalization Areas (CRAs) (Figure 3). Specific regulations and administrative procedures were adopted for the Revitalization Districts in order to provide more flexibility in zoning requirements, in order to facilitate redevelopment projects by improving review processes, and in order to improve the appearance and pedestrian facilities in these areas. Separate provisions were established within the Zoning Ordinance for each of the five CRDs. In addition, major planning studies were initiated and completed for each of the Revitalization Areas and Districts in order to ensure that revitalization efforts in each of these areas will reflect community goals. As will be discussed later in this report, redevelopment of older developed portions of the County presents both challenges and opportunities for water quality improvement.

In January, 2000, County staff published the "Infill and Residential Development Study," which outlined a number of recommended actions related to the County's planning and zoning processes and development requirements. The actions were intended to address concerns in several major areas of emphasis: site design and neighborhood compatibility; traffic and transportation; tree preservation; and stormwater management and erosion and sediment control. More information about these recommendations is presented later in this report.

A BRIEF HISTORY OF STORMWATER AND WATER QUALITY MANAGEMENT IN FAIRFAX COUNTY

GENERAL HISTORY[1]

The concepts of stormwater management and water quality controls have changed dramatically over the last few decades. Throughout most of this period, stormwater control was directed at controlling water runoff from storm events and preventing flooding. More recently, it has come

[1] Much of the discussion in this section is excerpted directly from an appendix in a County document entitled "The Role of Regional Ponds in Fairfax County's Watershed Management" (Environmental Coordinating Committee, Regional Pond Subcommittee, March 3, 2003). Much of that appendix, in turn, was based on the work of Jack White, a former employee of the Fairfax County Department of Public Works and Environmental Services and its predecessor agencies. County staff is grateful for Mr. White's efforts and acknowledges his work as the source of much of this overview.

to include the reduction of pollutants from stormwater runoff and the protection of streams and rivers from bank erosion, heavy sedimentation, and loss of biological diversity and habitat.

Until the middle of the 20th century, development in Fairfax County was largely unregulated. The primary goals of stormwater controls were to prevent catastrophic flooding and to collect and remove runoff from developed properties. This approach continued through the 1950s, when several hundred houses were allowed to be constructed in floodplains and streams were placed in concrete channels in order to prevent the flooding of these homes.

During the period from 1958 through 1975, 100-year floodplains were delineated and adopted for all streams having a drainage area greater than one square mile. In the 1960s, provisions were incorporated into the County's Building Code that limited the development potential of these areas. Also during the 1960s, design and construction of a series of impoundments was initiated in the Pohick Creek Watershed, with funding provided under Public Law 566, in order to control flooding and sedimentation in advance of anticipated development in this watershed.

In 1964, the County published its first set of formal guidelines for the preparation of construction plans. This document, titled "Policies and Guidelines for the Preparation of Subdivision Plans and Site Development Plans," was the forerunner of the current Public Facilities Manual (PFM). The early guidelines for stormwater management in this document called for "adequate drainage," which was generally attained through the conveyance of runoff through curb-and-gutter and concrete pipe or channel facilities. In 1964, the County began collecting developer contributions (pro rata share) for construction of major drainage system improvements downstream of development projects.

In 1967, the County adopted an erosion and sediment control ordinance, five years prior to the adoption of a state erosion and sediment control law.

In 1972, the County began to require all new development to manage stormwater runoff by reducing peak flow rates of the two-year and ten-year design storms to predevelopment peak flow rates. This requirement, along with strict enforcement of the erosion and sediment control law, was intended to reduce severe erosion of downstream channels and prevent the transport of large quantities of sediment through the County's waterways.

In 1973, the County's Board of Supervisors established a Tree Planting and Preservation Ordinance, which established: the Office of the County Arborist (now known as the Urban Forestry Management Branch of the Department of Public Works and Environmental Services); the Fairfax County Tree Commission; and requirements addressing the identification and protection of tree preservation areas during land development.

In 1973, the County expanded its pro rata share program. The purpose of this program was to require land developers to pay their share of the cost of providing off-site drainage improvements that were made necessary, at least in part, by their development projects. In the late 1970s, the County completed a countywide Master Drainage Plan, and the pro rata share program was revised to include some of these projects. This plan identified existing storm drainage

deficiencies along the major streams and tributaries in the County and identified improvements anticipated to be needed as a result of future land development.

In 1975, The Environmental Quality Corridor, or EQC, policy was incorporated into the Comprehensive Plan. The EQC system is an open space system designed to link and preserve natural resource areas and provide passive recreation. The EQC policy is described more completely later in this document.

In 1978, the Upper Occoquan Sewage Authority (UOSA) Water Reclamation Facility, which was constructed in the watershed of one of the County's primary sources of drinking water (the Occoquan Reservoir), was placed into service and became the nation's largest and most successful project for the indirect reuse of reclaimed water to supplement a public water supply. This facility was established pursuant to the Virginia State Water Control Board's 1971 Occoquan Policy, which called for the phasing out of small, outdated sewage treatment facilities in the Occoquan Watershed in favor of no more than three state-of-the-art advanced water reclamation plants.

Fairfax County addressed land use-related components of the effort to protect the Occoquan Reservoir from degradation in the early 1980s. A water quality best management practice (BMP) requirement for Fairfax County's portion of the Occoquan Watershed (over 63,000 acres) was incorporated into the Public Facilities Manual (PFM) in 1980 and was formalized through the adoption of a watershed-wide zoning overlay district (the Water Supply Protection Overlay District) in 1982. Also in 1982, the Board of Supervisors rezoned nearly 41,000 acres of land in the watershed to the R-C (Residential-Conservation) District, allowing no more than one dwelling unit per five acres of land in the affected area. The Board's 1982 actions were a landmark in land use and water quality control in the County and have persisted to this day.

In the mid-1980s, the County developed a regional stormwater management plan for approximately 100 square miles of rapidly developing portions of the County. The regional ponds recommended through this plan would be designed to control larger watersheds (100 to 300 acres of drainage), thereby obviating the need for on-site facilities in these watersheds and reducing County maintenance burdens. In addition to water quantity control functions, these facilities would be designed to serve as water quality BMPs. In 1989, as part of its approval of a report of a task force that was formed to evaluate safety and liability concerns associated with stormwater detention ponds, the County's Board of Supervisors approved the Regional Stormwater Management Plan, which originally identified 134 sites for the construction of regional stormwater management BMP ponds.

In 1990, Fairfax County became the first locality in Virginia to adopt tree cover requirements based on legislation passed by the Virginia General Assembly in 1989. This legislation allows localities to establish specific levels of tree cover on development sites and to require site plans for proposed land development to demonstrate how required tree cover levels will be met after a ten-year post development time period. The legislation allows the ten-year tree cover requirements to be met through the planting of new trees or the preservation of existing trees and forest stands. The 1990 tree cover legislation provided Fairfax County with an opportunity to update its existing tree preservation and planting ordinance and associated specifications that

were initially established in 1973; specifically, zoning district-specific tree cover requirements were established (ranging from 10% in commercial, industrial, and high density residential districts to 20% in lower density residential districts, based on a ten-year growth assumption). Incentives were provided to encourage developers to meet these requirements through tree preservation efforts rather than through tree planting.

In 1993, pursuant to the aforementioned Chesapeake Bay Preservation Act and Chesapeake Bay Preservation Area Designation and Management Regulations, the County adopted the Chesapeake Bay Preservation Ordinance (Chapter 118 of the Fairfax County Code). The Ordinance established Resource Protection Areas (RPAs) along the tidal shoreline, along "tributary" streams as defined by the Regulations, and within 100-year floodplains of streams collecting drainage from areas equal to or greater than 360 acres. The Ordinance also established Resource Management Areas (RMAs) in all areas outside of RPAs; one effect of this designation was the establishment of a countywide BMP requirement. The Ordinance, which was revised significantly in 2003, is discussed in more detail below.

As part of the National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act, in 1991 and 1992, Fairfax County submitted its Part 1 and Part 2 applications for a municipal permit from the Virginia Department of Environmental Quality (VDEQ) to discharge stormwater into State waters. To obtain this permit, Fairfax County was required to demonstrate that it had an effective stormwater management and monitoring program. In January, 1997, the first Fairfax County Municipal Separate Storm Sewer System (MS4) permit was issued. Monitoring efforts pursuant to MS4 permit conditions are ongoing.

In September, 1998, the County launched a stream protection initiative. The Stream Protection Strategy (SPS) Baseline Study, published in January, 2001, gave a temporal view of the condition of the County's streams using biological indicators such as fish and aquatic insects to determine the ecological integrity of streams. More information about the results of this study is provided later in this report.

In October, 2000, the Fairfax County Board of Supervisors adopted an amendment to the County's Policy Plan to establish an explicit objective for the protection and restoration of the ecological integrity of streams. The amendment also added language to the Plan to encourage the use of low impact site design techniques (since revised to reference "better site design" and low impact development techniques).

In October, 2001, the County launched a watershed planning initiative. The intended outcome of this initiative, which will take several years to complete, will be the establishment of watershed management plans for all 30 of the County's watersheds. More information about this initiative is provided later in this report.

Presently, the County is reevaluating its regional stormwater management policy and is pursuing efforts to better integrate better site design and low impact development practices into its stormwater management program. A March 3, 2003 County staff report entitled "The Role of Regional Ponds in Fairfax County's Watershed Management" recommended that regional ponds not be considered the preferred stormwater management alternative but that they instead by

viewed as one of many tools that can be considered to address stormwater management needs. The report also contained a comprehensive set of recommendations for improvements to the County's stormwater management efforts, and work is continuing on the development of implementation plans for these recommendations.

In summary, the County's stormwater management policies, practices, and requirements have evolved over time and are continuing to evolve today. Much has been learned about the relationship between impervious cover associated with development and impacts to water resources, and while the County has been a leader in the implementation of water quality controls (most notably in the Occoquan Watershed), much of the development that has occurred in the County has done so without the benefit of adequate stormwater management measures and/or water quality best management practices. Figure 4 displays properties on which stormwater management and/or water quality best management practice facilities are located; while there are over 3,250 such facilities in the County, there are substantial areas of the County within which stormwater and/or BMP controls are not in place.

THE CHESAPEAKE BAY PRESERVATION ORDINANCE

The Chesapeake Bay Preservation Ordinance, Chapter 118 of the Fairfax County Code, was first adopted on March 22, 1993 and became effective on July 1, 1993. The Ordinance has been amended several times since then; the most substantial amendment was adopted on July 7, 2003 to incorporate changes made in December, 2001 to the Chesapeake Bay Preservation Area Designation and Management Regulations. Revised maps of Chesapeake Bay Preservation Areas, applying field determinations of stream perenniality to the identification of Resource Protection Areas (RPAs), were adopted on November 17, 2003.

Section 118-1-7 of the County's Chesapeake Bay Preservation Ordinance establishes that RPAs include any land characterized by one or more of the following features:

- A tidal wetland;
- A tidal shore;
- A water body with perennial flow;
- A nontidal wetland connected by surface flow and contiguous to a tidal wetland or water body with perennial flow; and
- A buffer area as follows:
    - Any land within 100 feet of a feature listed above; and
    - Any land within a major floodplain (the 100-year floodplain of any stream collecting drainage from an area equal to or greater than 360 acres).

Resource Management Areas (RMAs) include any area not designated as an RPA.

The Chesapeake Bay Preservation Ordinance contains a provision regarding the possible designation of Intensely Developed Areas (IDAs); however, no IDAs have been designated to date.

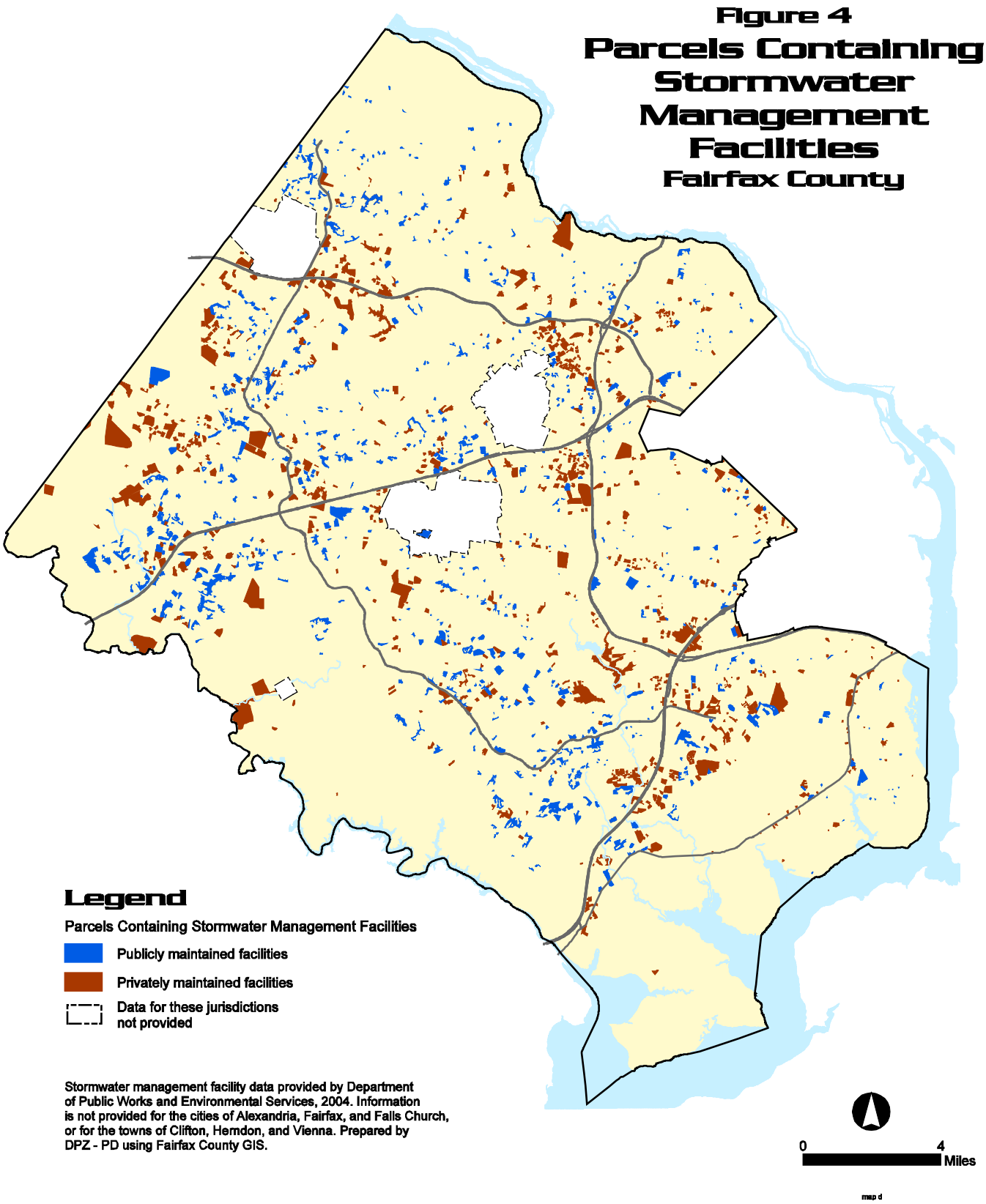
Figure 4
Parcels Containing Stormwater Management Facilities
Fairfax County
Legend
Parcels Containing Stormwater Management Facilities
Publicly maintained facilities
Privately maintained facilities
Data for these jurisdictions not provided
Stormwater management facility data provided by Department of Public Works and Environmental Services, 2004. Information is not provided for the cities of Alexandria, Fairfax, and Falls Church, or for the towns of Clifton, Herndon, and Vienna. Prepared by DPZ - PD using Fairfax County GIS.
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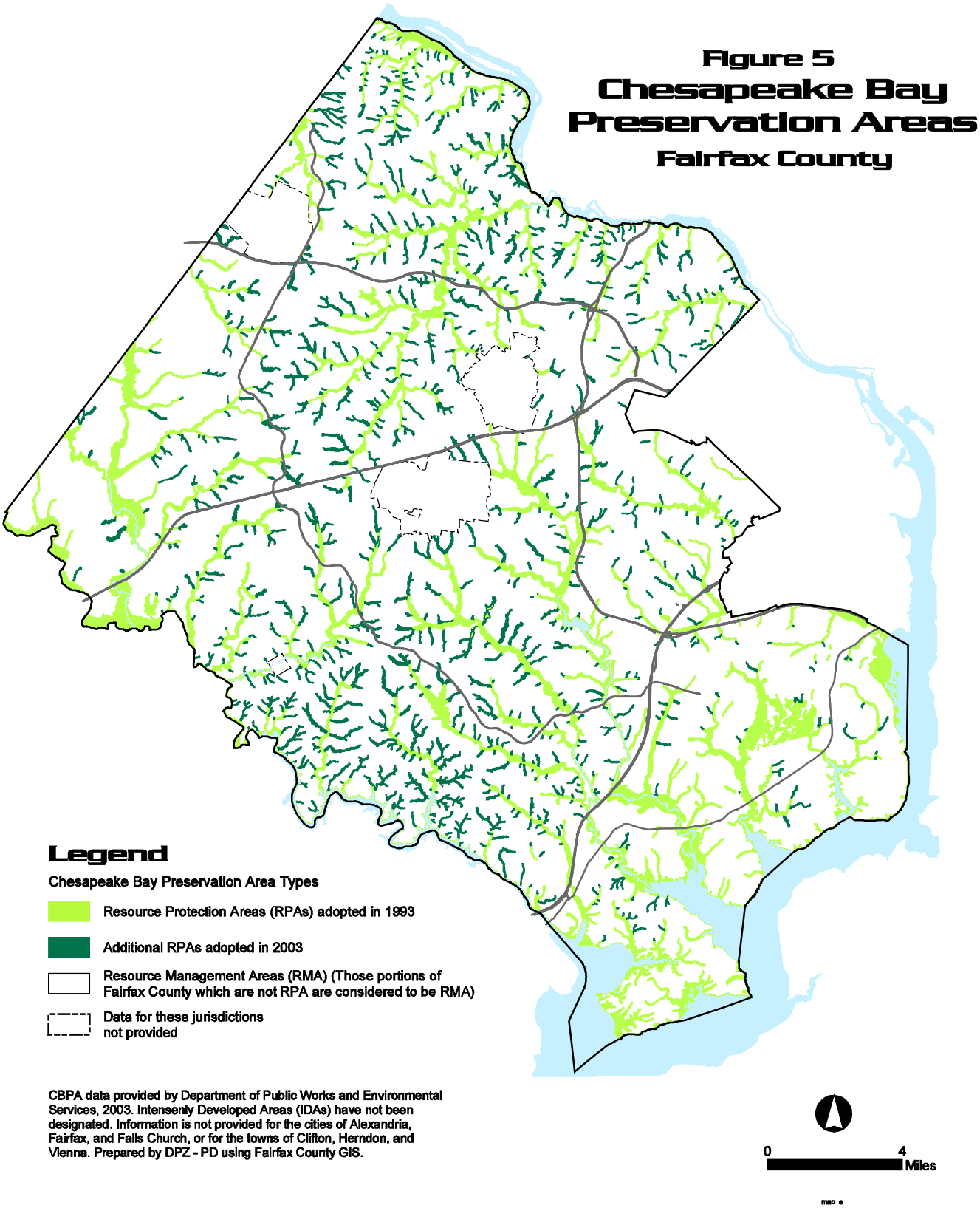
Figure 5
Chesapeake Bay Preservation Areas
Fairfax County
Legend
Chesapeake Bay Preservation Area Types
Resource Protection Areas (RPAs) adopted in 1993
Additional RPAs adopted in 2003
Resource Management Areas (RMA) (Those portions of Fairfax County which are not RPA are considered to be RMA)
Data for these jurisdictions not provided
CBPA data provided by Department of Public Works and Environmental Services, 2003. Intensenly Developed Areas (IDAs) have not been designated. Information is not provided for the cities of Alexandria, Fairfax, and Falls Church, or for the towns of Clifton, Herndon, and Vienna. Prepared by DPZ - PD using Fairfax County GIS.
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Land disturbing activities are generally prohibited in RPAs, although redevelopment, water-dependent development, certain roads and driveways, and flood control and stormwater management facilities that drain or treat water from multiple development projects or from a significant portion of a watershed are allowed, subject to certain conditions. Within the RPA buffer area, indigenous vegetation may be removed (subject to certain conditions) to provide for reasonable sight lines, access paths, general woodlot management, habitat management, and shoreline erosion control. Agricultural encroachments into the landward portions of the RPA buffer area are also permitted under certain conditions. Some specific activities are exempt from Ordinance requirements pursuant to Virginia's Chesapeake Bay Preservation Area Designation and Management Regulations, while other activities may occur within RPAs through the granting of an exception. Waivers to address the effective loss of a reasonable buildable area and exceptions for minor additions to existing structures are addressed administratively, while other exceptions must be approved by either the County's Board of Supervisors or Exception Review Committee following a public hearing. Water Quality Impact Assessments are required for non-exempt land disturbing activities in RPAs.

The Chesapeake Bay Preservation Ordinance also contains performance criteria that apply within both RPAs and RMAs. Included are criteria requiring: stormwater management best management practices for new development and redevelopment; reserve disposal sites and periodic pump outs for on-site sewage disposal facilities; minimization of land disturbance and impervious cover consistent with the proposed use, development, or redevelopment; preservation of indigenous vegetation to the maximum extent practicable consistent with the proposed use, development, or redevelopment; compliance with the County's Erosion and Sedimentation Control Ordinance (Chapter 104 of the County Code) for any land disturbing activity exceeding an area of 2,500 square feet; evidence of wetlands permits; and soil and water quality conservation assessments for agricultural uses.

A map of the County's Chesapeake Bay Preservation Areas is provided in Figure 5.

TIDAL WETLAND REGULATION

Water quality is dependent on vast and complex ecosystems that function in interrelated ways to enhance water quality. Wetlands serve important water quality functions: they trap nutrients and sediments; they serve as an overflow area for flood waters; and they provide habitat for a diverse array of species. The Commonwealth of Virginia acknowledged the importance of tidal vegetated wetlands in the total scheme of water quality protection when the General Assembly adopted the State's Wetlands Act of 1972. The Act was later expanded to encompass the protection of non-vegetated tidal wetlands in 1974. That legislation seeks to protect tidal wetlands and to curtail the negative impacts of tidal shoreline erosion on tidal wetlands and on water quality. The Wetlands Policy adopted by the General Assembly with the Wetlands Act captures the essence of wetlands protection:

> "Therefore, in order to protect the public interest, promote the public health, safety and the economic and general welfare of the Commonwealth, and to protect public and private property, wildlife, marine fisheries and the natural environment, it is declared to be the public policy of this Commonwealth to preserve the wetlands, and

> to prevent their despoliation and destruction and to accommodate necessary economic development in a manner consistent with wetlands preservation."

Fairfax County adopted its Wetlands Zoning Ordinance in 1983. This Ordinance established a Wetlands Board, which was provided with the authority to review specific projects along the County's tidal shoreline, as stipulated in the Virginia Wetlands Act.

ACQUISITION OF PARK LAND

The Fairfax County Park Authority, whose mission includes setting aside public spaces for protection and enhancement of environmental values, owns more land in the County (over 23,000 acres) than any other single entity. Much of this land is located along the County's network of streams; approximately 7,000 acres of stream valley land has been acquired by the Park Authority since the early 1950s, and the Authority adopted its first Stream Valley policy in 1973. This policy listed specific stream valleys identified for acquisition through development dedications or other means that would comprise the Stream Valley Park Plan. This Plan formed the basis of the Environmental Quality Corridor System that was incorporated into the County's Comprehensive Plan in 1975 and that played a major role in shaping development patterns. In 1998, the Stream Valley policy was revised and new guidelines for stream valley acquisition were adopted. These guidelines define stream valleys, their importance in their preservation, and establish that the stream valley park system be confined to major streams with inclusion of lateral tributaries on a discretionary basis. Continuity and public access to the stream valley park network are imperative elements of this policy.

Since its establishment as a multi-jurisdictional park agency in 1959, the Northern Virginia Regional Park Authority (NVRPA) has sought to fulfill its purpose: to carry out long-range open space conservation planning for Northern Virginia. Through the years, NVRPA has acquired more than 10,000 acres of parkland, operating 19 Regional Parks within the six jurisdictions it serves, including Fairfax County. A major goal influencing land acquisition and mandated by the Authority's Policy Plan is to "protect regionally significant resources," with an objective "to acquire and/or otherwise protect strategic lands adjacent to the region's water resources; regional shorelines and/or any lands deemed important to the region's watershed . . ."

From 1960 through 1974, NVRPA gradually acquired its 5,000-acre Bull Run and Occoquan Reservoir properties and the vast majority of the Bull Run shoreline acreage in Fairfax County. Approximately 790 acres were acquired on the shoreline of Mason Neck in 1978, contributing to the 2,277 acres currently under management by the U.S. Fish and Wildlife Service, as part of the Mason Neck National Wildlife Refuge. More than 1,500 tidal shoreline acres adjacent to Belmont Bay and Pohick Bay on the Potomac River were protected between 1972 and 1983 by NVRPA for public parkland use. Above the Great Falls of the Potomac River, over 1,850 acres of nontidal riparian lands, almost 700 of which lie within the boundaries of Fairfax County, have been protected by NVRPA through easements and acquisition.

Existing policies, goals, and objectives of the NVRPA Policy Plan remain consistent, guiding land planning and acquisition decisions by the Authority's Board and contributing to the continued health and well-being of the natural resources and citizens of Northern Virginia. ■

WATER QUALITY FACTORS

BACKGROUND

Water resource protection and restoration cannot be fully understood without an awareness of the physical and socioeconomic conditions that influence these issues. A brief overview of demographic and land use conditions was provided in the previous section of this report. In this section, physical factors such as climate, geology, topography, hydrology, soils, wetlands, and forest cover will be introduced, as will be information regarding potable water supply sources in Fairfax County.

This section concludes with an overview of water quality threats and existing pollution sources that have been documented in Fairfax County.

CLIMATE[2]

Fairfax County's climate can be characterized as being temperate and humid. Average annual precipitation ranges from just over 39 inches per year at Ronald Reagan Washington National Airport, which is located in Arlington County (based on a period of record from 1948 to 2003) to just under 44 inches at Tysons Corner (based on a similar period of record). Annual precipitation at Washington Dulles International Airport (identified as "Chantilly" by the Southeast Regional Climate Center), which is located along the County's western boundary, is just over 41 inches per year (based on a period of record between 1962 and 2003). The wettest year during the aforementioned periods of record was 2003, with just over 59 inches of precipitation recorded at National Airport and with over 64 inches recorded at Tysons Corner and Dulles Airport. The driest year during these periods of record was 1965, with just under 27 inches reported at National Airport, nearly 31.5 inches recorded at Tysons Corner, and just under 29 inches recorded at Dulles Airport. Annual average snowfall is 16 inches at National Airport, 20.6 inches at Tysons Corner, and 23.2 inches at Dulles Airport. The highest average maximum temperature occurs in July (88.1, 82.1, and 87.1 degrees F at National Airport, Tysons Corner, and Dulles Airport, respectively) while the lowest average minimum temperature occurs in January (28.3, 26.4, and 22.2 degrees F at National Airport, Tysons Corner, and Dulles Airport, respectively). While precipitation falls throughout the year, precipitation during the cooler fall, winter, and spring months is typically associated with low pressure systems and fronts producing relatively long periods of steady precipitation. In the warmer months of the year, brief, heavy downpours associated with frontal systems or atmospheric convection are more common. In addition, tropical systems occasionally produce prolonged, heavy downpours in the summer and fall months.

[2] All climatic data presented in this section has been taken from the Southeast Regional Climate Center's Web site at www.dnr.state.sc.us/climate/sercc/index.html.

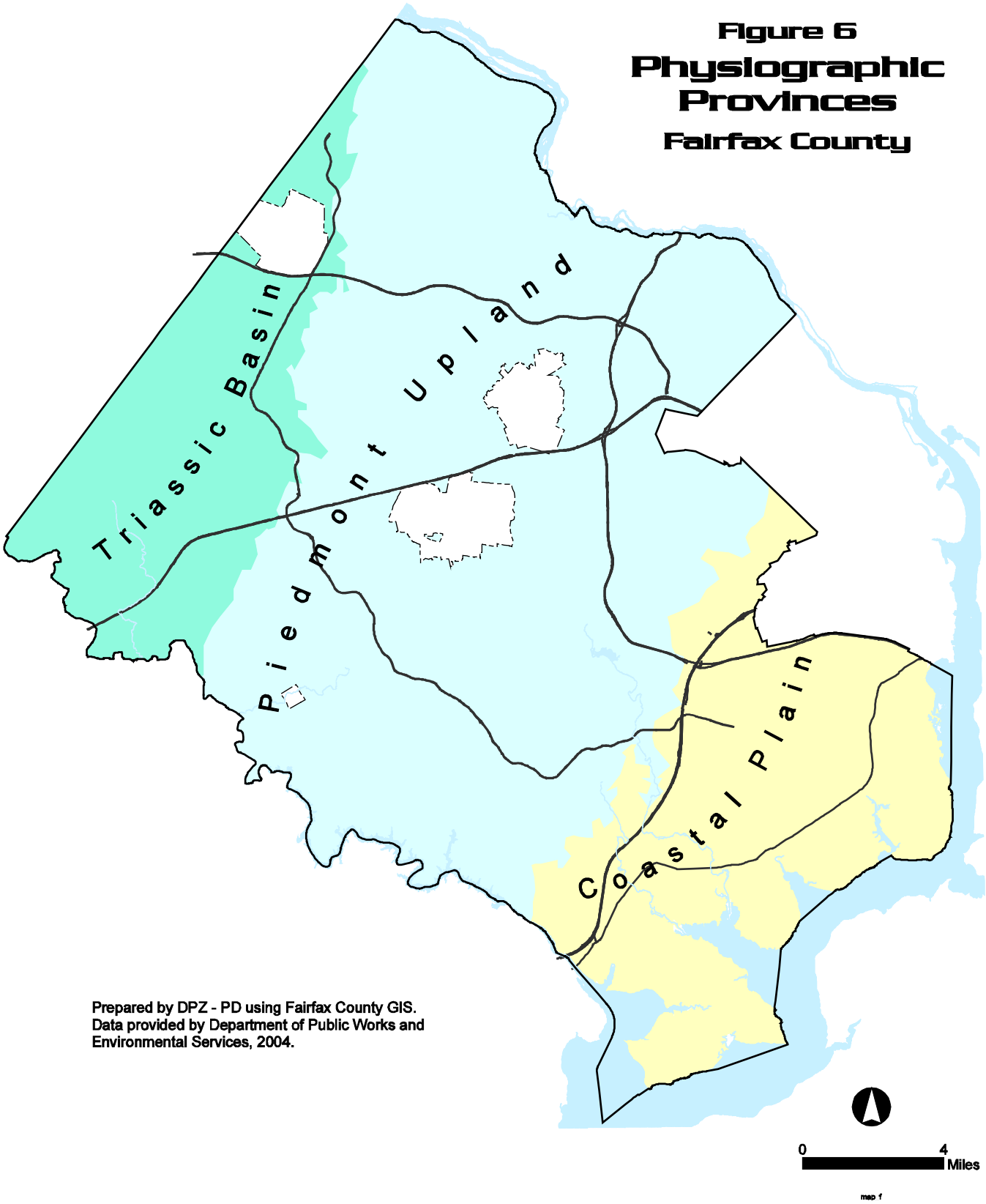
Figure 6
Physiographic Provinces
Fairfax County
Triassic Basin
Piedmont Upland
Coastal Plain
Prepared by DPZ - PD using Fairfax County GIS.
Data provided by Department of Public Works and Environmental Services, 2004.
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GEOLOGY AND TOPOGRAPHY[3]

Fairfax County straddles the "Fall Line," which is the boundary between the Piedmont Upland and Coastal Plain physiographic provinces. The Fall Line roughly follows the path of Shirley Memorial Highway (I-95 and I-395), with the Coastal Plain located to the east of the Fall Line and the Piedmont Upland located to the west. The western portion of the Piedmont Upland physiographic province in Fairfax County contains a distinct subprovince known as the "Triassic Basin," "Piedmont Lowland," or "Culpepper Basin." The locations of the Coastal Plain, Piedmont Upland, and Triassic Basin in Fairfax County are shown in Figure 6.

The Coastal Plain physiographic province occupies approximately 26 percent of Fairfax County. The province consists of unconsolidated sand, silt, clay, and gravel strata deposited by ancient oceans and freshwater rivers. The overall drainage is to the southeast. Drainage patterns are well developed in the western portion of the province. Broad, level areas are found in the central (Hybla Valley) and southern (Gunston, Mason Neck) portions.

The Piedmont Upland Physiographic Province occupies approximately 56 percent of Fairfax County. It occurs in the central portion of the County, west of the Coastal Plain. The province is underlain by metamorphic rocks, predominantly schist, granite, gneiss, and greenstone. Remnants of the Coastal terrace may be found on high, broad ridge tops in the eastern half of the province. A well-dissected dendritic drainage pattern (resembling the branches of a tree when viewed on a map) occurs throughout the province. The hilltops are typically fairly wide and rolling, except in places along the lower tributaries of large streams. Here, V-shaped valleys with steep slopes and narrow ridge tops occur.

As noted above, the Triassic Basin is actually a subprovince of the Piedmont Upland. It occurs in the western portion of the County, occupying approximately 18 percent of the County's area. The geology consists largely of red sedimentary (sandstone, siltstone, shale, and conglomerate) rocks. Two horseshoe-shaped intrusions of igneous diabase, diorite, and syenite rocks occur in the vicinity of Herndon and Centreville. The drainage is somewhat dendritic, but not as well developed as in the Piedmont Upland. The hilltops are wide and gently rolling, with long gently sloping side slopes and nearly level areas.

The highest natural elevation in Fairfax County is approximately 520 feet above sea level and can be found on a Coastal terrace remnant in the Piedmont Upland Physiographic Province (in the Tysons Corner area of the County). The lowest elevation is slightly above sea level, along the County's tidal shoreline. Relief is generally highest within the Piedmont Upland Physiographic Province, with elevations of ridge tops typically being 100 feet higher than elevations of stream valleys. Relief is particularly high within and near the Potomac Palisades area (along the nontidal portion of the Potomac River upstream of Arlington County), along and near the shoreline of the Occoquan Reservoir and Bull Run, and in the area of the Fall Line.

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[3] The discussion of physiographic provinces was taken from the Fairfax County Web site entitled "Ratings of Soils for Urban Development in Fairfax County" (http://www.fairfaxcounty.gov/dpwes/environmental/soilrating.htm).

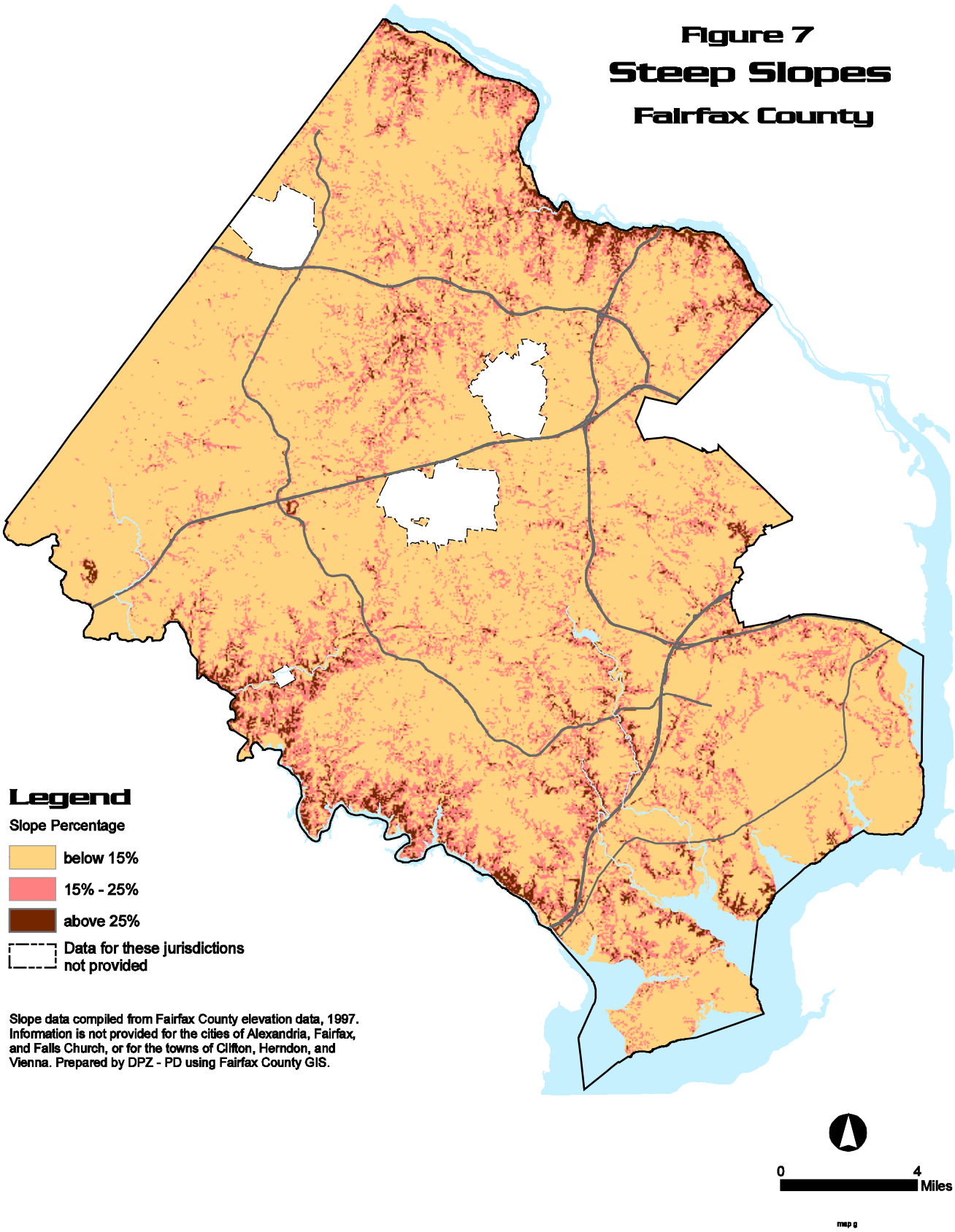
Figure 7
Steep Slopes
Fairfax County
Legend
Slope Percentage
below 15%
15% - 25%
above 25%
Data for these jurisdictions not provided
Slope data compiled from Fairfax County elevation data, 1997. Information is not provided for the cities of Alexandria, Fairfax, and Falls Church, or for the towns of Clifton, Herndon, and Vienna. Prepared by DPZ - PD using Fairfax County GIS.
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Significant relief is also present in portions of the Coastal Plain, particularly along the edges of Hybla Valley, along the edges of valleys associated with drainageways and embayments outside of the Hybla Valley, and where soils formed from Marine Clay parent materials (locally known as "Marine Clay Soils") are prevalent. In the Triassic Basin, relief is generally more gradual, although there can be significant differences in elevation in the aforementioned areas of intrusive igneous rocks.

Steep slopes (defined by County policy as gradients of 15 percent or greater) can be found throughout most of the County. Areas of steeply sloping terrain are typically associated with stream valleys and embayments, although in the Coastal Plain they are also associated with the edges of Hybla Valley and with soils formed from Marine Clay parent materials. Slopes are particularly pronounced in the high relief areas noted earlier as well as in other areas in the Piedmont Upland Physiographic Province (see Figure 7).

HYDROLOGY

Drainage patterns throughout Fairfax County are generally well developed, with a dendritic pattern characterizing most of the County's stream systems. However, many streams in older developed portions of the County have been piped, and topography is gentle or flat within portions of the Triassic Basin and the Hybla Valley area of the Coastal Plain.

The headwaters of most of the County's stream systems are characterized by ephemeral or intermittent drainage swales or narrow channels. These swales and channels coalesce into larger channels, which, in turn, join with other drainageways to form even larger streams. The stream system is supplied both by surface water runoff and groundwater sources. Rainfall that soaks into the ground moves downward into the groundwater system; seeps and springs are locations where groundwater enters the surface water system; where drainage channels are fed by groundwater seeps or springs, they typically assume a perennial character (that is, they flow throughout the year). There are approximately 850 miles of perennial streams within Fairfax County (excluding the Potomac River, Occoquan River, tidal embayments, and the Occoquan Reservoir) fed by smaller intermittent headwater streams.

The area that drains to a common point along a stream or to a particular water body is known as a "watershed." Watersheds can be of any size or scale, from an area of only a few acres or less upstream of a headwater stream to a broad, regional classification such as the 64,000 square mile Chesapeake Bay Watershed. The boundaries of a "watershed," then, depend as much on definition as on topography. In Fairfax County, 30 watersheds have been recognized, even though the entirety of the County is located within the watersheds of both the Potomac River and Chesapeake Bay. Watersheds that have been designated by Fairfax County are identified in Figure 8, which also displays the network of streams located within each of these watersheds.

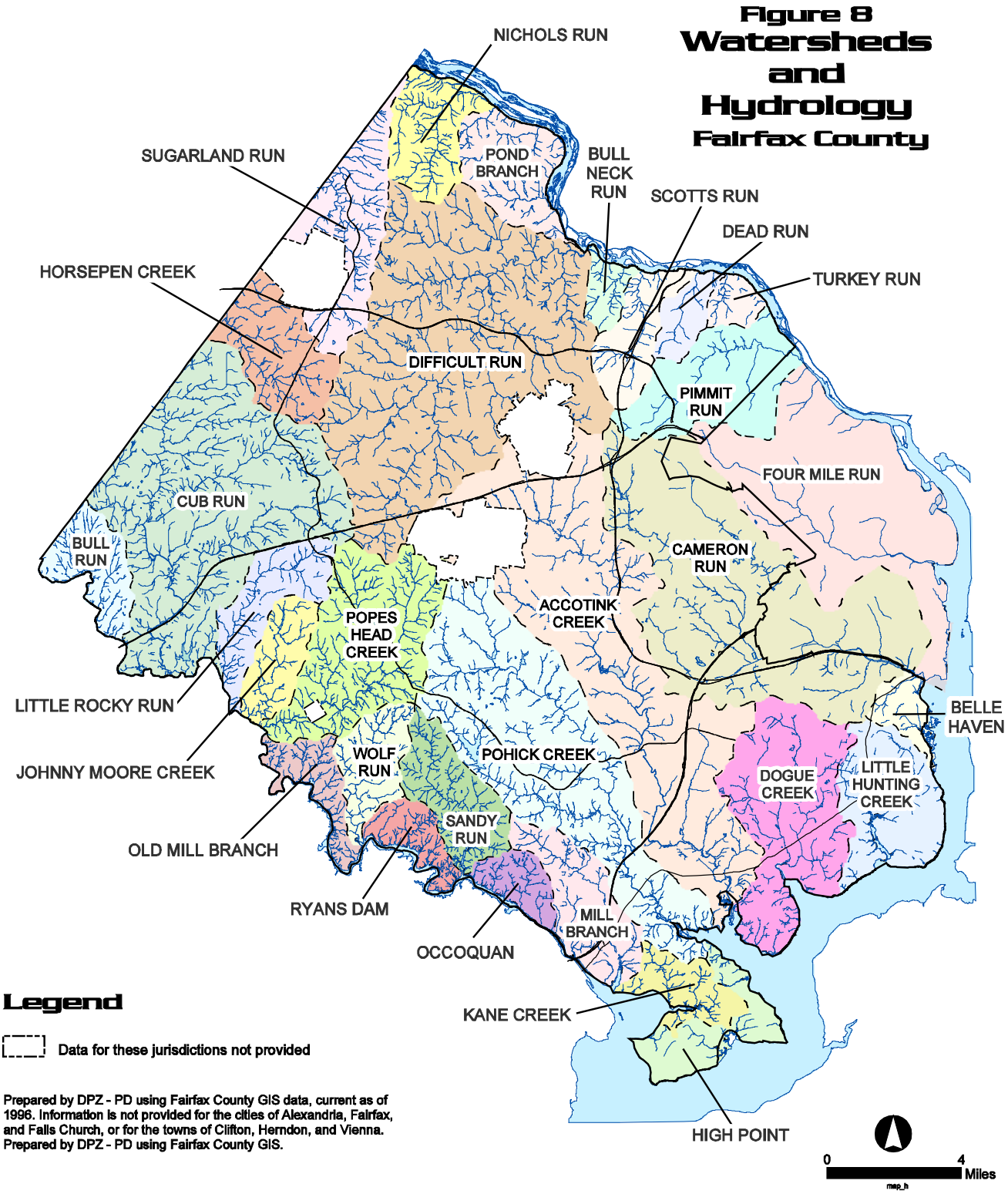
Figure 8
Watersheds and Hydrology
Fairfax County
NICHOLS RUN
SUGARLAND RUN
POND BRANCH
BULL NECK RUN
SCOTTS RUN
DEAD RUN
TURKEY RUN
HORSEPEN CREEK
DIFFICULT RUN
PIMMIT RUN
FOUR MILE RUN
CUB RUN
BULL RUN
CAMERON RUN
ACCOTINK CREEK
POPES HEAD CREEK
LITTLE ROCKY RUN
BELLE HAVEN
JOHNNY MOORE CREEK
WOLF RUN
POHICK CREEK
DOGUE CREEK
LITTLE HUNTING CREEK
SANDY RUN
OLD MILL BRANCH
RYANS DAM
MILL BRANCH
OCCOQUAN
KANE CREEK
HIGH POINT
Legend
Data for these jurisdictions not provided
Prepared by DPZ - PD using Fairfax County GIS data, current as of 1996. Information is not provided for the cities of Alexandria, Fairfax, and Falls Church, or for the towns of Clifton, Herndon, and Vienna.
Prepared by DPZ - PD using Fairfax County GIS.
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100-YEAR FLOODPLAINS

Floodplains are 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. Federal programs typically address floodplains of watercourses collecting drainage from one square mile (640 acres) or more of area. The County's definition of "floodplain," as set forth in the Zoning Ordinance, is much more inclusive, in that includes areas adjacent to any stream or watercourse that collects drainage from an area greater than 70 acres. Minor floodplains are associated with streams with drainage areas between 70 and 360 acres. Other floodplain areas, with drainage areas greater than 360 acres, are commonly referred to as "major floodplains." Figure 9 displays streams in Fairfax County that are associated with major floodplains and minor floodplains. Major floodplains are a component of the County's Resource Protection Area designation in the Chesapeake Bay Preservation Ordinance. Other regulatory implications of floodplain designations are described later in this report.

Undisturbed floodplain areas provide water quality benefits by filtering some pollutants from sheet flow runoff from adjacent properties before this runoff enters streams. In addition, floodplains provide temporary storage of overbank flows from larger storm events, thereby reducing adverse impacts in downstream areas when compared with the impacts that would occur if floodplain areas were to be developed.

SOILS

Soils are formed over time through interactions of geology/parent material, climate, organisms, and relief/topography; their characteristics in any location reflect the complexities of these interactions. These soil characteristics, in turn, can affect water resources in a number of ways. Highly permeable soils allow water to percolate downward into the water table, thereby replenishing the ground water system, which, in turn, replenishes the surface water system through seeps and springs. When such soils are covered with impermeable surfaces, groundwater recharge is reduced and surface water runoff during rainfall events is increased. This increased runoff, in turn, can have adverse effects on the ecological health of receiving streams (see the discussion later in this report). Highly permeable soils are also sensitive to adverse water quality issues associated with the release of hazardous materials or other pollutants, in that these pollutants can percolate rapidly through the soil and into the ground water system.

Soil characteristics are also a determinant of the suitability of on-site sewage treatment systems such as septic systems and infiltrative measures of stormwater management. Soils with good percolation characteristics can serve as a filter for septic system effluent or stormwater runoff, reducing pollutant concentrations as the water percolates downward towards the water table. However, soils with excessive permeability or high water tables may not provide sufficient filtering functions, resulting in inadequate sewage treatment and/or pollutant removal, thereby jeopardizing groundwater resources. Conversely, soils that are high in clay content or that otherwise have slow percolation rates may not provide sufficient capacity to accept wastewater

from on-site sewage disposal systems and may not have sufficient capacity to allow for the provision of infiltration stormwater management practices.

Soil erodibility is a key water quality concern in jurisdictions such as Fairfax County that have experienced and continue to experience significant land development. As the vegetated ground cover is removed from a development site and soils are exposed to rainfall, particles are entrained from the surface and carried away by stormwater runoff. If not trapped on the site by erosion and sediment control measures, these sediments and their associated pollutants can degrade downstream water quality, thereby reducing the ecological value of receiving streams. Ultimately, these sediments and their associated pollutants can enter the Potomac River and Chesapeake Bay.

Soil conditions can also have an effect on development suitability of properties. Some soils in Fairfax County, for example, contain significant amounts of clay particles with high shrink-swell potentials. In extreme cases, such soils can become unstable, resulting in slope failures. Even in less extreme cases, these soils can cause substantial damage to foundations of structures if engineering solutions are not taken in the design and construction of these structures.

A general soil map of Fairfax County is provided in Figure 10. As can be seen from this map, the distribution of soil associations in Fairfax County is greatly influenced by geology; the Coastal Plain, Piedmont Upland, and Triassic Basin each have their own distinct soil associations.

Highly permeable soils are generally not present within Fairfax County. However, many soils in the County are characterized by slow rates of infiltration and permeability and therefore present constraints to the provision of on-site sewage disposal facilities. This issue is discussed in more detail later in this section of the report.

In terms of soil erodibility, the County has characterized the erosion potential of soils under construction site conditions in all areas of the County where soils have been mapped. The results, presented in Figure 11, illustrate that, under construction conditions, soils outside of stream valleys throughout much of the County are characterized by moderate to severe erosion potential, with some notable exceptions (generally the areas characterized by a flat or gentle topography). It is important to recognize that Figure 11 does not illustrate soil erodibility under natural conditions; it should not be interpreted to reflect erodibility factors applied in the Revised Universal Soil Loss Equation or to reflect soil loss tolerance values applied for agricultural planning purposes. Rather, Figure 11 illustrates the need for sensitivity to erosion and sediment controls during the construction process in order to protect County streams from degradation. It should also be recognized that soil erodibility within a soil may vary with depth. Many upland areas of the Piedmont Upland province in Fairfax County, for example, contain soils that are considered to have a moderate erosion potential, even though their parent materials, if exposed, would have a severe erosion potential.

The Natural Resources Conservation Service, in coordination with the Northern Virginia Soil and Water Conservation District, is developing an updated soil survey for the entirety of Fairfax County. This survey will include those areas that have not, to date, been mapped.

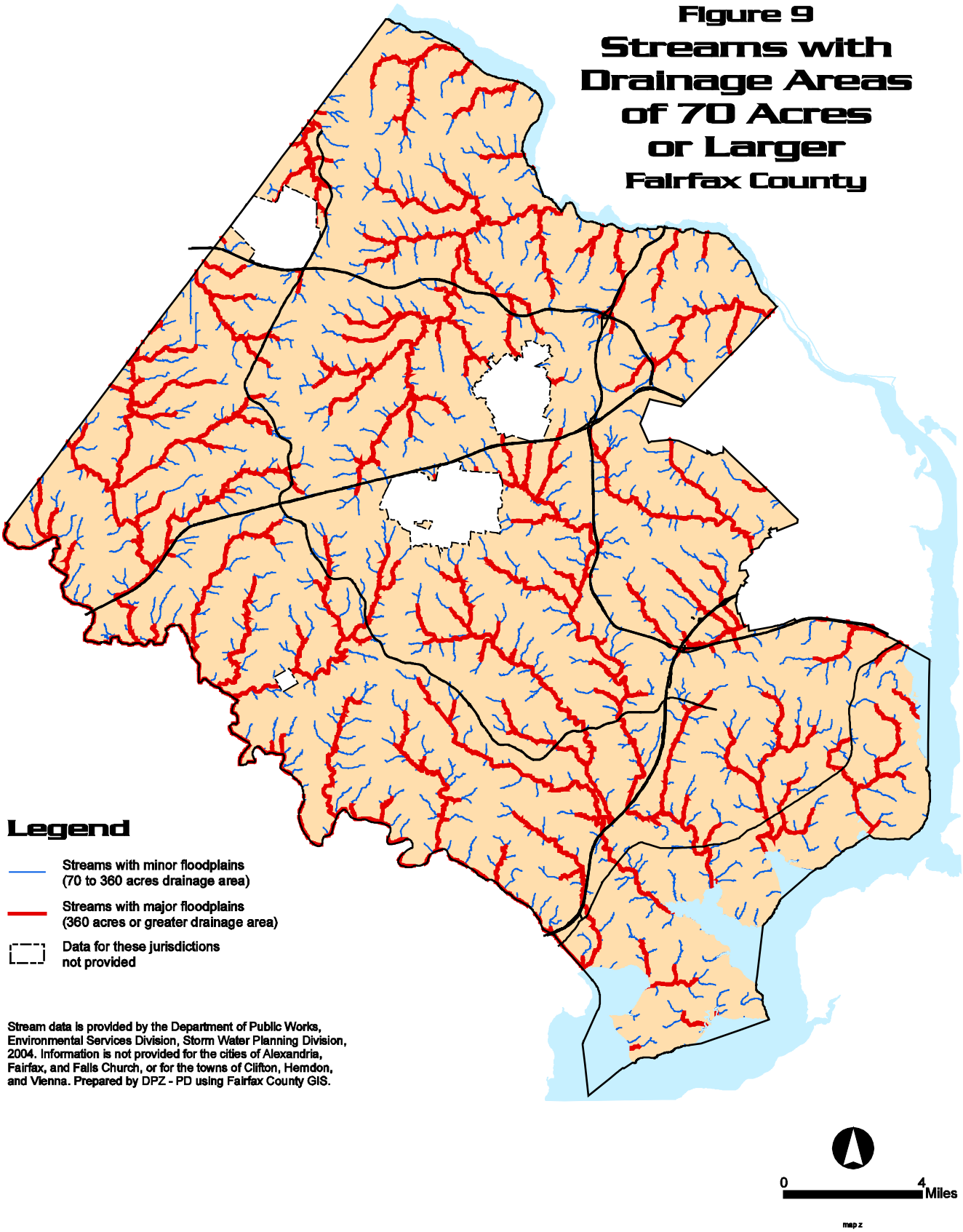
Figure 9
Streams with Drainage Areas of 70 Acres or Larger
Fairfax County
Legend
Streams with minor floodplains (70 to 360 acres drainage area)
Streams with major floodplains (360 acres or greater drainage area)
Data for these jurisdictions not provided
Stream data is provided by the Department of Public Works, Environmental Services Division, Storm Water Planning Division, 2004. Information is not provided for the cities of Alexandria, Fairfax, and Falls Church, or for the towns of Clifton, Herndon, and Vienna. Prepared by DPZ - PD using Fairfax County GIS.
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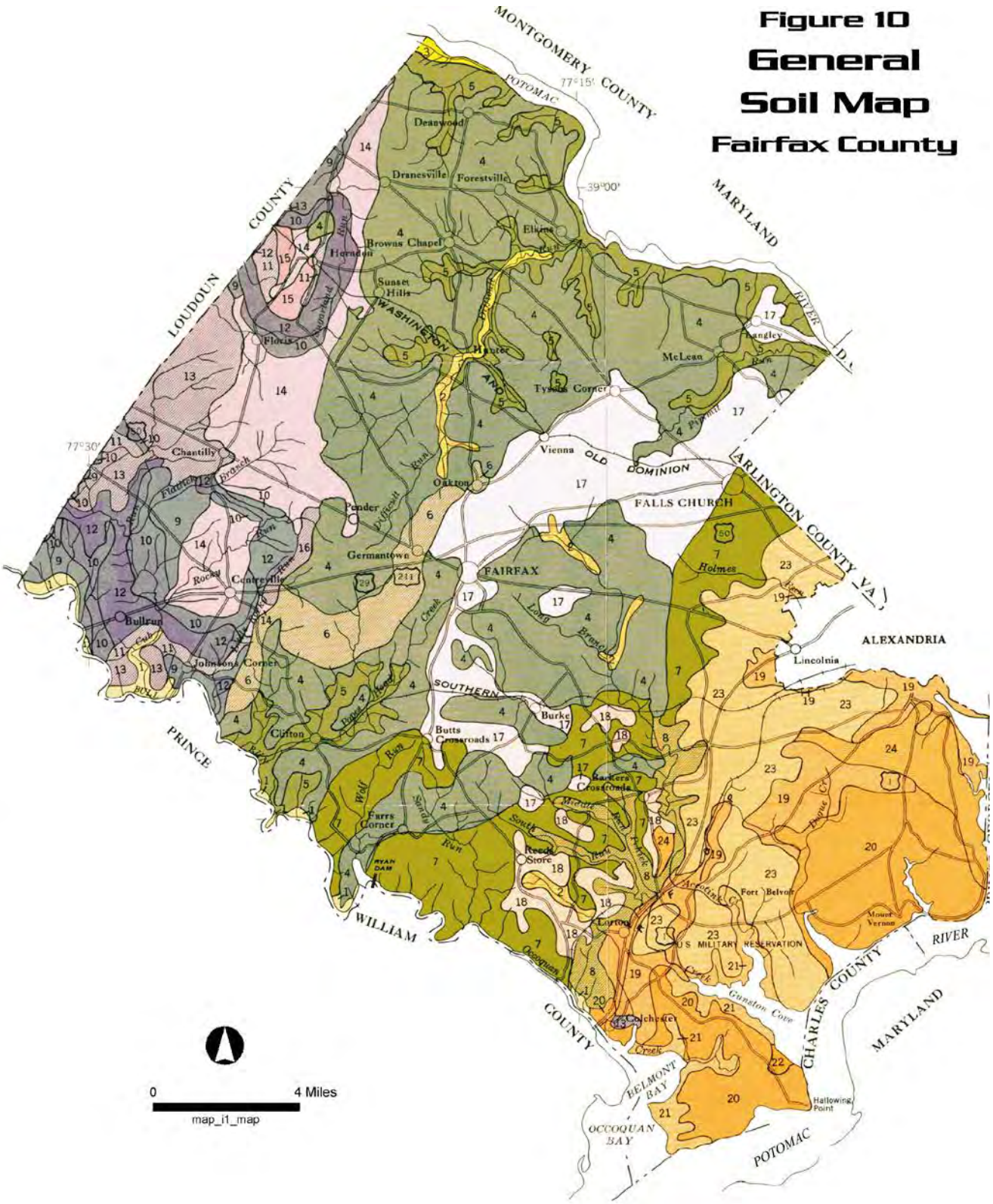
Figure 10
General
Soil Map
Fairfax County
MONTGOMERY COUNTY
MARYLAND
POTOMAC
RIVER
LOUDOUN
COUNTY
WASHINGTON
AND
OLD
DOMINION
FALLS CHURCH
ARLINGTON COUNTY, VA.
ALEXANDRIA
FAIRFAX
SOUTHERN
PRINCE
WILLIAM
COUNTY
CHARLES COUNTY
MARYLAND
POTOMAC
RIVER
BELMONT BAY
OCCOQUAN BAY
Deanwood
Dranesville
Forestville
Elkins
Browns Chapel
Herndon
Sunset Hills
Floris
Hunter
McLean
Langley
Tysons Corner
Vienna
Oakton
Chantilly
Pender
Germantown
Centreville
Bullrun
Johnsons Corner
Clifton
Butts Crossroads
Burke
Rockers Crossroads
Farrs Corner
Reeds Store
Lorton
Fort Belvoir
Mount Vernon
Lincolnia
Holmes
Colchester
Hallowing Point
US MILITARY RESERVATION
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Legend

(For Figure 10)

SOIL ASSOCIATIONS

SOILS ON ALLUVIAL DEPOSITS

1 Rowland-Bermudian-Bowmansville.
2 Chewacla-Wehadkee.
3 Huntington-Lindside.

SOILS ON CRYSTALLINE ROCK OF THE PIEDMONT UPLAND

4 Glenelg-Elioak-Manor.
5 Manor-Glenelg-Elioak.
6 Orange-Bremo-Elbert.
7 Appling-Louisburg-Colfax.
8 Louisburg-Appling-Worsham.

SOILS ON SANDSTONE, SHALE, AND CONGLOMERATE OF THE PIEDMONT LOWLAND

9 Penn-Calverton-Croton.
10 Brecknock-Catlett-Croton.
11 Kelly-Brecknock-Catlett.
12 Iredell-Mecklenburg-Rocky land.
13 Calverton-Readington-Croton.
14 Penn-Bucks-Calverton (Sandy).
15 Calverton-Brecknock-Croton (Loams).
16 Mayodan-Calverton-Penn.

SOILS ON MIXED CRYSTALLINE ROCKS AND OLDER COASTAL PLAIN SEDIMENTS

17 Fairfax-Beltsville-Glenelg.
18 Fairfax-Beltsville-Appling.

SOILS ON COASTAL PLAIN SEDIMENTS

19 Lunt-Hilly and Steep land, loamy and gravelly sediments-Beltsville
20 Matapeake-Mattapex-Woodstown.
21 Hilly and Steep land, loamy and gravelly sediments-Woodstown-Matapeake.
22 Galestown-Sassafras-Woodstown.
23 Beltsville-Elkton-Sassafras.
24 Beltsville-Hilly and Steep land, loamy and gravelly sediments-Matapeake.

Source: USDA General Soil Map of Fairfax County, Virginia, 1963

map_i1_legend

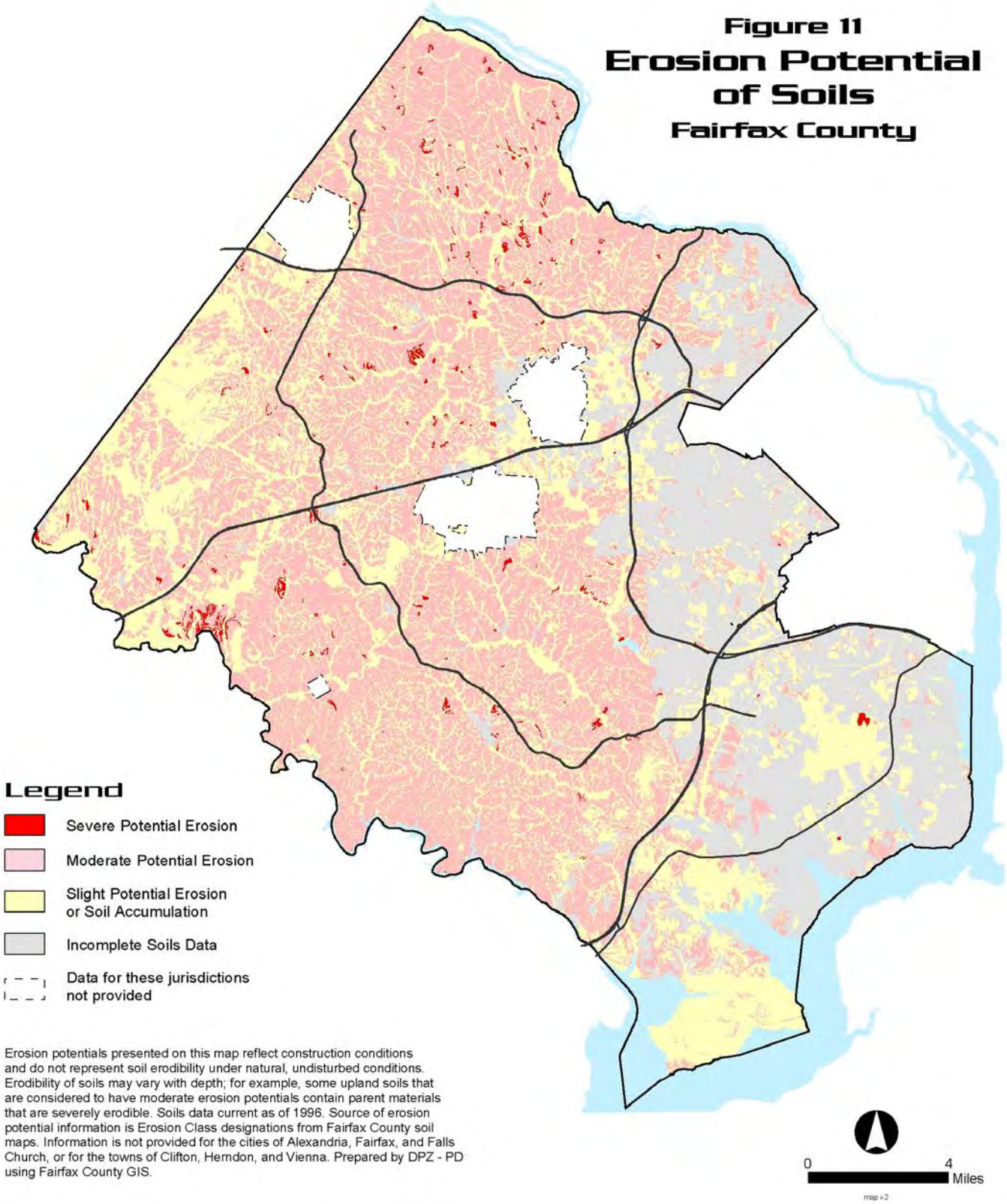
Figure 11
Erosion Potential of Soils
Fairfax County
Legend
Severe Potential Erosion
Moderate Potential Erosion
Slight Potential Erosion or Soil Accumulation
Incomplete Soils Data
Data for these jurisdictions not provided
Erosion potentials presented on this map reflect construction conditions and do not represent soil erodibility under natural, undisturbed conditions. Erodibility of soils may vary with depth; for example, some upland soils that are considered to have moderate erosion potentials contain parent materials that are severely erodible. Soils data current as of 1996. Source of erosion potential information is Erosion Class designations from Fairfax County soil maps. Information is not provided for the cities of Alexandria, Fairfax, and Falls Church, or for the towns of Clifton, Herndon, and Vienna. Prepared by DPZ - PD using Fairfax County GIS.
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WETLANDS

By federal definition, wetlands are "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Tidal wetlands are wetlands located within the influence of tidal action (defined by Virginia as "lands lying between and contiguous to mean low water and an elevation above mean low water equal to one and one-half times the mean tide range . . ."), while nontidal wetlands include all other wetland areas. Wetlands provide a variety of important water quality and habitat functions. They provide habitat for a wide range of plants and animals and protect other water resources through the uptake and filtering of pollutants and through the detention and/or reduction in velocity of flood waters and other storm drainage. The recognition of the many environmental values of wetlands has resulted in the inclusion of certain wetlands as core Resource Protection Area (RPA) components requiring the restoration and/or protection of 100-foot buffer areas (see the first section of this report).

Wetlands are defined based on the presence of hydrophytic ("water loving") vegetation, hydric soils (soils with evidence of at least periodic saturation during the growing season), and hydrology that indicates inundation or saturation for at least part of the growing season. On-site surveys are needed to confirm the presence of a wetland and, where present, to define its boundaries. To date, there has not been a comprehensive map produced of wetland resources in Fairfax County. However, there are several map resources available to assist in the determination of areas with high potential for wetlands; these resources have been used in the estimation of wetland locations for the purpose of mapping Resource Protection Areas. Included as such resources are the U.S. Fish and Wildlife Service's National Wetlands Inventory maps, the County's soils map along with its list of soils that are typically hydric, County topographic maps, and County tidal wetland maps. The County's Department of Public Works and Environmental Services has prepared a draft map identifying potential wetland areas based on the above resources; refinements are anticipated prior to completion of the final map. A copy of the draft map is presented in Figure 12.

Fairfax County contains both tidal and nontidal wetlands. Tidal wetlands are located along tidal shorelines in the Coastal Plain Physiographic Province, while nontidal wetlands are located in areas throughout the remainder of the County. In general, nontidal wetlands are concentrated in stream valley areas, but isolated upland wetlands are present in places as well. All tidal wetlands and certain nontidal wetlands (those that are contiguous and connected by surface flow to other RPA core area features) are included as core RPA features requiring 100-foot buffer areas. Other nontidal wetlands are subject to regulation under Section 404 of the Clean Water Act, which is administered by the U.S. Army Corps of Engineers in coordination with the Virginia Department of Environmental Quality. In addition, many activities proposed for tidal wetland areas are subject to the review and approval of the County's Wetlands Board.

Development proposals requiring wetlands permits from the U.S. Army Corps of Engineers typically are required to provide compensation or mitigation for jurisdictional wetlands that will be filled. The U.S. Army Corps of Engineers is not required to seek compensation efforts within the same political jurisdiction as the wetland impacts, and developers of some projects involving

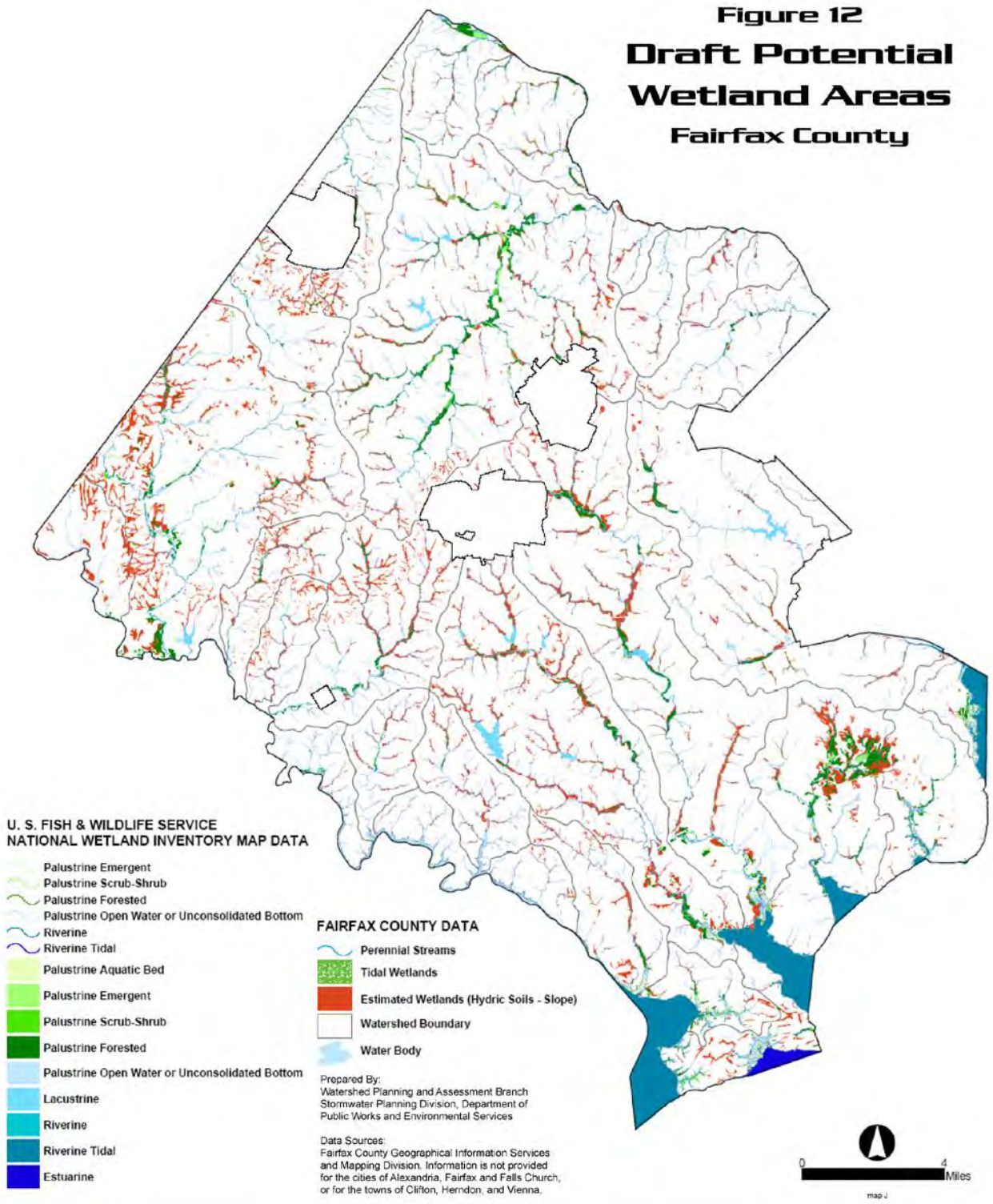
Figure 12
Draft Potential
Wetland Areas
Fairfax County
U. S. FISH & WILDLIFE SERVICE
NATIONAL WETLAND INVENTORY MAP DATA
Palustrine Emergent
Palustrine Scrub-Shrub
Palustrine Forested
Palustrine Open Water or Unconsolidated Bottom
Riverine
Riverine Tidal
Palustrine Aquatic Bed
Palustrine Emergent
Palustrine Scrub-Shrub
Palustrine Forested
Palustrine Open Water or Unconsolidated Bottom
Lacustrine
Riverine
Riverine Tidal
Estuarine
FAIRFAX COUNTY DATA
Perennial Streams
Tidal Wetlands
Estimated Wetlands (Hydric Soils - Slope)
Watershed Boundary
Water Body
Prepared By:
Watershed Planning and Assessment Branch
Stormwater Planning Division, Department of
Public Works and Environmental Services
Data Sources:
Fairfax County Geographical Information Services
and Mapping Division. Information is not provided
for the cities of Alexandria, Fairfax and Falls Church,
or for the towns of Clifton, Herndon, and Vienna.
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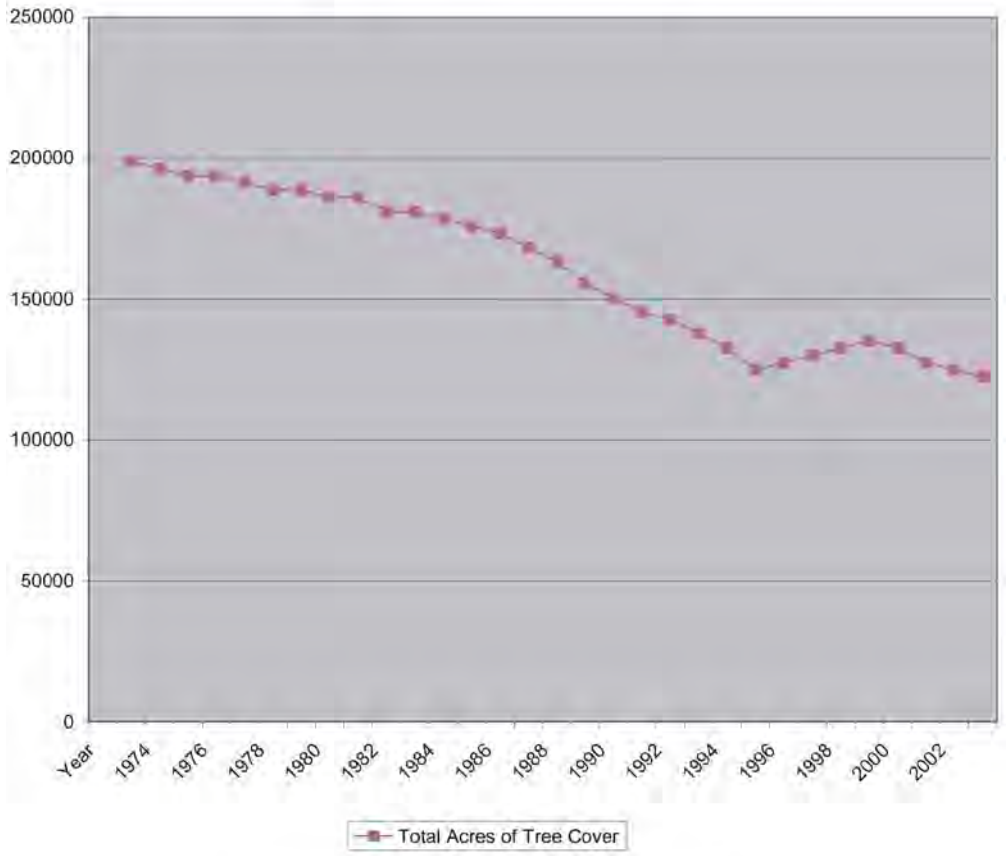
Example of a forested tidal wetland located east of Sandy Point, Mason Neck State Park.
Photo: Beth Rado

wetland losses in Fairfax County have pursued compensation efforts in other jurisdictions. Staff from the Fairfax County Department of Public Works and Environmental Services has coordinated with the U.S. Army Corps of Engineers to identify watershed restoration opportunities in Fairfax County that can be sought as compensation for wetland losses in the County based on the recently-completed Countywide Stream Physical Assessment project. More information about the Countywide Stream Physical Assessment is provided later in this report.

TREE COVER

As noted earlier in this report, English settlement began in Fairfax County in the early 1600s. The settlement of the County and the use of its resources over several centuries resulted in the clearing of the County's pre-settlement vegetation long before the County's rapid increase in population (and the associated land development) in the latter half of the 20th century; indeed the County was largely agricultural in character prior to its emergence first as a bedroom community for Washington, D.C. and later as an employment center in its own right. However, prior to

Figure 13
Total Acres of Tree Cover by Year, 1973-2004



Data provided by the Urban Forestry Division of the Fairfax County Department of Public Works and Environmental Services.
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development of much of the County's land, secondary growth forests had reclaimed much of the land that had been farmed, and much of the undeveloped land remaining in the County is characterized by a mature deciduous forest cover. More recent trends have seen a steady decline in tree cover in Fairfax County (see Figure 13)[4]. It is estimated that, in 1973, there were nearly 200,000 acres of land with tree cover in the County, or 79% of the County's land mass. While this number may be somewhat inflated due to the resolution of imagery that was used in the tree cover analysis, it is likely that the actual tree cover exceeded 70% of the County's land mass. The estimated tree cover in 2003 was 122,400 acres, or 48% of the County's total landmass.

[4] It should be noted that term "tree cover" includes areas characterized by relatively high densities of development with large, mature trees. "Tree cover" and "forest" are not synonymous.

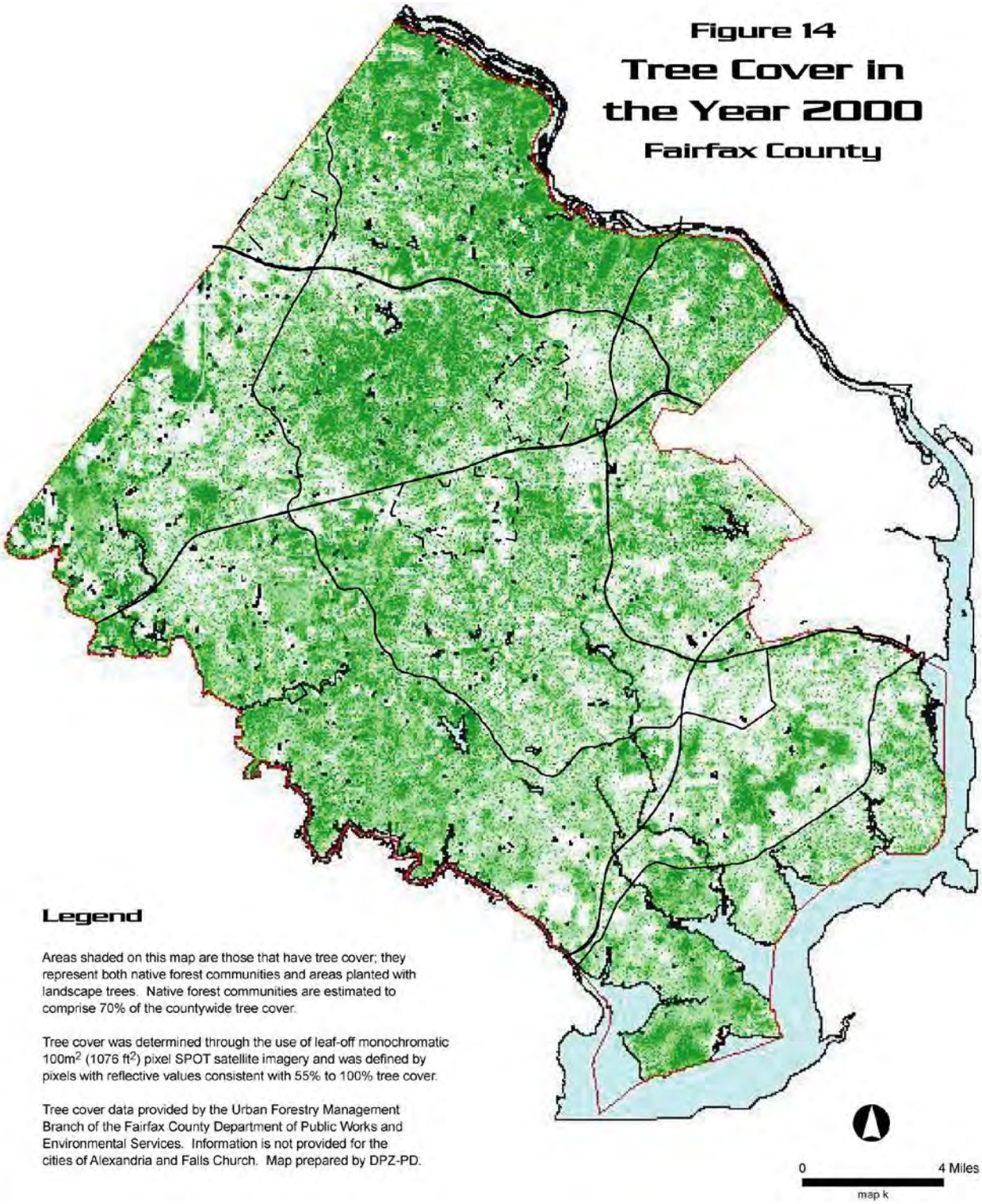
Figure 14
Tree Cover in the Year 2000
Fairfax County
Legend
Areas shaded on this map are those that have tree cover; they represent both native forest communities and areas planted with landscape trees. Native forest communities are estimated to comprise 70% of the countywide tree cover.
Tree cover was determined through the use of leaf-off monochromatic 100m² (1076 ft²) pixel SPOT satellite imagery and was defined by pixels with reflective values consistent with 55% to 100% tree cover.
Tree cover data provided by the Urban Forestry Management Branch of the Fairfax County Department of Public Works and Environmental Services. Information is not provided for the cities of Alexandria and Falls Church. Map prepared by DPZ-PD.
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Again, this figure may be inflated somewhat due to the resolution of the imagery; it is likely that the actual figure fell somewhere between 40% and 45%. Regardless of the precise figure, it is clear that there has been a steady decline of tree cover over the last 30 years, with an average decrease per year of roughly 1%. As can be seen in Figure 13, however, this trend reversed for a few years in the mid to late 1990s, suggesting that the growth in the planted and natural tree cover during this period outpaced the removal of tree cover due to land development (or that the quality of imagery used in the analysis changed, resulting in changes in interpretations). The last several years have again seen a decreasing trend; it is not clear whether this trend will reverse if and when the pace of development in the County again slows.

At this time, large tracts of unfragmented forest are generally limited to park and other government-owned lands, stream valley corridors, and areas within the far western, southern, and northern portions of the County. The County has been active in acquiring many of the remaining large tracts of forested land and recently acquired, through purchase and dedication, over 2,000 acres of land in the western part of the County that includes a large, generally unfragmented, rare basic oak hickory forest formed on diabase-derived soils. In addition, the County has partnered with the Northern Virginia Conservation Trust to seek voluntary agreements from land owners to protect high quality resources on their properties (these and other County initiatives are addressed later within this report).

While large tracts of unfragmented forested land are not common in Fairfax County, substantial areas of tree cover remain in areas throughout the County, including areas characterized by relatively high densities of residential development (see Figure 14). While these areas lack the habitat values of unfragmented land, the County's tree cover serves important water quality functions by reducing the erosive force of rainfall (through interception of raindrops by the tree cover and, where leaf litter has not been removed by land owners, by softening the impact of raindrops on the ground), providing for infiltration and vegetative uptake of rainfall, thereby reducing runoff, erosion, and the associated conveyance of nonpoint source pollutants, and shading impervious surfaces and streams, thereby reducing the potential for adverse thermal impacts to streams. In addition to water quality benefits, tree cover provides energy conservation benefits (through reducing the urban "heat island" effect and by shading structures), habitat benefits, air quality benefits, property value benefits, and reductions in carbon dioxide, which has been linked to global warming. A document produced for the Chesapeake Bay Program by the United States Department of Agriculture Forest Service entitled "Chesapeake Bay Watershed Forestry 2003" highlights the following benefits of forests:

> "Scientific findings show that forests are the most beneficial land use for water quality. Forests enhance water quality by filtering out large amounts of pollution and nutrients before they enter streams, rivers, and the Bay. By providing shade and enhanced water retention, forests reduce water temperature, prevent soil erosion, and mitigate flooding. Forests also provide important terrestrial habitat for many species of wildlife and protect aquatic habitat throughout the Bay watershed. Finally, trees themselves are a living resource that contribute to the economy, improve air quality, provide recreational opportunities, and enhance the quality of life for residents throughout the watershed. Restoration and protection of forests is fundamental to saving the Bay."

Of particular interest and importance from a water quality standpoint is the presence of undisturbed forested areas (including native herbaceous and shrub cover) along the County's streams. Forested riparian buffer areas perform a number of environmental functions, including:

- The provision of valuable unfragmented plant and wildlife corridors;
- The removal of nutrients and other pollutants from surface water and groundwater;
- The shading of streams and other bodies of water, thereby reducing the potential for adverse thermal impacts;
- The improvement of stream habitat conditions;
- The trapping of sediment from flood waters and sheet flow entering from developed and/or developing areas; and
- The separation of activities that may have an adverse impact on water resources (e.g., lawn fertilization and use of pesticides) from these resources.

The County has embarked on an ambitious effort to prepare watershed management plans for each of its 30 watersheds. As part of this effort, baseline stream assessments have been performed for all streams in the County to evaluate their conditions and to identify deficiencies such as insufficient riparian buffer areas. A more complete discussion of this effort, and an overview of the results of the stream assessments, is provided later in this report.

POTABLE WATER SUPPLY SOURCES IN FAIRFAX COUNTY

Fairfax County's water supply comes from the Potomac River, the Occoquan Reservoir, Goose Creek, community wells, and private wells. Fairfax Water (formerly the Fairfax County Water Authority), is the County's primary supplier of drinking water, but some areas of the County have water service provided by other jurisdictions. Fairfax Water also provides drinking water to the Prince William County Service Authority, Loudoun County Sanitation Authority, Virginia America Water Company (City of Alexandria and Dale City), Town of Herndon, Fort Belvoir, and Dulles Airport. Fairfax Water's production was 48.99 billion gallons in 2003.

TABLE 4
Sources of Fairfax Water's Water Supply, 2003

Sources	Gallons (in billions)
Occoquan Reservoir (Lorton/Occoquan)	19.84
Potomac (Corbalis)	29.01
Wells	0.01
Purchased	0.05
Untreated	0.08
TOTAL	48.99

Source: Fairfax Water (formerly the Fairfax County Water Authority). Note that this information does not include private well water supplies.

There are approximately 12,000 single family residences and businesses that are served by individual well water supplies in Fairfax County. While there are no areas in the County for which surface water supply pipes are not permitted, houses continue to be constructed in areas

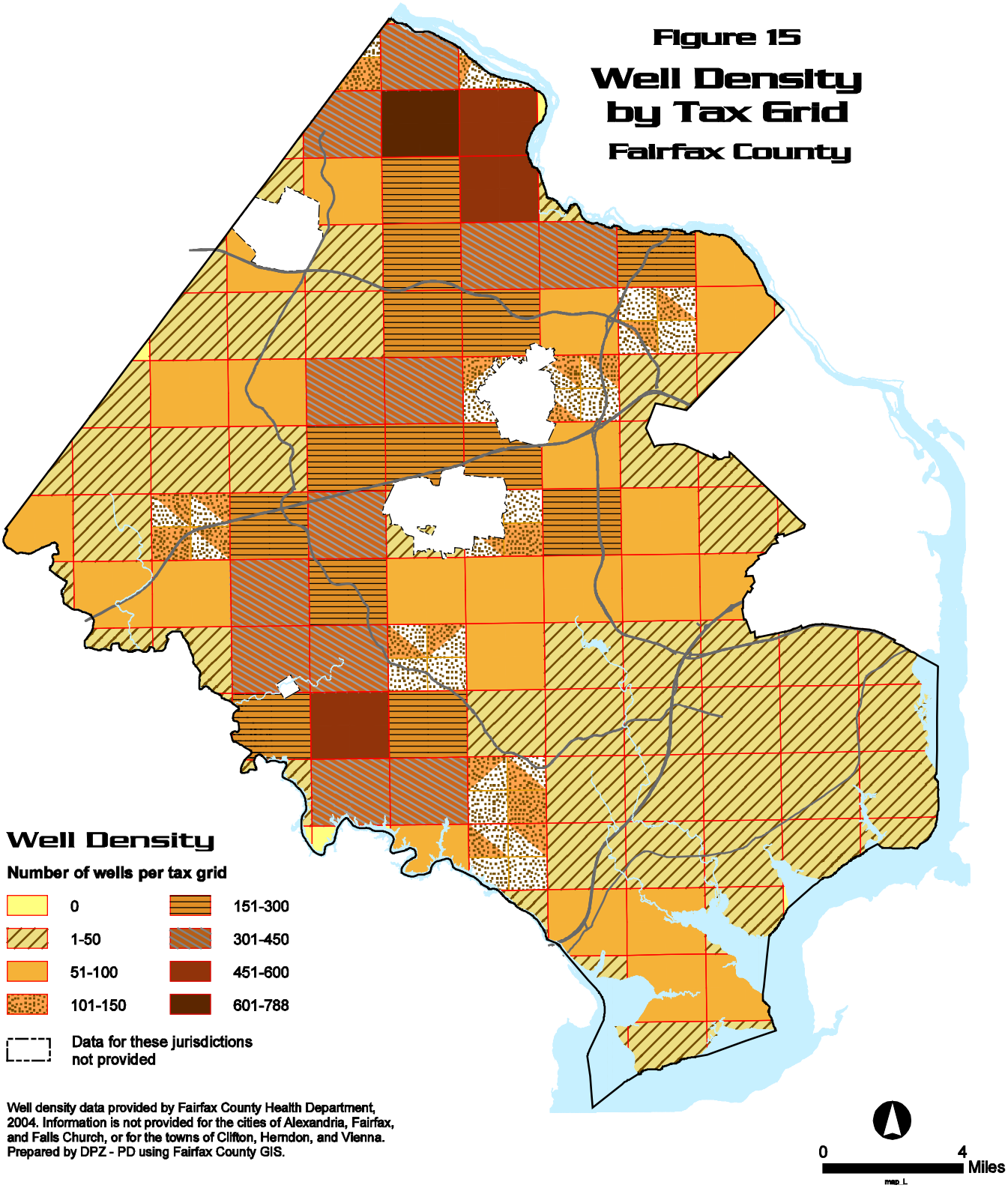
Figure 15
Well Density by Tax Grid
Fairfax County
Well Density
Number of wells per tax grid
0
1-50
51-100
101-150
151-300
301-450
451-600
601-788
Data for these jurisdictions not provided
Well density data provided by Fairfax County Health Department, 2004. Information is not provided for the cities of Alexandria, Fairfax, and Falls Church, or for the towns of Clifton, Herndon, and Vienna.
Prepared by DPZ - PD using Fairfax County GIS.
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where access to existing water mains is limited by physical distance and where groundwater supplies are sufficient. In 2003, for example, 163 New Well Permits were issued by the County's Health Department for single family residences. There were, by comparison, 321 wells closed in 2003. In addition, there are 75 non-community well water supplies that serve facilities in the County such as schools, restaurants, parks, and other commercial use buildings. These wells serve at least 25 people for at least six months out of the year. They are sampled for potability quarterly. The results are posted with the Virginia Department of Health, Office of Drinking Water.

In general, ground water supplies are taken from unconfined aquifers. The only substantial area where there are known confined aquifers is the Coastal Plain Physiographic Province, where sedimentary layers of rock dip toward the southeast. The Coastal Plain contains a significant aquifer that is recharged in the area along the western boundary of the Coastal Plain, roughly along I-95. Two areas along the Fall Line (the boundary of the Coastal Plain and Piedmont Upland Physiographic Provinces) in Fairfax County have been identified as recharge areas for the principal confined Coastal Plain aquifer (one such area is located along, but primarily east, of I-395 north of the Capital Beltway and along the Beltway in the Franconia area, and the other between I-95 and Richmond Highway in the Lorton area), although this aquifer could, potentially, be recharged from a broader area in the Coastal Plain near the Fall Line. While this aquifer is not a significant source of Fairfax County's water supply, it may provide potable water for jurisdictions east of the County. Ideally, groundwater recharge areas such as the Fall Line area of Fairfax County should be kept in low density development. However, the Fall Line aquifer recharge areas in Fairfax County have long been characterized by relatively high density residential, commercial, and industrial development.

In general, areas characterized by high groundwater well use in Fairfax County (see Figure 15) are in Piedmont Upland areas where groundwater is unconfined and tends to move in fractures and faults within bedrock. There are, however, other areas in the County where there are fewer wells but where groundwater serves as the primary source of potable water (e.g., the Mason Neck area of southern Fairfax County and the low density residentially-zoned areas of far western Fairfax County). The Mason Neck wells are supplied by Coastal Plain aquifers, while the western portion of the County is located in the Triassic Basin area, where groundwater moves in fractures and faults within bedrock but where the system of fractures in some areas tends to be more extensive than that of the Piedmont Upland, thereby resulting in a more regional groundwater system.

The County recognizes the need for water conservation measures in support of preserving and protecting its water supply. Toward this end, the County, under the auspices of the Metropolitan Council of Governments, supports and follows the Metropolitan Washington Water Supply and Drought Awareness Response Plan: Potomac River System. The Plan consists of two interrelated components: 1) a year-round program emphasizing wise water practices and 2) a water supply and drought awareness and response plan. In addition, Fairfax Water's "Water, Use It Wisely" program provides water conservation tips on its internet site and in its newsletters. Fairfax Water also offers plant tours and staff presentations on water supply and water treatment issues to complement organizations' watershed protection efforts. ■

WATER POLLUTION SOURCES

Surface water pollution can be characterized as either "point source" or "nonpoint source." Point sources of water pollutants are identifiable sources that discharge pollutants into receiving waters, generally at a fairly steady rate. Nonpoint sources are more diffuse sources of pollutants that are generally associated with stormwater runoff. Such pollutants include: sediment from construction sites; the runoff of fertilizers, pesticides, and animal wastes from residential areas; atmospheric pollutants that are deposited on impervious surfaces and carried via stormwater runoff into surface water bodies; runoff of pollutants from roads and parking areas; motor oil and other pollutants that are dumped into storm drains, and litter. Stormwater runoff itself can adversely affect downstream water resources through stream bed and bank erosion (which can be a major source of sediment pollution) and through thermal impacts. Because of their diffuse nature, nonpoint source pollutants are generally more difficult to manage than point source pollutants.

Potential ground water contamination sources can include: septic fields; leaking underground storage tanks; other hazardous materials releases, including improper oil disposal; leachate from landfills and uncontrolled dump sites; leaking sewer lines; fertilizers; pesticides; road salt; agricultural wastes; and urban nonpoint source pollutants. In addition, radon is a naturally occurring substance, and it is not unusual for it to be present in groundwater sources in Fairfax County.

POINT SOURCE POLLUTANTS

VIRGINIA POLLUTANT DISCHARGE ELIMINATION SYSTEM

Fairfax County is not characterized by heavy industry. Therefore, there are relatively few point sources of water pollution within the County. The Clean Water Act's National Pollutant Discharge Elimination System (NPDES) requires dischargers of wastewater into State waters to report these discharges and meet water quality requirements incorporated into their permits. In Virginia, the NPDES program is administered as the Virginia Pollutant Discharge Elimination System (VPDES) by the Virginia Department of Environmental Quality (VDEQ). Point source discharges are controlled by VDEQ and must meet all applicable State and federal water quality requirements.

The most significant point sources in Fairfax County are sewage treatment plants; two large treatment facilities are located in the County: the Noman M. Cole, Jr. Pollution Control Plant (NMCPCP), which is located in the southern portion of the County and which is operated by Fairfax County; and the Upper Occoquan Sewage Authority (UOSA) Water Reclamation Plant in the Centreville area.

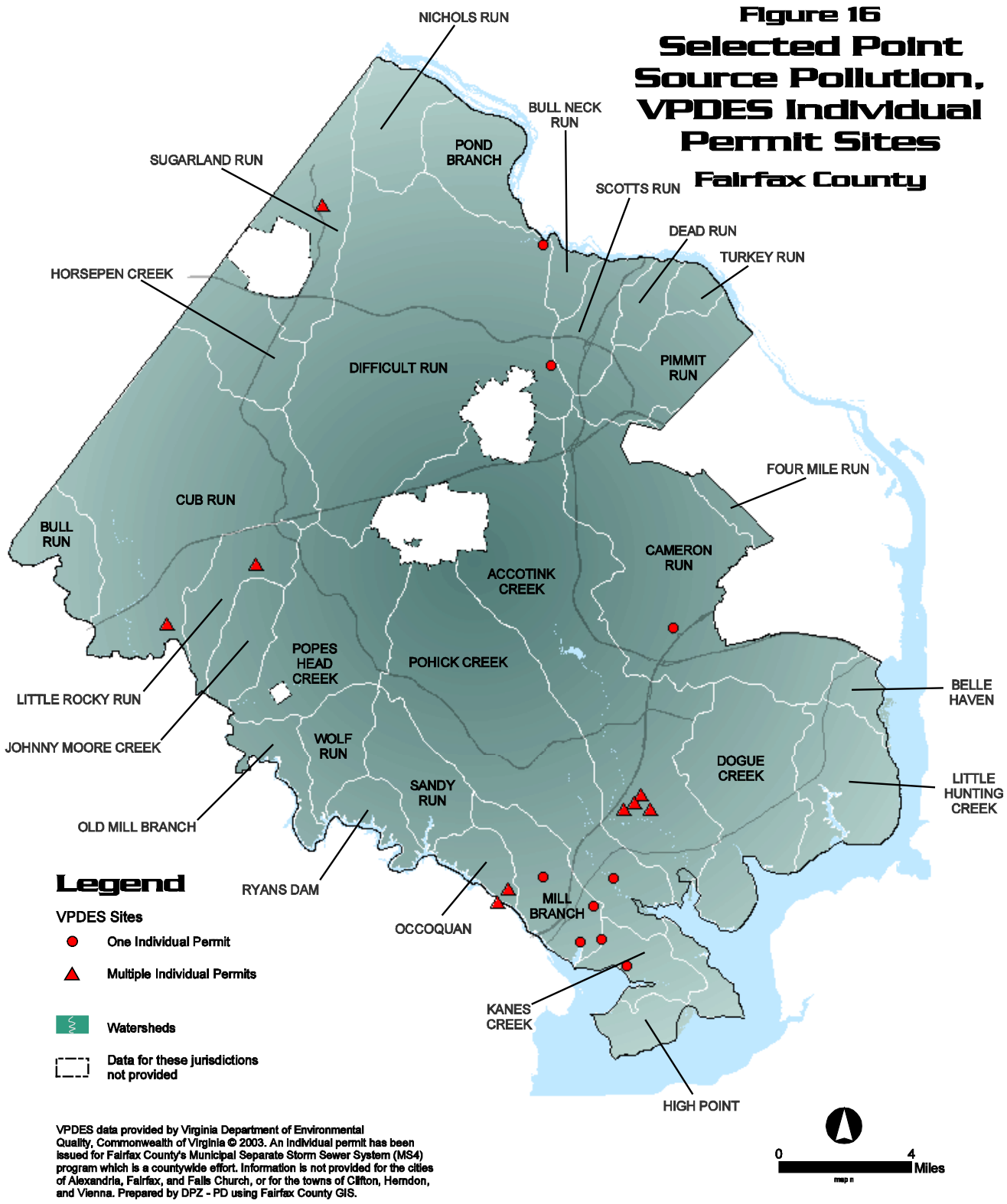
The NMCPCP is a 54 million gallon per day (mgd) advanced wastewater treatment facility that incorporates preliminary, primary, secondary, and tertiary treatment processes to remove pollutants from wastewater generated by residences and businesses in Fairfax County. The original plant, which began operation in 1970 at a treatment capacity of 18 million gallons a day

(mgd), has undergone two capacity and process upgrades to meet more stringent water quality standards. After treatment, the wastewater is discharged into Pohick Creek, a tributary of Gunston Cove and the Potomac River.

Construction to expand the plant treatment capacity to 67 mgd began in 1997, with completion planned by the end of 2004. This includes process upgrades to remove ammonia to less than 1 mg/l and total nitrogen to less than 8 mg/l in order to meet Virginia Water Quality Standards and the Chesapeake Bay Program goals for total nitrogen. Also included in the project are: flow equalization tanks, a new/upgraded laboratory for water quality testing, upgraded odor control systems, new instrumentation and control systems, and a new septage receiving facility. The recent plant upgrades have incorporated biological nutrient removal (BNR); the plant now removes almost 100% of the ammonia from plant influent wastewater, and the plant's effluent has been certified to be free of toxics by an independent lab, as required by the facility's VPDES permit.

As noted earlier, UOSA's Water Reclamation Facility was placed into service in 1978, pursuant to the Virginia State Water Control Board's 1971 Occoquan Policy, which called for the phasing out of small, outdated sewage treatment facilities in the Occoquan Watershed in favor of no more than three state-of-the-art advanced water reclamation plants. The UOSA facility serves the western portions of Fairfax and Prince William Counties, as well as the Cities of Manassas and Manassas Park. UOSA staff has noted that the Water Reclamation Plant includes primary-secondary treatment followed by the following advanced waste treatment processes: chemical clarification, two-stage recarbonation with intermediate resettling, multimedia filtration, granular activated carbon adsorption, post carbon filtration, chlorination for disinfection, and dechlorination. The plant's capacity is 32 million gallons a day (mgd) and is being expanded to a capacity of 54 mgd. The plant expansion has been largely completed.

More than 85% of the County's households and nearly all businesses in the County are connected to public sewer. The Wastewater Planning and Monitoring Division (WPMD) of the Department of Public Works and Environmental Services has indicated that the current 12-month rolling average flow to NMCPCP is 44.3 million gallons per day (MGD). Approximately 12.5 MGD is conveyed from the County to the UOSA facility. Three other facilities to which wastewater from the County is conveyed are located outside of the County. The Blue Plains facility, which is operated by and located in the District of Columbia, collects wastewater from sewered areas in the northern portion of the County, including the Tysons Corner, McLean, Reston, and Herndon areas. The current 12-month rolling average flow from Fairfax County to Blue Plains is 28.5 MGD. Wastewater from much of the area inside the Capital Beltway in and south of the Falls Church area (with the exception of portions of the Annandale and Baileys Crossroads areas) is conveyed to a facility operated by the Alexandria Sanitation Authority. Wastewater from portions of the Springfield, Franconia, and Rose Hill areas, as well as portions of the County located along the Richmond Highway Corridor and the George Washington Memorial Parkway south of the City of Alexandria, is also conveyed to this facility. The 12-month rolling average flow from the County to this facility is 22.2 MGD. A small portion of the County in the Baileys Crossroads area is served by a facility operated by Arlington County; approximately 2.2 MGD is conveyed from the County to this facility.



VPDES data provided by Virginia Department of Environmental Quality, Commonwealth of Virginia © 2003. An individual permit has been issued for Fairfax County's Municipal Separate Storm Sewer System (MS4) program which is a countywide effort. Information is not provided for the cities of Alexandria, Fairfax, and Falls Church, or for the towns of Clifton, Herndon, and Vienna. Prepared by DPZ - PD using Fairfax County GIS.

Wastewater treatment facilities and other facilities that discharge more than 1,000 gallons per day of wastewater are required to obtain individual VPDES permits from the VDEQ. VDEQ has issued 47 Individual Permits to 19 different facilities/permittees in Fairfax County, including the two sewage treatment plants identified above, additional, much smaller, sewage treatment facilities (including two that have yet to have been constructed), pipeline facilities, petroleum storage terminals, water treatment facilities, the County's Municipal Separate Storm Sewer System permit (addressing nonpoint sources but categorized as an Individual VPDES Permit), and other dischargers. Figure 16 displays the locations of these discharges.

In addition to Individual VPDES Permits for discharges of greater than 1,000 gallons per day, VDEQ issues General Permits for a variety of activities involving lesser volumes of discharge. Included are: General Permits for Cooling Water (associated with the purging of boiler systems in large buildings and the associated discharge of water into storm drains); Storm Water Construction (permits required for construction sites or other land disturbances that exceed five acres in size); Storm Water Industrial (stormwater runoff from landfills, asphalt plants, other industrial activities, vehicle storage/maintenance yards, and other facilities); Non-Metallic Mineral Mining (quarries); Ready-Mix Concrete (concrete batching plants); Municipal Separate Storm Sewer System permits for smaller jurisdictions; and otherwise unclassified General Permits. A recently enacted state law will require Fairfax County to assume responsibility for stormwater construction permits in the future.

TABLE 5
VPDES General Permits in Fairfax County Issued by VDEQ
December, 2003

Type of General Permit	Number
Storm Water Construction	291
Storm Water Industrial	38
Ready-Mix Concrete	19
Cooling Water	19
Non-Metallic Mineral Mining	8
Municipal Separate Storm Sewer System	4
Other (less than 1,000 gallons per day)	4
TOTAL	383

Source: Virginia Department of Environmental Quality
Includes permits issued in Fairfax City, the City of Falls Church, and the Towns of Herndon and Vienna
The numbers above reflect all General Permits that have been issued by VDEQ. In many cases, multiple permits have been issued to individual facilities; these multiple permits are not consolidated in the data provided in this table.

In Fairfax County, a total of 383 General Permits have been issued by VDEQ, broken down as presented in Table 5. A distribution of General Permits by watershed in Fairfax County is provided in Figure 17. It should be noted that the data provided to the County by VDEQ includes points of discharge located in Fairfax and Falls Church Cities and in the Towns of

Figure 17

Virginia Pollutant Discharge Elimination System Permit Type by Watershed

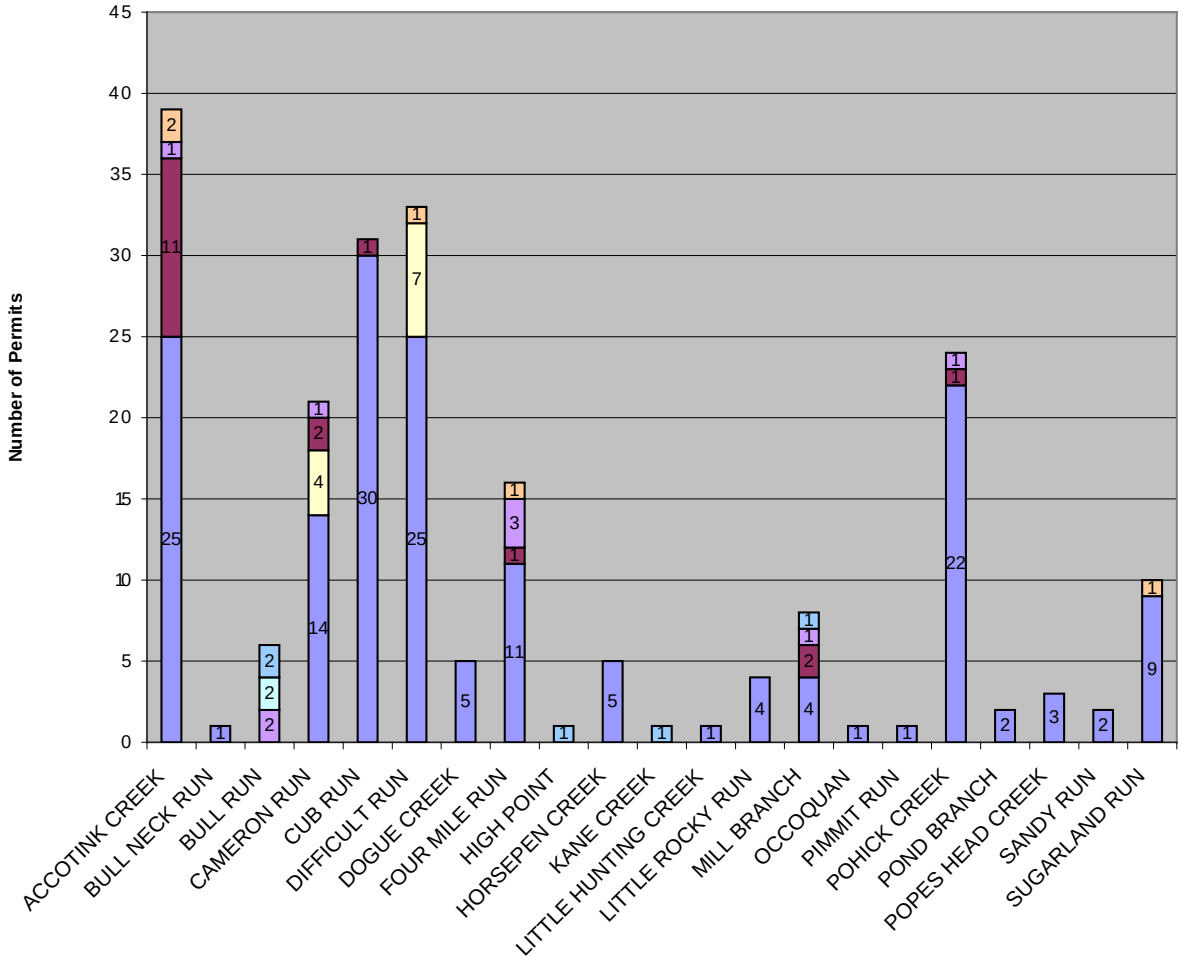


Chart contains only watersheds with permits, not all watersheds. Source: Virginia Department of Environmental Quality

LEGEND

- * MS4 General Permit
- Less Than 1,000 GPD General Permit
- Non-Metalic Mineral Mining General Permit
- Ready-Mix Concrete General Permit
- Storm Water Industrial General Permit
- Cooling Water General Permits
- Storm Water Construction General Permit

*MS4 information includes data from the city of Fairfax, and the Towns of Clifton, Herndon, and Vienna. VPDES data provided by Virginia Department of Environmental Quality, Commonwealth of Virginia © 2003. Prepared by DPZ - PD using Fairfax County GIS.

map_n

Herndon and Vienna. It should also be noted that individual facilities may have more than one VPDES permit; as an example, there have been eight Non-Metallic Mineral Mining General Permits issued to the two stone quarries in the County.

TITLE III OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) AND SPILL RESPONSE

The federal Superfund Amendments and Reauthorization Act (SARA) of 1986 included a provision known as the "Emergency Planning and Community Right-to-Know Act," otherwise referred to as "Title III." This law requires facilities that manufacture, process, or store certain hazardous or toxic chemicals above certain threshold levels to report to state and local governments and to report releases of certain hazardous materials in a timely manner. There are five reporting programs under Title III of SARA as follows:

- Section 302, Emergency Planning Notification: This provision requires facilities that have "Extremely Hazardous Substances" in quantities exceeding EPA-established "threshold planning quantities" to notify the Virginia Emergency Response Council (VERC) and the Local Emergency Planning Committee (LEPC). The Fairfax Joint Local Emergency Planning Committee (FJLEPC) refers to these facilities as "Critical Hazard Facilities." There have been 90 such facilities (plus four bulk storage facilities) identified in the 2003 Hazardous Materials Emergency Response Plan (covering calendar year 2002) in the geographic area covered by FJLEPC. More information about these facilities is provided below.

- Section 304, Emergency Release Notification: This provision requires, with some exemptions, facilities to notify VERC, the local LEPC, and the local fire department regarding the release of any Extremely Hazardous Substances at or above specific "reportable quantities." These agencies, along with the National Response Center (operated by the National Guard) must also be notified regarding the release of hazardous substances (again at or above "reportable quantities") that are listed under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

- Section 311, Material Safety Data Sheet (MSDS) Submission: This provision requires, with some exemptions, facilities to provide information, if requested, to VERC, local LEPCs, and local fire departments regarding chemicals requiring reporting under the Occupational Safety and Health Administration (OSHA) hazard communication standard.

- Section 312, Emergency and Hazardous Chemical Inventory (also known as "Tier II Reporting): This provision requires annual submissions of "Tier II" reports to VERC, local LEPCs, and local fire departments regarding hazardous materials that are present at or above certain quantities. The "Extremely Hazardous Substances" referenced in Section 302 are a subset of the larger list of hazardous materials covered under this Section. The Tier II form includes information regarding the types and quantities of hazardous materials on the site, how these chemicals are used and stored, and points of contact at each facility. As is the case with Section 311, retail gas stations that comply with underground storage tank requirements and that hold less than 75,000 gallons of

gasoline or 100,000 gallons of diesel fuel are exempt from this requirement. In Fairfax County, 463 facilities were required to submit Tier II reports in the year 2003, including all of the Critical Hazard Facilities and bulk storage facilities.

- Section 313, Toxics Release Inventory: This provision requires certain industrial facilities to report to VERC and the U.S. Environmental Protection Agency regarding the manufacturing, processing, use, and/or release of any toxic chemical in excess of certain thresholds during the course of a calendar year (including releases that are allowed through permits). In the year 2002, twelve facilities in Fairfax County and two in Fairfax City filed such reports with the Virginia Department of Environmental Quality.

The Virginia Department of Environmental Quality (VDEQ) receives all Title III notification reports submitted in Virginia on behalf of VERC. In Fairfax County, the Fire and Rescue Department also retains copies of these reports (with the exception of Toxics Release Inventory reports) and coordinates activities of the Fairfax Joint Local Emergency Planning Committee (FJLEPC).

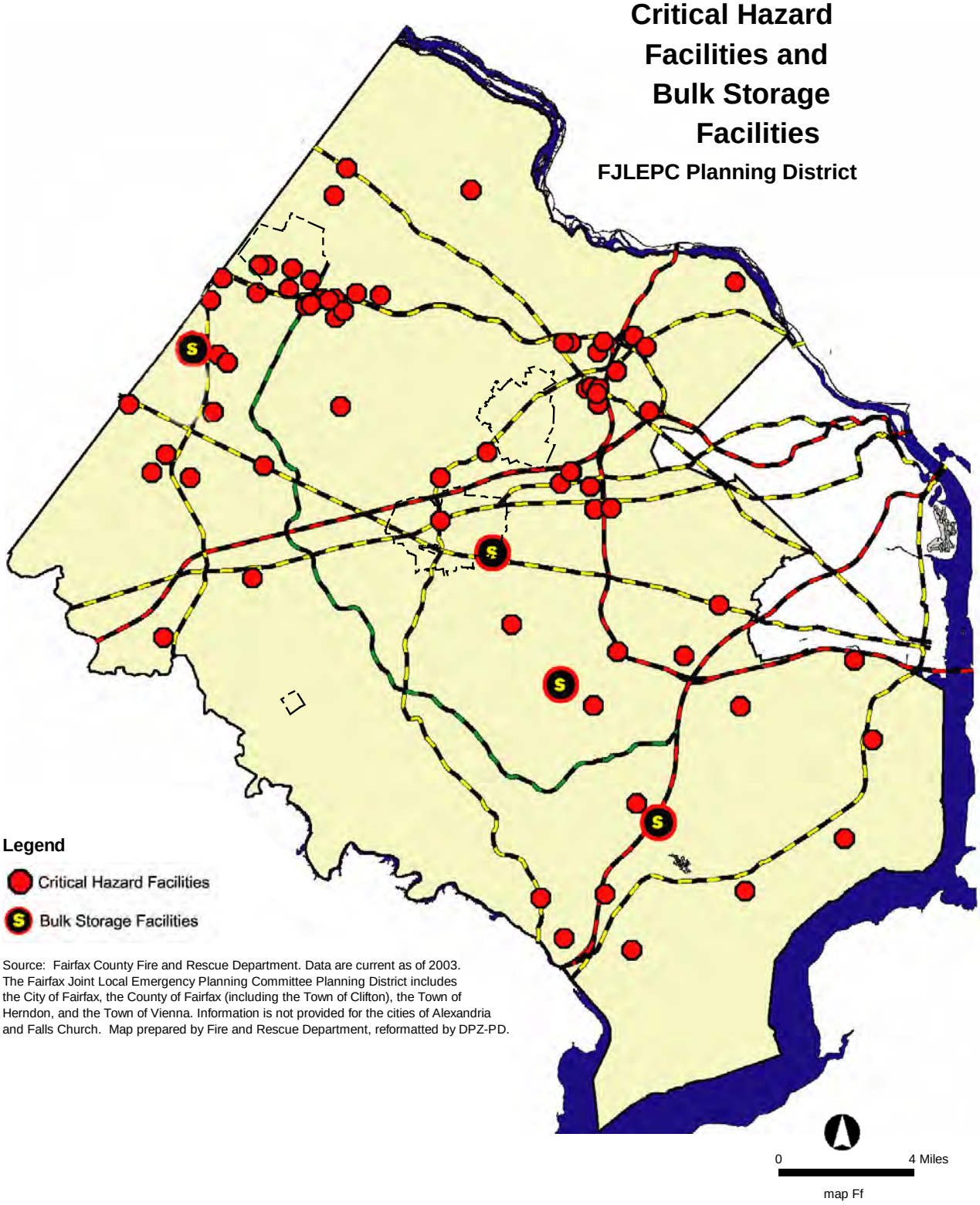
Title III of SARA also requires states to organize emergency planning areas and to establish Local Emergency Planning Committees (LEPCs) to provide for community representation in the development and coordination of emergency response plans addressing potential chemical releases. The FJLEPC Planning District includes the City of Fairfax, the County of Fairfax (including the Town of Clifton), the Town of Herndon, and the Town of Vienna. Committee members represent local government officials, police, fire and rescue officials, environmental and governmental planners, public health professionals, hospital officials, public utility and transportation officials, representatives of business organizations, professional societies, civic organizations, and the media. These representatives meet six times a year. The FJLEPC collects information about hazardous materials; develops and updates, on an annual basis, the Hazardous Materials Emergency Response Plan (HMERP); and provides information to the public about the use, storage, and manufacture of hazardous materials by attending public functions such as Fall for Fairfax and USGS (U. S. Geological Survey) Safety Day. In addition, the Committee has published three brochures and has produced a video tape, all for public information.

As noted above, there were a total of 463 facilities in FJLEPC's geographic area that were required to file "Tier II" reports in the year 2003 under Section 312 of SARA Title III. Ninety of these facilities have been identified in the 2003 HMERP as "Critical Hazard Facilities," which are described in the report as those facilities "which are considered most likely to release a hazardous material into the community." Roughly 20 of these facilities will not be considered as Critical Hazard Facilities in the 2004 report as a result of a resurvey conducted by a telecommunications firm that operates these facilities. In addition to the 90 Critical Hazard Facilities, the 2003 report identifies four bulk storage facilities such as petroleum tank farms. The majority of the remaining Tier II facilities store gasoline or diesel fuel (e.g., County schools) and are not otherwise exempted from reporting (e.g., most gas stations have been exempted from this reporting requirement). Figure 18 displays the general locations of the Critical Hazard

Figure 18

Critical Hazard Facilities and Bulk Storage Facilities

FJLEPC Planning District



Source: Fairfax County Fire and Rescue Department. Data are current as of 2003. The Fairfax Joint Local Emergency Planning Committee Planning District includes the City of Fairfax, the County of Fairfax (including the Town of Clifton), the Town of Herndon, and the Town of Vienna. Information is not provided for the cities of Alexandria and Falls Church. Map prepared by Fire and Rescue Department, reformatted by DPZ-PD.

Facilities and bulk storage facilities. As can be seen from this map, Critical Hazard Facilities are generally concentrated in "high tech" corridors such as Tysons Corner and the Reston-Herndon area.

For each Critical Hazard Facility and bulk storage facility identified in the HMERP, the HMERP describes the extremely hazardous substances that are used or stored and discusses notification procedures in the event of an incident, on site means of detecting incidents, evacuation routes, clean-up resources, and identification of parties responsible for the site. The majority of the facilities identified in the HMERP are listed because of batteries that are used in support of wireless telecommunications facilities; these batteries contain quantities of sulfuric acid that exceed the threshold planning quantity for this chemical. A number of other facilities use batteries that exceed the threshold planning quantity for sulfuric acid for the purpose of ensuring that there will be an uninterrupted power supply for computers and/or general operations. Other common chemicals are anhydrous ammonia and chlorine.

The County's Fire and Rescue Department (FRD) responds to all reported incidents of hazardous material releases, spills, and discharges. FRD Operations Division staff is trained and equipped to initiate spill control measures to reduce the possibility of hazardous materials reaching streams and other sensitive resources. FRD also maintains a contract with a major commercial hazardous materials response company to provide additional containment and cleanup support for larger-scale incidents.

The Hazardous Materials and Investigative Services (HMIS) Section of FRD investigates complaints of potential and actual releases, many of a non-emergency nature. Approximately 500 investigations of oil or other liquid spills are conducted each year. HMIS staff, through vigorous enforcement of appropriate codes and ordinances, ensures that the responsible parties take appropriate spill control and cleanup actions. HMIS also provides for long-term monitoring of sites that have been subject to contamination in order to minimize the potential for the movement of contaminants into the County's water resources.

NONPOINT SOURCE POLLUTANTS

While Fairfax County contains several point sources of water pollutants, nonpoint source pollution has had a much more profound influence on the current condition of the County's water resources. The rapid growth in the County's population and employment in the latter half of the 20th Century, continued growth in the early part of the 21st Century, and the associated land use changes that were outlined in the first section of this report have changed the character of stormwater runoff in Fairfax County dramatically. Watersheds and subwatersheds that were once characterized by forests, farmland, and other pervious cover are now largely developed. Some rainfall that, at one time, could infiltrate through pervious surfaces into the groundwater system is now intercepted by impervious surfaces and conveyed into streams. This stormwater runoff has changed the hydrologic characteristics of the receiving streams, resulting in stream bed and bank erosion and the conveyance of sediment into downstream areas. In addition, stormwater runoff from both impervious and pervious areas carries with it pollutants that have accumulated on these surfaces, whether the pollutants are pesticides and fertilizers applied to turf areas, metals and hydrocarbons that have accumulated on roads and parking areas, or sediment

that has been entrained and carried downstream from development sites. It should be stressed that the land conversions that have occurred in response to population and employment growth in the County have not necessarily or uniformly been "bad" from a water quality standpoint; to the contrary, land has been used throughout Fairfax County, and water pollutants have been generated from these uses, since Colonial times. It should be recognized, however, that the character of this runoff has changed significantly as the County has evolved from an agricultural community to the vibrant employment center it has become today, and that this change in character continues to present substantial stresses to the County's water resources.

Within the watershed of the Potomac River and the larger Chesapeake Bay watershed, both agricultural and urban/suburban nonpoint sources of pollution are significant concerns. However, the extent of agricultural use of land in Fairfax County has dwindled substantially as the County has evolved. The 1930 U.S. Census, for example, identified 1,244 farms in Fairfax County, covering 123,626 acres of land. The 2002 Census of Agriculture, by contrast, identified 151 farms covering 9,946 acres. Clearly, when considered in a broad context, traditional agricultural uses (i.e., cropland, dairy farming, and livestock operations) are no longer a substantial nonpoint source pollution issue in Fairfax County.

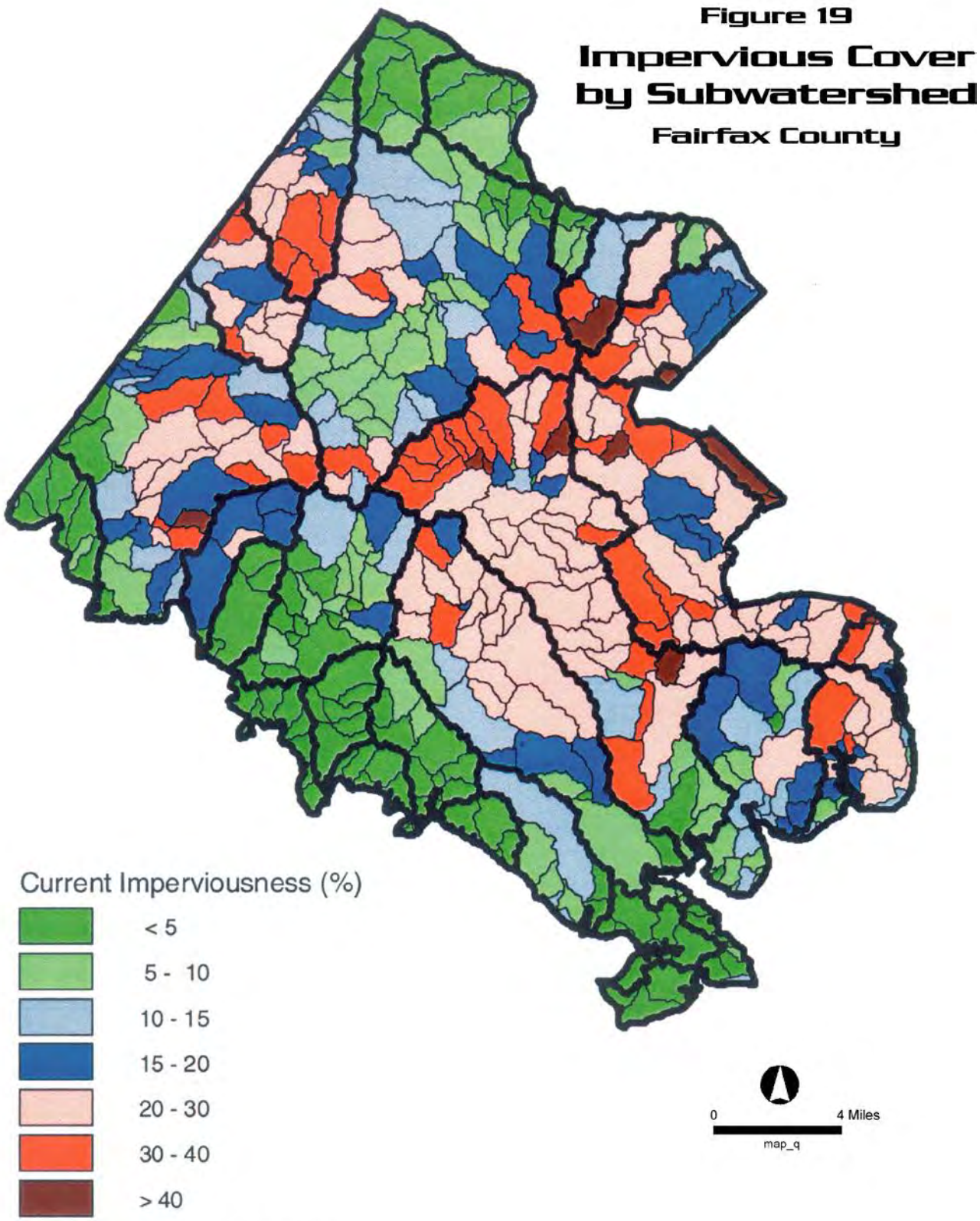
The character of agricultural uses in Fairfax County has shifted from the traditional forms of agriculture noted above to residential horse operations; according to the Northern Virginia Soil and Water Conservation District (NVSWCD), a preponderance of agricultural land in Fairfax County is now associated with such operations. Agricultural uses that remain in Fairfax County are subject to soil and water conservation planning requirements of the Chesapeake Bay Preservation Ordinance. It is noted that the County's Ordinance defines "agricultural land" broadly to include plant nurseries and properties on which horses are maintained. Conservation planning for such uses can result in significant reductions in pollutant runoff, and NVSWCD develops soil and water conservation plans for all agricultural land as defined by the Ordinance. The plans include best management practices to reduce sediment pollution from erosion, excess nutrients from animal waste and fertilizers, and misuse of pesticides and herbicides. The plans also prescribe riparian buffers for Resource Protection Areas. Per a County ordinance requirement, soil and water conservation plans are also developed for Agricultural and Forestal Districts in the County (of which there were 42 in 2003). NVSWCD also develops conservation plans for landowners receiving state cost-share money for installing agricultural best management practices, such as manure storage and composting structures, or fencing to keep animals out of streams. In addition to cost share practices, landowners voluntarily install best management practices that protect water quality. In 1999 and 2000, NVSWCD worked with landowners to achieve runoff reductions of 7,191 pounds of nitrogen and 838 pounds of phosphorus; these reductions met the state's Potomac Watershed Tributary Strategy goals for agriculture in Fairfax County.

Since 1994, when soil and water conservation plans began to be developed in support of the Chesapeake Bay Preservation Ordinance, such plans have been drafted for 9,859 acres of land and 260,091 linear feet of RPAs. It should be noted, however, that some of these plans are no longer active due to conversion of agricultural land to other uses. In addition, there are many additional parcels of land in agricultural use for which soil and water conservation planning is still needed.

Of particular note regarding nonpoint source pollution is the issue of stormwater runoff hydrology. As watersheds and subwatersheds become more impervious, infiltration of water into the ground decreases, thereby reducing the volumes of water that percolate downward and replenish the groundwater system. This, in turn, can reduce the base flow that this groundwater system provides to streams. Potentially, streams that are supplied by spring water can lose this source of constant flow as the water table drops and change from perennial streams to intermittent streams.

The reduction in infiltration into the soil that is associated with increased impervious cover is countered by an increase in stormwater runoff at the surface. Water that once reached the stream through slow percolation and movement in the ground is now conveyed rapidly into the stream over the surface (assuming that the drainage is not conveyed into a stormwater detention or retention facility). The character of stormwater runoff at the surface also changes, as runoff is conveyed more rapidly into streams when it is conveyed over impervious surfaces and pipes rather than vegetative surfaces. The effect of increased impervious cover, then, is a "flashier" flow characteristic in the receiving stream. The total volume of water entering the stream is higher than it was under pervious conditions, and the peak volume in the stream is much higher, and occurs much earlier, than it did under pervious conditions. The frequency and intensity of flash flooding increases. Because the morphology, or form, of the stream had developed over time to accommodate the hydrologic conditions associated with a pervious cover, the stream becomes imbalanced as the character of the hydrology changes. To accommodate the higher peak and total volumes of flow, the channel deepens and widens through stream bed and stream bank erosion; additional sediment is conveyed into downstream areas (and ultimately the Potomac River and Chesapeake Bay).

Impervious cover can also increase the temperature of stormwater runoff entering streams, as broad, unshaded paved surfaces can become much hotter than areas characterized by a turf or forest cover. There is also a direct correlation between impervious cover and runoff of natural and man-made pollutants, including hydrocarbons and metals from roads and parking lots and nutrients that can cause high algal growth in downstream waters such as the tidal Potomac River and Chesapeake Bay (the algal growth degrades habitat by blocking sunlight and by reducing dissolved oxygen concentrations as the algae decay—this is why the reduction in nutrient loads has been a central component of Chesapeake Bay restoration efforts). The flashier stormwater runoff hydrology, increased temperature fluctuations, and pollutants that may be associated with runoff from impervious surfaces all can have a detrimental impact to aquatic species that inhabit streams, and there is a clear relationship between impervious cover in a watershed or subwatershed and the ecological quality of the stream system. Thomas Schueler, an authority on this relationship, has developed a three-tier description to characterize this impact: streams in watersheds with an impervious cover of ten percent or less tend to be rich in biodiversity and have good water quality characteristics. These streams are considered to be "sensitive." Streams in watersheds with 11 to 25 percent impervious cover demonstrate instability in their channels; they retain some biodiversity but do not have species that are particularly sensitive to hydrologic changes and stream pollutants and therefore are not as rich in biodiversity as the "sensitive" streams; these streams are considered to be "impacted." Streams in watersheds with more than



Source: Fairfax County Department of Public Works & Environmental Services, 2004. Current imperviousness is based on 1997 planimetric data.

25% impervious cover are characterized as "degraded," with unstable channels and low stream biodiversity.

Figure 19 identifies the current imperviousness of each subwatershed area in Fairfax County, based on 1997 planimetric data. As can be seen in this figure, subwatersheds throughout much of Fairfax County exceed 10% impervious cover. In general, the watersheds that retain more than 90% of their pervious cover are located in: the areas of the Occoquan Watershed that have been zoned for five-acre lot residential development; the Great Falls area in northern Fairfax County; the Difficult Run Watershed in the west-central part of the County; the Mason Neck peninsula in the southern part of the County; and portions of the Pohick, Accotink, and Dogue Creek Watersheds in southern Fairfax County. Impervious cover values well in excess of 30% characterize many of the subwatersheds throughout other portions of the County. As will be discussed later in this report, there is a strong relationship between subwatershed impervious cover and habitat values of streams in Fairfax County.

Much of the focus of the County's water resource management efforts has been related to the issue of impacts of impervious cover and to the control of nonpoint source pollution; the recently-initiated efforts to develop watershed management plans for all of the County's watersheds and to reevaluate stormwater management policies are both largely driven by the impacts associated with the development of the County. These efforts are discussed in detail later in this report.

GROUNDWATER POLLUTANTS

STORAGE TANKS

Leaking underground and above ground storage tanks pose a direct threat to surface and groundwater resources. Underground storage tanks (USTs) have been regulated by the federal Resource Conservation and Recovery Act since 1984. In Virginia, the Virginia Department of Environmental Quality (VDEQ) has assumed the authority for implementation and enforcement of these regulations. As of December, 1988, new USTs storing petroleum products and hazardous materials were required to meet certain requirements regarding corrosion protection, overfill and spill prevention, leak detection, and, in the case of USTs storing hazardous materials, secondary containment with measures to detect failures of the innermost containment structure. USTs that were in existence as of that date were required to be upgraded or replaced within a ten-year period. In addition, owners and operators of USTs containing petroleum products and hazardous materials must demonstrate evidence of financial responsibility in the event of a release. Notification forms must be submitted to VDEQ for all USTs storing petroleum products and hazardous materials.

VDEQ maintains a data base of underground storage tanks based on registration data that have been compiled since 1986. As of early 2004, a total of 1,859 underground storage tanks were identified as being in use in Fairfax County. However, according to VDEQ staff, there may be significant error in this figure; it is suspected that a substantial number of USTs that are included in the data base no longer exist. In addition, there may be additional tanks that VDEQ does not

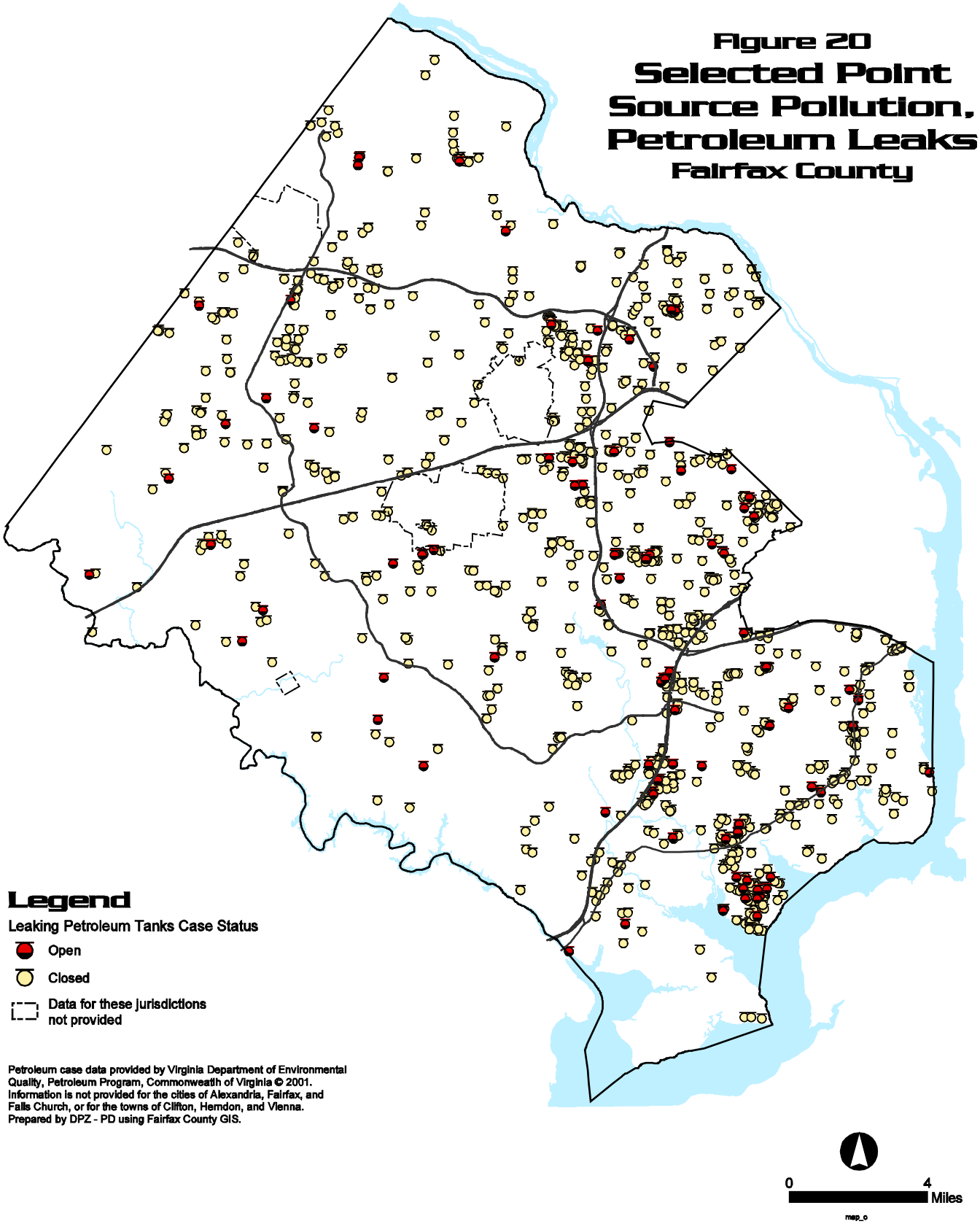


Figure 20
Selected Point Source Pollution, Petroleum Leaks
Fairfax County
Legend
Leaking Petroleum Tanks Case Status
Open
Closed
Data for these jurisdictions not provided
Petroleum case data provided by Virginia Department of Environmental Quality, Petroleum Program, Commonweatlh of Virginia © 2001.
Information is not provided for the cities of Alexandria, Fairfax, and Falls Church, or for the towns of Clifton, Herndon, and Vienna.
Prepared by DPZ - PD using Fairfax County GIS.
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have information about. VDEQ is in the process of verifying the information in its data base, but reliable data are not available at this time.

Data regarding open and closed cases of leaking storage tanks (both underground and above ground) are available from VDEQ. The Northern Regional Office of VDEQ has reported that, as of August 2, 2004, there were 168 open cases (and 1,842 closed cases) of leaking storage tanks in Fairfax County (including the Towns of Clifton, Herndon, and Vienna). VDEQ does not have records for all sites with open or closed cases of leaking storage tanks incorporated into its geographic information system (GIS); however, a majority of these data points have been included in the GIS, and VDEQ staff has indicated that the general patterns evident from these data are representative of its overall experiences with leaking storage tanks. Figure 20 presents the VDEQ data regarding leaking storage tanks that have been incorporated into its GIS and that have been made available through the VDEQ Web site; these data are current as of 2001.

Incidences of leaking tanks have occurred throughout the County but have been generally concentrated in commercial, industrial, and institutional areas. While Figure 20 suggests that there are concentrations of such releases in commercial, industrial, and institutional areas, it is the experience of VDEQ that a substantial proportion of the total number of petroleum releases in Fairfax County is related to residential heating oil tanks. Of the 2,010 total cases of leaking storage tanks in Fairfax County, 287, or just over 14%, involved releases from residential heating oil tanks.

Above ground storage tanks are regulated by the Clean Water Act; VDEQ requires registration of any such tank that has a capacity above 660 gallons. Smaller above ground tanks and most above ground home heating oil tanks are not subject to VDEQ registration requirements, although releases from these tanks are regulated. Locally, Fire Prevention Code Permits (issued by the County's Fire and Rescue Department) are required for above ground tanks that are greater than 55 gallons in capacity (30 gallons for liquefied petroleum (LP) gas); however, residential heating tanks are exempt from this requirement, and summary data of local permits are not available. According to the 2000 Census of Population and Housing, 14,567 housing units (4.2% of the County's total) were heated by fuel oil or kerosene in the year 2000 while 3,296 housing units were heated by bottled, tank, or LP gas. Many of the tanks storing these fuels are above ground facilities; however, some of these tanks may be underground tanks. Therefore, information regarding the total number of above ground storage tanks in Fairfax County is not available.

Facilities that store petroleum products or hazardous materials in above ground tanks with an aggregate capacity above 25,000 gallons are required to pursue pollution prevention and contingency measures, such as routine tank inspections, employee training, and the development of soil discharge contingency plans. There are fewer than one dozen such facilities in Fairfax County; these include asphalt and paving facilities, petroleum bulk storage facilities (i.e., tank farms), the Noman M. Cole, Jr. Pollution Control Plant, and a Washington Post facility in Springfield.

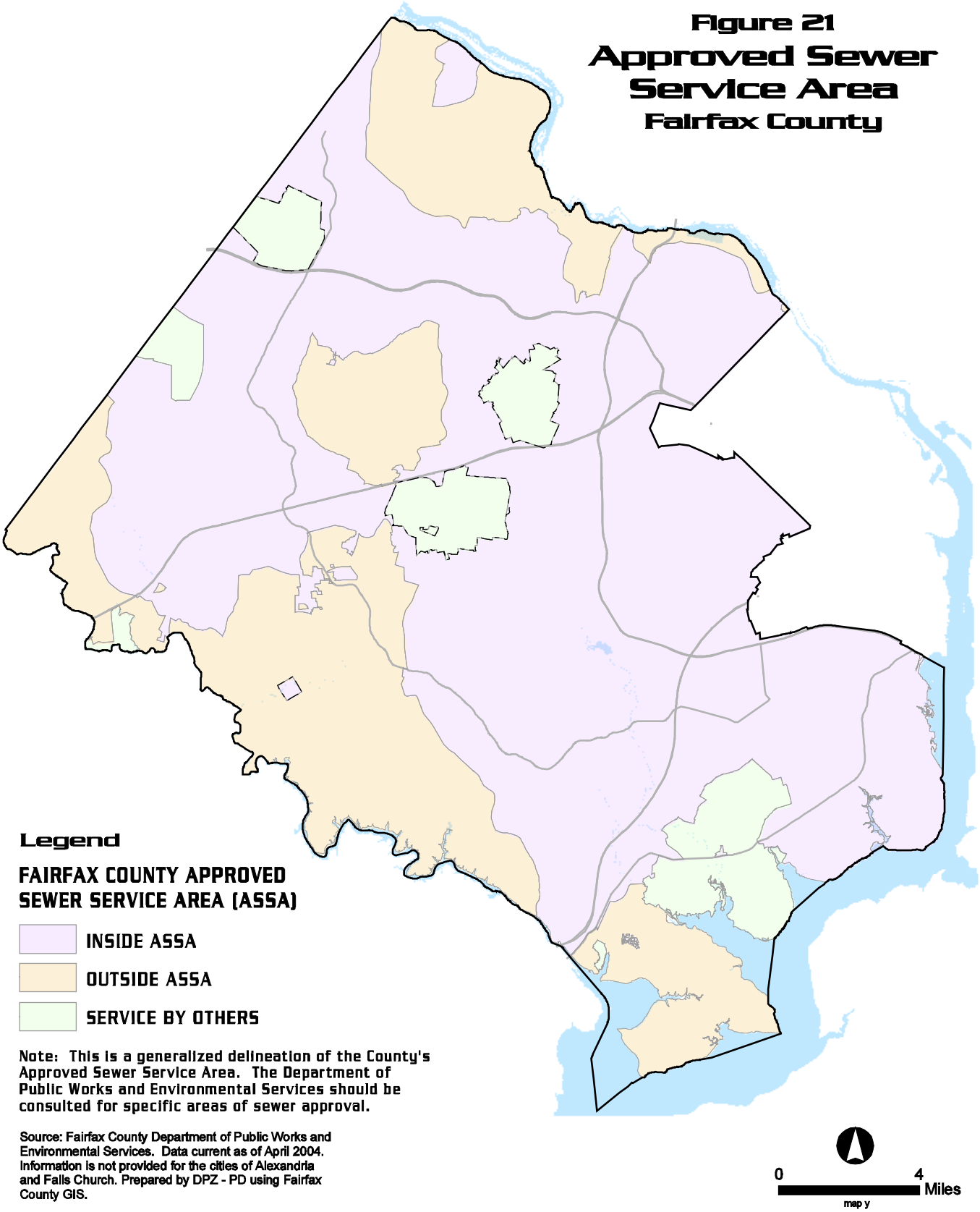
Figure 21
Approved Sewer Service Area
Fairfax County
Legend
FAIRFAX COUNTY APPROVED SEWER SERVICE AREA (ASSA)
INSIDE ASSA
OUTSIDE ASSA
SERVICE BY OTHERS
Note: This is a generalized delineation of the County's Approved Sewer Service Area. The Department of Public Works and Environmental Services should be consulted for specific areas of sewer approval.
Source: Fairfax County Department of Public Works and Environmental Services. Data current as of April 2004. Information is not provided for the cities of Alexandria and Falls Church. Prepared by DPZ - PD using Fairfax County GIS.
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Data regarding releases from above ground storage tanks are not available. However, experiences of the County's Fire and Rescue Department suggest that most releases from such tanks are a result of human error, either due to improper filling of the tanks or to accidental damage to the tanks. Leaks can also occur as a result of corrosion and freezing/thawing of pipes. VDEQ has prepared a fact sheet for owners of home heating oil tanks that offers useful recommendations regarding the placement and routine inspection and maintenance of such tanks and guidance regarding leaks from these tanks. A monthly tank checklist is provided within this brochure.

SANITARY SEWER

Figure 21 displays the location of the approved sanitary sewer service area in Fairfax County (known as the Board-adopted "Approved Sewer Service Area," or ASSA); this area covers nearly 234 square miles of the County. Fairfax County's policy is to limit the expansion of this area to those areas with densities or intensities of development that require such service and that are contiguous to the existing service area. Expansions of the sanitary sewer service area may also be considered where needed to remedy public health problems caused by failing on-site sewage disposal systems. In general sanitary sewer service is not provided to lower density residential areas. In all, Fairfax County has and maintains approximately 3,145 miles of sanitary sewer lines, 50 sewage flow meters, 61 pumping stations, and 257 sewage grinder pumps. More than 87% of the 360,000 households and virtually all businesses in the County are connected to public sewer.

Leaking sanitary sewer lines can introduce bacterial, nutrient, and other pollutants into the surface water and groundwater systems. As such, the inspection of these lines for leaks and the repair of any leaking pipe is critical to the maintenance and restoration of high quality water resources in Fairfax County. The County's Department of Public Works and Environmental Services (DPWES) maintains a 24-hour emergency response line through which citizens can report sanitary sewer system backups, line breaks, sewage odors, and overflowing manholes. In addition, DPWES has an infiltration abatement program. This program includes evaluations of the sewer system to identify areas with excessive inflow/infiltration problems. In addition, DPWES tests portions of the sanitary sewer system each year through mechanical techniques; closed circuit television inspection is pursued along sewer lines with suspected leaks and in older portions of the sanitary sewer system. Where leaks are detected or suspected, DPWES will pursue repair and rehabilitation efforts, including dig up repairs, manhole rehabilitation, and trenchless pipe repair technologies such as robotic, cured-in-place, and fold-and reformed pipe rehabilitation processes. In 2003, 187 miles of old sewer lines and 34 miles of new sewer lines were inspected, and approximately 26 miles of sanitary sewer lines were rehabilitated. Over 170 miles of sewer line have been rehabilitated over a six year period.

ON-SITE SEWAGE DISPOSAL SYSTEMS

There are approximately 30,000 parcels in Fairfax County with on-site sewage disposal systems. This number changes as older homes are demolished for new development and new homes are built on vacant lots without public sewer. Roughly 99% of these systems are traditional septic systems; other, newer systems are used to a more limited degree. All on-site sewage disposal

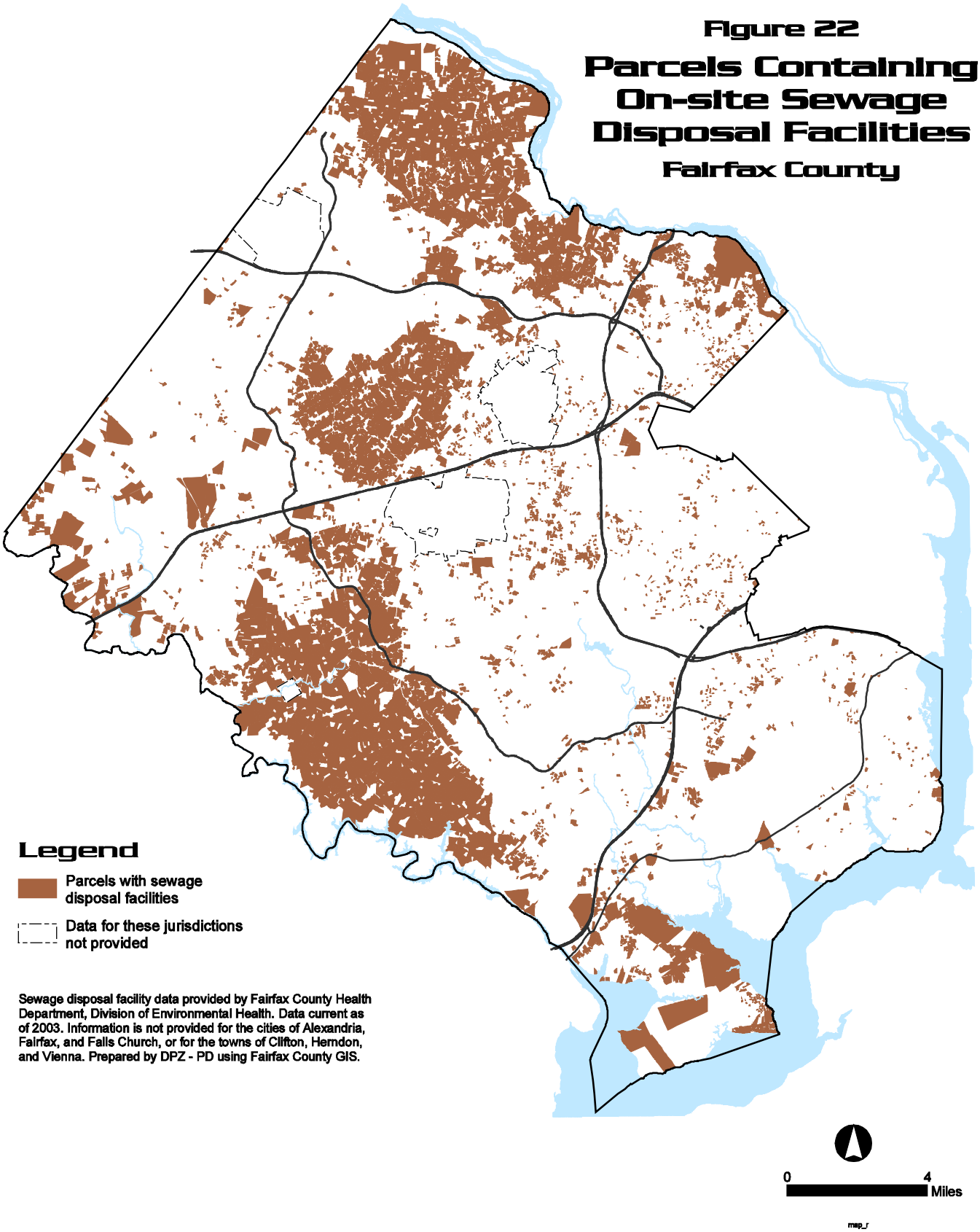
Figure 22
Parcels Containing On-site Sewage Disposal Facilities
Fairfax County
Legend
Parcels with sewage disposal facilities
Data for these jurisdictions not provided
Sewage disposal facility data provided by Fairfax County Health Department, Division of Environmental Health. Data current as of 2003. Information is not provided for the cities of Alexandria, Fairfax, and Falls Church, or for the towns of Clifton, Herndon, and Vienna. Prepared by DPZ - PD using Fairfax County GIS.
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systems are regulated by Chapter 68.1 of the Fairfax County Code, which incorporates the Commonwealth of Virginia Sewage Handling and Disposal Regulations by reference.

On-site sewage disposal facilities are concentrated in lower density residential areas of the County, where access to the County's sanitary sewer system is not provided (Figure 22). As noted earlier, it is the County's policy to limit the expansion of the sanitary sewer system to those areas with densities or intensities of development that require such service and that are contiguous to the existing service area. Expansions of the sanitary sewer service area may, however, also be considered where needed to remedy public health problems caused by failing on-site sewage disposal systems.

Properly designed, sited, and maintained septic systems should not pose a threat to groundwater or surface water resources. However, systems that are improperly designed, improperly installed, and/or poorly maintained are likely to have more limited life spans, eventually resulting in system failure and in potential releases of pollutants into surface water and/or groundwater resources. Chapter 68.1 of the Fairfax County Code establishes design, siting, and maintenance requirements for all on-site sewage disposal facilities, including maximum soil percolation rate criteria for drain fields as well as separation distances that must be maintained between septic system components (including drain fields) and a variety of man made and natural features, including surface water resources. All new traditional septic systems are required to have alternating drain fields, a 100 percent reserve drain field area (recently increased from 50%), standardized pump chamber design when applicable, and above ground inspection ports on the septic tank.

Fairfax County's maintenance requirements include mandatory pumping of septic tanks at least once every five years, and annual notices are sent to all system owners advising them of the need to turn the flow diversion valves. Notices for septic tank pump-outs are sent to property owners once every five years; approximately one-fifth of all septic tanks are pumped each year. Even if properly maintained, septic systems will ultimately need to be rehabilitated or replaced.

The County's design, siting, and maintenance requirements have generally been effective in minimizing the extent of contamination associated with on-site sewage disposal. The County is one of only a few counties in the State to require permits for all repairs of septic systems. In Fiscal Year 2003, 995 onsite septic systems were evaluated for system repair as a result of referrals and complaints Countywide. Of these evaluations, 776 repair permits were issued for repair or replacement of mechanical components of the system, with approximately 1% of the permits requiring complete replacement of a failed septic system. This trend has remained steady for the past three years. However, several areas of the County have soils that have slow percolation rates and therefore are poorly suited for traditional on-site sewage disposal systems. An emerging concern in these areas is the advent of technologically advanced, high maintenance alternatives to traditional on-site sewage disposal systems. These facilities have been proposed in Fairfax County at an increasing rate, and the technological complexity of most of these systems and their associated intensive maintenance requirements generate concerns about the ability of property owners to maintain these facilities appropriately. These facilities, when well-maintained, do not present a threat to water resources. However, should these systems not be maintained adequately, they can fail, resulting in the pollution of surface and groundwater

resources. This concern was highlighted in the recent report of the New Millennium Occoquan Watershed Task Force. The County's Environmental Coordinating Committee has appointed an interagency subcommittee to explore solutions to this concern, including the possible establishment of a self-supporting authority to provide for the management of on-site sewage disposal systems. ■

WATER QUALITY CONDITIONS

While some of Fairfax County's water resources exhibit characteristics that are supportive of high quality ecological systems, most bodies of water in the County have experienced degradation as land use changes within their watersheds have resulted in increased impervious cover, with the resulting changes in hydrologic conditions as described earlier in this report. In addition, high fecal coliform bacteria concentrations have been measured in streams throughout the County. Several ongoing efforts have documented various aspects of water quality conditions in the County. This section of this report highlights key findings from several of these efforts.

ANNUAL STREAM WATER QUALITY REPORT

The Stream Water Quality Report has been produced on an annual basis by the Fairfax County Health Department; responsibility for production of this report is now being assumed by the Department of Public Works and Environmental Services. The report presents chemical, temperature, and fecal coliform bacteria data obtained from stream sampling sites located throughout the County. The 2002 report includes data collected from 84 sampling sites taken from 25 of the County's 30 watersheds. Monitoring parameters include fecal coliform bacteria, total phosphorus, nitrate nitrogen, dissolved oxygen, pH, and temperature. In addition, the 2002 report presents data associated with ten years of testing for eight heavy metals as well as results of analysis of grab samples taken from Lake Accotink and a sampling effort in the Accotink Watershed within Fairfax City.

The data do not indicate significant trends in average stream temperature or in chemical parameter concentrations in the 17 year period identified in the 2002 report (the report includes data from 1986-2002). Further, almost all samples collected met chemical water quality standards (with 6% of the samples having dissolved oxygen concentrations below 4.0 mg/l, four samples exceeding 10 mg/l of nitrate nitrogen, four samples with pH values above 8.5, and 16 samples with pH values below 6.0 (with follow-up testing indicating normal pH at these sites). However, consistent with previous years' analyses, fecal coliform bacteria concentrations routinely exceeded Virginia's Water Quality Standards; only 17% of the samples had fewer than 200 fecal coliform bacteria per 100 ml of water (Virginia's geometric mean standard for two or more samples over a 30 day period), and 25% of the samples had more than 1,000 fecal coliform bacteria per 100 ml of water (Virginia's single-event standard). More discussion regarding fecal coliform bacteria issues is provided later.

STREAM PROTECTION STRATEGY

The Stream Protection Strategy (SPS) program was initiated in 1997 in order to provide a comprehensive assessment of the ecological health of the County's streams based on biological, physical, and chemical conditions. A comprehensive baseline survey was initiated in 1998 that included the monitoring of 114 stream segments Countywide; this study established the first survey of fish and benthic macroinvertebrate (aquatic insects) communities in the County. The results of this survey, which was published in January, 2001, were used to classify each of the

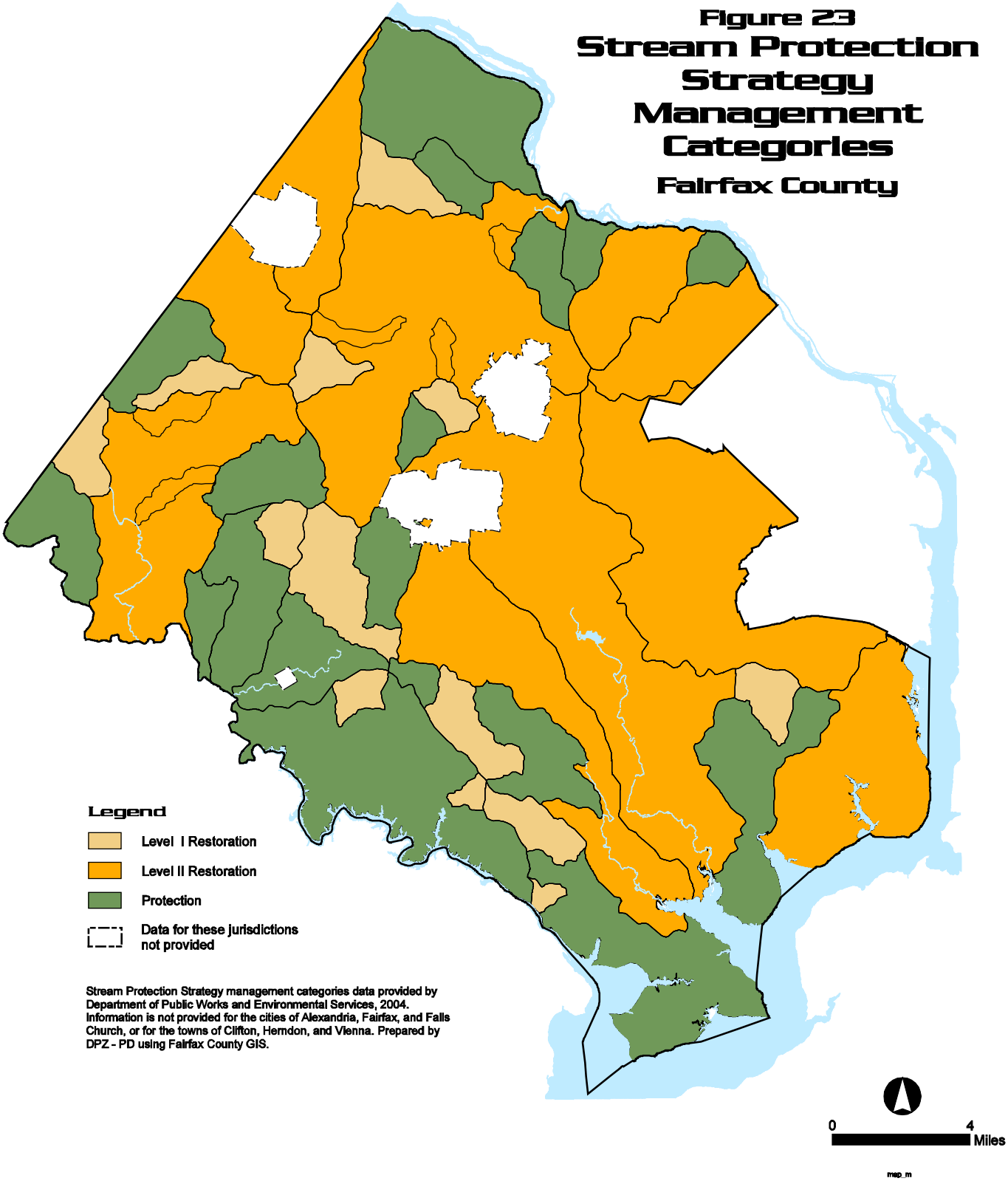
Figure 23
Stream Protection Strategy Management Categories
Fairfax County
Legend
Level I Restoration
Level II Restoration
Protection
Data for these jurisdictions not provided
Stream Protection Strategy management categories data provided by Department of Public Works and Environmental Services, 2004. Information is not provided for the cities of Alexandria, Fairfax, and Falls Church, or for the towns of Clifton, Herndon, and Vienna. Prepared by DPZ - PD using Fairfax County GIS.
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County's subwatersheds into management categories based on their biological conditions and projected land use changes. Three categories were established as follows:

- Watershed Protection: This category has been assigned to subwatersheds with streams with biological communities that are relatively healthy. The primary goal in these areas is to "preserve biological integrity by taking measures to identify and protect, to the extent possible, the conditions responsible for current high quality rating of these streams."

- Watershed Restoration Level I: This category has been assigned to subwatersheds with streams that have fair biological conditions and that are in areas where substantial development activity is ongoing, but that still hold potential for significant stream quality enhancement. The primary goal in these areas is "to reestablish healthy biological communities, where feasible, by taking measures to identify and remedy the cause(s) of stream degradation both broad scale and site specific."

- Watershed Restoration Level II: This category has been assigned to subwatersheds characterized by relatively high development densities, significantly degraded instream habitat conditions, and significantly impacted biological communities. The primary goal in these areas is "to maintain areas to prevent further degradation and to take active measures to improve water quality to comply with Chesapeake Bay initiatives, Total Maximum Daily Load (TMDL) regulations and other water quality initiatives and standards."

Figure 23 displays the management categories assigned to subwatersheds in Fairfax County. There are some differences between the subwatershed-specific categories shown in Figure 23 and a similar figure that was presented in the January, 2001 publication. This is due to reclassifications that have been made by the Department of Public Works and Environmental Services subsequent to the publication of the report.

The SPS Baseline Study concluded that there is a statistically significant relationship between drainage area imperviousness and biological quality; the highest quality streams are located in areas that are largely undeveloped or developed in low densities, while the most degraded streams are located in areas that are most intensely developed. This relationship is evident in Figure 23; which generally identifies the lowest-impervious subwatersheds as being in the "Watershed Protection" category.

The SPS program has served as a springboard for more intensive stream assessment and watershed management efforts, which are described below and later in this report. The SPS program itself is ongoing, with a stratified random sampling procedure used to evaluate the state of the County's streams on an annual basis and the establishment of permanent sites to assess trends at selected locations. Data provided by volunteer water quality monitors from the Northern Virginia Soil and Water Conservation District and the Audubon Naturalist Society will be used to support trend analysis; these data, which are collected at each monitoring location several times per year, also provide information that can be used to identify and alert appropriate

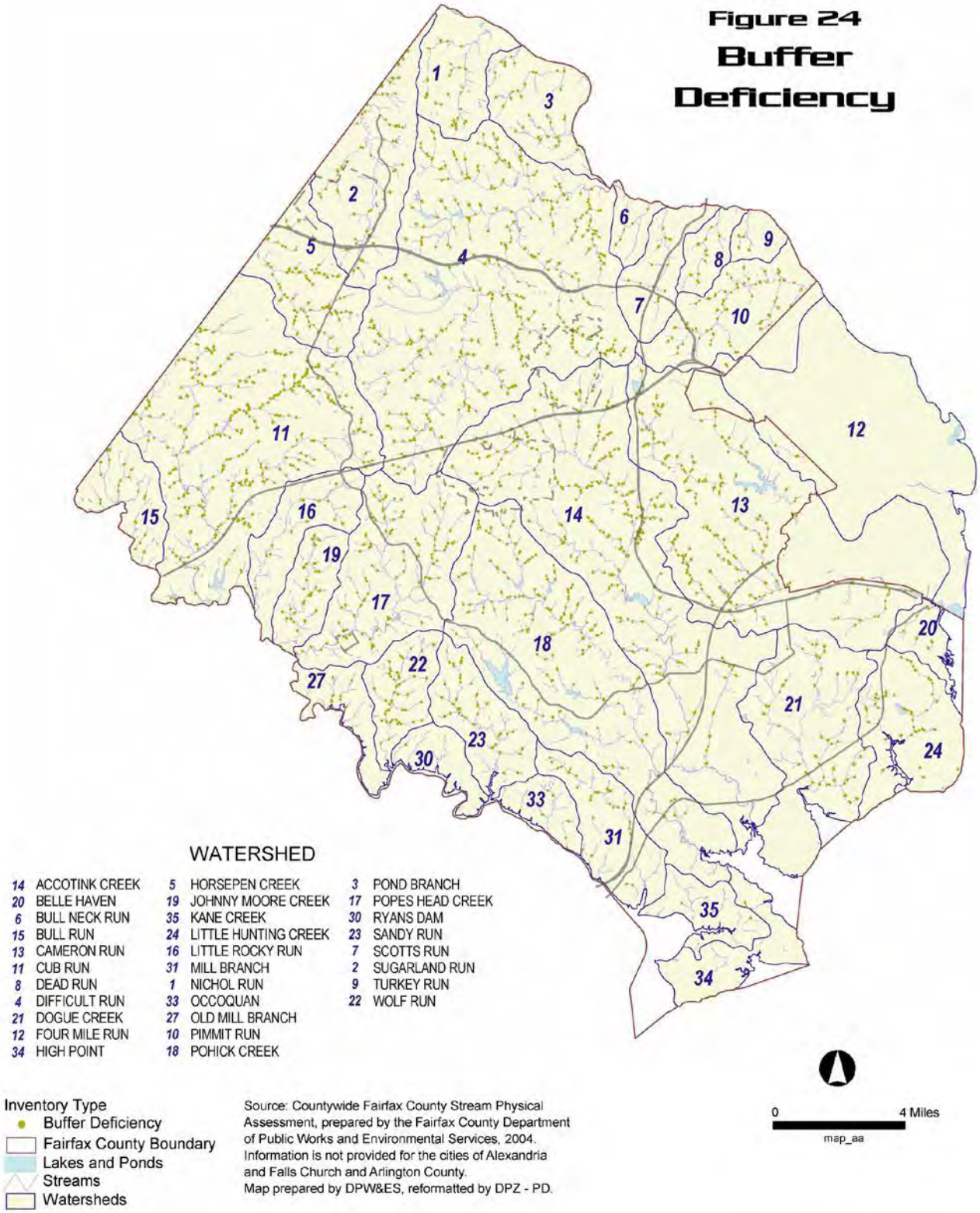
Figure 24
Buffer
Deficiency
WATERSHED
14 ACCOTINK CREEK
20 BELLE HAVEN
6 BULL NECK RUN
15 BULL RUN
13 CAMERON RUN
11 CUB RUN
8 DEAD RUN
4 DIFFICULT RUN
21 DOGUE CREEK
12 FOUR MILE RUN
34 HIGH POINT
5 HORSEPEN CREEK
19 JOHNNY MOORE CREEK
35 KANE CREEK
24 LITTLE HUNTING CREEK
16 LITTLE ROCKY RUN
31 MILL BRANCH
1 NICHOL RUN
33 OCCOQUAN
27 OLD MILL BRANCH
10 PIMMIT RUN
18 POHICK CREEK
3 POND BRANCH
17 POPES HEAD CREEK
30 RYANS DAM
23 SANDY RUN
7 SCOTTS RUN
2 SUGARLAND RUN
9 TURKEY RUN
22 WOLF RUN
Inventory Type
Buffer Deficiency
Fairfax County Boundary
Lakes and Ponds
Streams
Watersheds
Source: Countywide Fairfax County Stream Physical Assessment, prepared by the Fairfax County Department of Public Works and Environmental Services, 2004.
Information is not provided for the cities of Alexandria and Falls Church and Arlington County.
Map prepared by DPW&ES, reformatted by DPZ - PD.
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parties to problems such as rapidly degrading stream channels and illegal discharges. A fecal coliform monitoring component will be incorporated into the SPS program in the future. A Watershed Protection and Restoration strategies study is also being completed with the following goals:

- Establishment of management categorizations at the subwatershed scale based on predicted ultimate imperviousness;
- The identification of areas where the use of selected Low Impact Development (LID) techniques for promoting groundwater recharge is most feasible;
- The ranking and prioritization of subwatersheds for implementation of LID techniques and stormwater quality retrofits.

COUNTYWIDE STREAM PHYSICAL ASSESSMENT

An extensive set of baseline stream condition information has been collected throughout the County to support watershed protection and restoration efforts. This assessment was conducted on approximately 801 miles of streams, and results will be incorporated into the watershed planning process to assist in the determination of appropriate watershed management strategies. The assessments included an inventory of physical stream features and habitat assessments; inventory information such as stream obstructions, stream reaches experiencing erosion, insufficient riparian buffer areas, and dump sites along streams will be incorporated into the watershed management planning process. Maps displaying the following features are provided in Figures 24, 25, and 26:

- Buffer Deficiencies;
- Pipes, Ditches, Dumps, and Utilities; and
- Erosion and Obstructions.

IMPAIRED WATERS

As noted on the Web site of the Virginia Department of Environmental Quality (VDEQ), Section 303 (d) of the Clean Water Act requires states to identify waters that are not in compliance with water quality standards and to develop plans, known as "Total Maximum Daily Loads," or TMDLs, to restore and maintain the water quality for these impaired waters. The TMDL effort is designed to determine the total amounts of pollutants of concern that a particular body of water can receive and still achieve water quality standards. In Virginia, the 1997 Water Quality Monitoring, Information and Restoration Act requires that implementation plans be developed for every TMDL in the state in order to bring pollutant loads down to the levels identified by the TMDLs. Two TMDLs have been developed by the state and approved by the U.S. Environmental Protection Agency for bodies of water in or near Fairfax County: a 4.5 mile segment of Accotink Creek upstream of Lake Accotink; and Four Mile Run, which is located largely in Arlington County and the City of Alexandria but which collects drainage from portions of Fairfax County. An implementation plan has been developed for Four Mile Run, and an implementation plan is being developed for Accotink Creek.

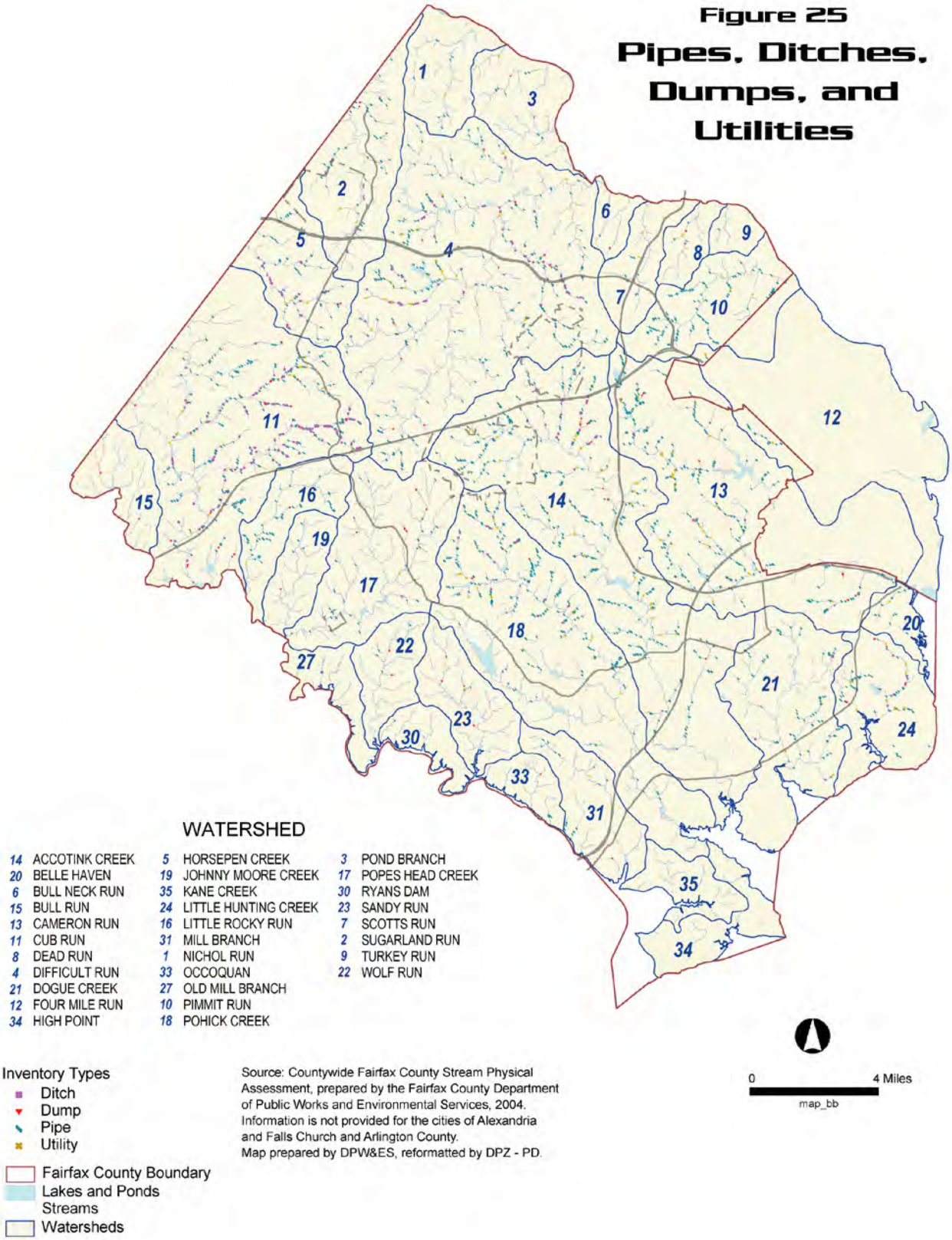
Figure 25
Pipes, Ditches, Dumps, and Utilities
WATERSHED
14 ACCOTINK CREEK
20 BELLE HAVEN
6 BULL NECK RUN
15 BULL RUN
13 CAMERON RUN
11 CUB RUN
8 DEAD RUN
4 DIFFICULT RUN
21 DOGUE CREEK
12 FOUR MILE RUN
34 HIGH POINT
5 HORSEPEN CREEK
19 JOHNNY MOORE CREEK
35 KANE CREEK
24 LITTLE HUNTING CREEK
16 LITTLE ROCKY RUN
31 MILL BRANCH
1 NICHOL RUN
33 OCCOQUAN
27 OLD MILL BRANCH
10 PIMMIT RUN
18 POHICK CREEK
3 POND BRANCH
17 POPES HEAD CREEK
30 RYANS DAM
23 SANDY RUN
7 SCOTTS RUN
2 SUGARLAND RUN
9 TURKEY RUN
22 WOLF RUN
Inventory Types
Ditch
Dump
Pipe
Utility
Fairfax County Boundary
Lakes and Ponds
Streams
Watersheds
Source: Countywide Fairfax County Stream Physical Assessment, prepared by the Fairfax County Department of Public Works and Environmental Services, 2004.
Information is not provided for the cities of Alexandria and Falls Church and Arlington County.
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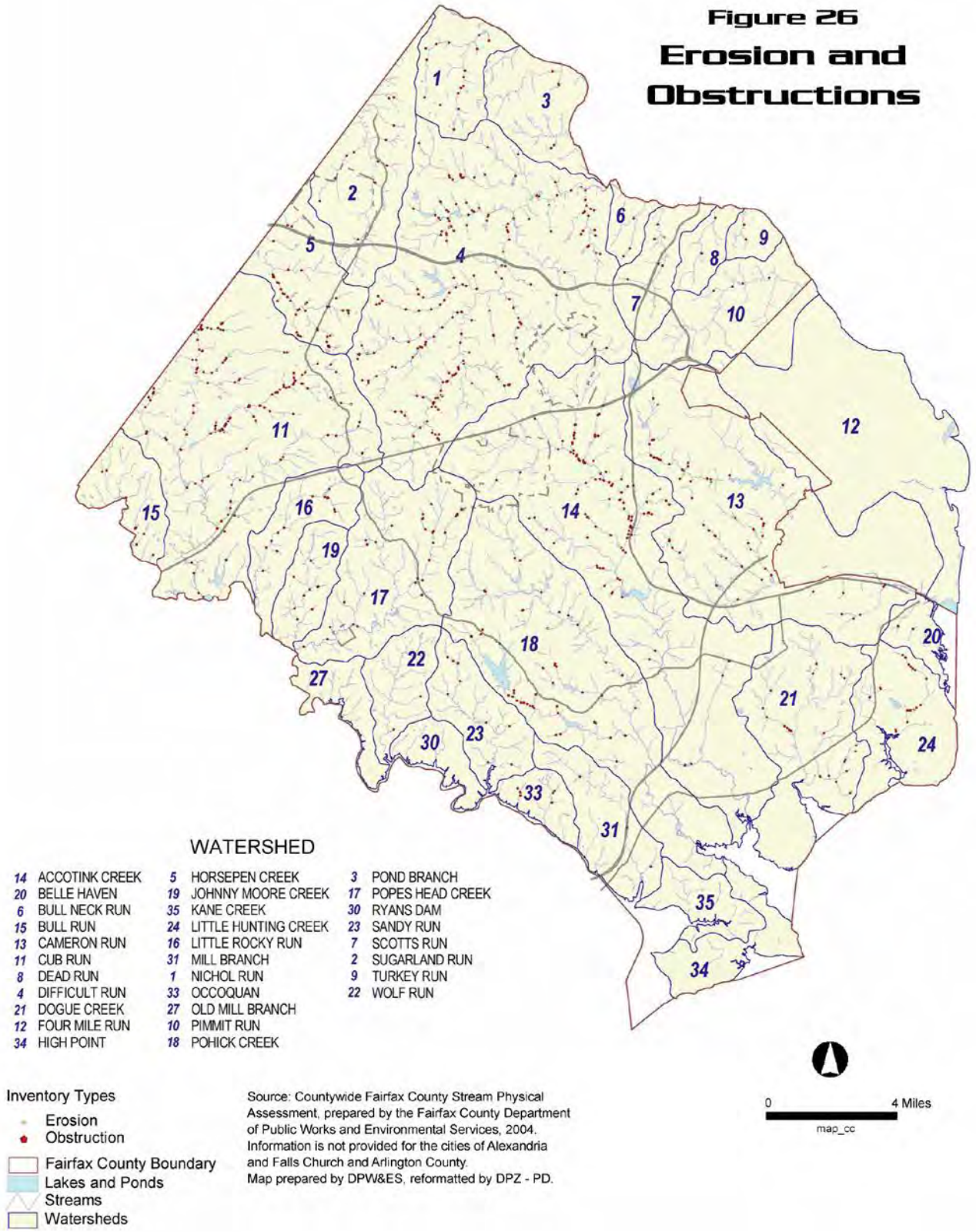
Figure 26
Erosion and Obstructions
WATERSHED
14 ACCOTINK CREEK
20 BELLE HAVEN
6 BULL NECK RUN
15 BULL RUN
13 CAMERON RUN
11 CUB RUN
8 DEAD RUN
4 DIFFICULT RUN
21 DOGUE CREEK
12 FOUR MILE RUN
34 HIGH POINT
5 HORSEPEN CREEK
19 JOHNNY MOORE CREEK
35 KANE CREEK
24 LITTLE HUNTING CREEK
16 LITTLE ROCKY RUN
31 MILL BRANCH
1 NICHOL RUN
33 OCCOQUAN
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3 POND BRANCH
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30 RYANS DAM
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2 SUGARLAND RUN
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22 WOLF RUN
Inventory Types
Erosion
Obstruction
Fairfax County Boundary
Lakes and Ponds
Streams
Watersheds
Source: Countywide Fairfax County Stream Physical Assessment, prepared by the Fairfax County Department of Public Works and Environmental Services, 2004.
Information is not provided for the cities of Alexandria and Falls Church and Arlington County.
Map prepared by DPW&ES, reformatted by DPZ - PD.
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VDEQ updates its list of impaired waters in Virginia every two years. The 2002 list identified 17 bodies of water that are partially or entirely located in Fairfax County that are impaired (see Table 6). TMDLs and implementation plans will need to be prepared for each of these bodies of water. It is anticipated that TMDLs will be developed for these waters by 2014, with several TMDLs to be developed earlier (e.g., Popes Head Creek, Bull Run, Difficult Run, and another segment of Accotink Creek).

A draft of the 2004 Water Quality Assessment 305(b)/303(d) Integrated Report, dated March, 2004, identifies a number of changes to the list of impaired waters, including additional impaired waters designations as follows:

1. Holmes Run downstream of Lake Barcroft (fecal coliform);
2. Holmes Run upstream of Lake Barcroft (general standard—benthic);
3. Tripps Run upstream of Lake Barcroft (general standard—benthic).

This report also identifies additional impairments for bodies of water that had already been identified as being impaired, as follows:

1. Difficult Run downstream of Captain Hickory Run (fecal coliform and e Coli);
2. The tidal portion of Little Hunting Creek (fecal coliform);
3. The nontidal portion of Accotink Creek downstream of Calamo Branch (fecal coliform);
4. Other portions of Accotink Creek upstream of Lake Accotink (e Coli)
5. A segment of Bull Run between Cub Run and roughly one mile downstream of Popes Head Creek (fecal coliform)
6. The Occoquan River near the Route 123 bridge (fecal coliform)

As part of the development of TMDLs for Accotink Creek and Four Mile Run, studies were undertaken to determine the sources of the fecal coliform bacteria that are present in each stream. For Accotink Creek, the United States Geological Survey (USGS), in partnership with the Virginia Department of Conservation and Recreation (DCR), VDEQ, the City of Fairfax, and Fairfax County, conducted DNA tests to "fingerprint" the species associated with the fecal coliform bacteria extracted from stream water samples. The initial study results indicated that sources of bacteria from identifiable samples were distributed as follows: 40% waterfowl; 20% human; 13% dogs; 5.4% raccoons; 1.4% deer; and 21% other. A draft TMDL for Accotink Creek that has been developed by VDEQ and approved by the U.S. Environmental Protection Agency (EPA) includes a goal to reduce the human sources of fecal coliform bacteria by 99%. As a follow-up to the TMDL, the USGS has initiated another study, in cooperation with Fairfax County, the City of Fairfax, and DCR, to identify and track specific sources of discharges of human fecal coliform bacteria into the Accotink Creek watershed. It is anticipated that this study will lead to the development of a cost-effective implementation plan for the watershed to address TMDL requirements.

For Four Mile Run, the Northern Virginia Regional Commission (NVRC), in partnership with the Virginia Polytechnic Institute, conducted a DNA "fingerprinting" analysis of the sources of fecal coliform bacteria in streams in that watershed. The results of this analysis, as presented in the TMDL report that was submitted to and accepted by VDEQ (and subsequently approved by

TABLE 6
Impaired Waters in Fairfax County:
The Virginia Department of Environmental Quality's 2002 List

Name	County	Impairment
Sugarland Run	Fairfax, Loudoun	Fecal Coliform
Difficult Run	Fairfax	General Standard (Benthic)
Pimmit Run	Fairfax, Arlington	Fecal Coliform
VA Tidal Waters from Woodrow Wilson Bridge to Brent Point	Fairfax, Prince William, Stafford	Fish Tissue - PCBs
Hunting Creek/Cameron Run	Fairfax, Alexandria, City of	Ammonia, Fecal Coliform, Fish Tissue - PCBs
Backlick Run	Fairfax, Alexandria, City of	Fecal Coliform
Little Hunting Creek	Fairfax	Fish Tissue - PCBs
Pohick Bay	Fairfax	Ammonia, Fish Tissue - PCBs
Accotink Creek	Fairfax, Fairfax City of	Fecal Coliform
Accotink Creek *	Fairfax	Fecal Coliform
Accotink Creek	Fairfax	General Standard (Benthic)
Pohick Creek	Fairfax	Fecal Coliform, Fish Tissue - PCBs, PAH
Popes Head Creek	Fairfax	General Standard (Benthic)
Bull Run	Prince William, Fairfax	General Standard (Benthic)
Occoquan Reservoir	Fairfax, Prince William	Dissolved Oxygen, Total Phosphorus
Occoquan Bay	Fairfax, Prince William	pH, Fish Tissue - PCBs
Mills Branch	Fairfax	Fecal Coliform

Source: Virginia Department of Environmental Quality Web site.
Note: Four Mile Run is not listed on the Web site addressing TMDLs in Fairfax County, although a small portion of the watershed of Four Mile Run is located within the County. A TMDL Study for Four Mile Run has already been developed.
*A TMDL Study for this stream segment has already been developed.

EPA), indicated that sources of bacteria from identifiable samples were as follows: 31.8% waterfowl; 18.9% raccoons; 17.9% human; 12.9% canine; 5.6% deer; and 12.9% other. Of particular note in the Four Mile Run study was a suggestion that fecal coliform bacteria in storm drains appear to regrow, thereby perpetuating high fecal coliform bacteria concentrations. The TMDL allocations determined for Four Mile Run require reductions in current levels of fecal coliform bacteria from human and canine sources of 98%. It is anticipated that a ten-year strategy will be pursued to reduce fecal coliform bacterial levels in Four Mile Run that will focus on a broad range of actions, including outreach and education efforts.

The TMDL requirement to address the dissolved oxygen impairment in the Occoquan Reservoir is of particular note, in that the VDEQ "Impaired Waters Fact Sheet" indicates that the Reservoir "fully supports the public water supply use, and is not impaired as a drinking water source." However, the Reservoir is considered to be impaired because of low dissolved oxygen concentrations in the waters at the bottom of the reservoir (especially near the toe of the dam embankment); dissolved oxygen concentrations in these waters are typically below 4.0 mg/l. The VDEQ fact sheet recognizes that "bottom dissolved oxygen depletion occurs naturally in reservoirs due to stratification." Yet, a TMDL study identifying a strategy to remove the impairment must still be developed by VDEQ by 2010. In light of actions that have already been taken to reduce nutrient inputs into the Reservoir (e.g., stringent point source discharge limitations; nonpoint source best management practice requirements), this will be a particular challenge that has the potential to impact land use policies throughout the watershed of the Reservoir. At this time, the Northern Virginia Regional Commission and Occoquan Watershed Monitoring Laboratory are discussing the development of the TMDL study with VDEQ.

Another, broader, TMDL effort that is of particular note is that addressing the entirety of the Chesapeake Bay system. As noted on the Chesapeake Bay Program's Web site (www.chesapeakebay.net/info/wqcriteriatech/index.cfm), "most of the mainstem Chesapeake Bay and many of its tidal tributaries have been listed as impaired waters," and "a regulatory TMDL covering the entire 64,000 square mile Bay watershed will be put in place by 2011 if Bay water quality is not restored by 2010." Clearly, this lends considerable urgency to current cooperative, voluntary efforts to restore the health of the Chesapeake Bay and its tributaries. The current focus of this effort is the development of strategies to restore to the Bay and its tributaries those water quality conditions that are needed to support the living resources that inhabit these waters. "Tributary strategies" are being developed by each Bay Program jurisdiction in each of the Bay's major watersheds to identify the maximum pollutant loads that can be accommodated by each tributary consistent with the goal of restoring living resource habitats and to achieve reductions in pollutant loadings to attain these maximum pollutant loads. Once these targets are attained, they must be maintained (that is, increases in pollutant loadings resulting from continued growth and development must be offset). Efforts to develop a "Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy for the Shenandoah and Potomac River Basins" in Virginia are under way. While the Tributary Strategy and TMDL efforts fall beyond the scope of this Comprehensive Plan Supplement, the significance of this effort to Fairfax County should be recognized; indeed, it is possible, if not likely, that expensive nutrient and sediment reduction efforts, such as upgrades to sewage treatment plants, contributions to upgrades of plants to which the County contributes, and nonpoint source best

management practice retrofit projects, will need to be pursued. Growth and development policies and practices in the County and region could also be affected. Information regarding the State's Tributary Strategy effort can be found at the following Web site: http://www.naturalresources.virginia.gov/Initiatives/TributaryStrategies/index.cfm. ■

SHORELINE CONSIDERATIONS

Tidal shorelines are dynamic areas that are subject to both natural and man made stresses, and these stresses, in turn, are capable of degrading the living resources of the adjacent tidal waters. A central focus of the Chesapeake 2000 Agreement is the protection and restoration of these living resources, as evidenced by the following excerpt from the Agreement:

> "The Chesapeake Bay's natural infrastructure is an intricate system of terrestrial and aquatic habitats, linked to the landscapes and the environmental quality of the watershed. It is composed of the thousands of miles of river and stream habitat that interconnect the land, water, living resources and human communities of the Bay watershed. These vital habitats–including open water, underwater grasses, marshes, wetlands, streams and forests–support living resource abundance by providing key food and habitat for a variety of species. Submerged aquatic vegetation reduces shoreline erosion while forests and wetlands protect water quality by naturally processing the pollutants before they enter the water. Long-term protection of this natural infrastructure is essential. …"

Key management issues associated with tidal shoreline areas include:

(1) Shoreline erosion:

Tidal shoreline areas are typically dynamic and subject to the erosive force of tidal waters; private property and structures can be threatened by erosion. However, local engineered solutions to erosion concerns may, if not planned appropriately, aggravate erosion conditions elsewhere along the shoreline, resulting in water quality degradation through the introduction of sediment and associated nutrients as well as through the loss of natural riparian buffer areas.

(2) Shoreline access:

The recreational and aesthetic opportunities provided by tidal shoreline areas create demands for access to these areas. Yet the provision of access to these areas can, in some cases, have a deleterious effect on water quality. It should be stressed that some forms of recreational access to the tidal shoreline (e.g., activities related to environmental education, nature, and passive recreation) do not impact the shoreline and can provide a greater appreciation of the shoreline. However, other forms of access, while providing desirable recreational opportunities, can involve the clearing of vegetation that protects the shoreline from erosion and that provides valuable habitat and water quality improvement functions. Facilities associated with boating access (e.g., fueling facilities; sanitary waste storage facilities) can pollute water resources if not carefully managed. Motorboats themselves can create or exacerbate turbidity, thereby reducing water clarity and adversely affecting aquatic species. In addition, the

operation of such vessels can produce pollutants (e.g., spilled petroleum products, litter, and sanitary waste).

According to guidance provided by the Virginia Institute of Marine Science (VIMS), Fairfax County's tidal shoreline is approximately 76 miles in length, or slightly less than 1.5% of the entire tidal shoreline of the Commonwealth. One distinguishing characteristic of the County's shoreline area is its pattern of ownership. While much of the Commonwealth's shoreline area is privately owned (the Department of Conservation and Recreation's Division of Chesapeake Bay Local Assistance's Local Assistance Manual states that less than one percent of the shoreline is publicly owned), the situation is quite different in Fairfax County, where, according to the VIMS Shoreline Situation Report, approximately 63% of the County's tidal shoreline was in public ownership (including Mount Vernon) in 1979. Substantial majorities of the County's nontidal Potomac River and Occoquan Reservoir shorelines are also in public ownership.

Along the tidal shoreline, the National Park Service owns and maintains the George Washington Memorial Parkway, which stretches approximately 8.3 miles between Mount Vernon and the City of Alexandria. Only relatively small portions of the tidal shoreline in this area are privately owned. The multi-use Mount Vernon Trail is a central feature of the Parkway; it stretches 18.5 miles along the Potomac River shoreline from Theodore Roosevelt Island (near Rosslyn in Arlington County) to Mount Vernon. The trail, roughly 2/3 of which is located in Fairfax County, provides a major source of public access for citizens of the entire region as well as to visitors to the region. Another major federal owner of tidal shoreline land in Fairfax County is the U.S. Army; Fort Belvoir includes substantial areas of tidal shoreline along the Potomac River, Dogue Creek, and Gunston Cove.

The Mason Neck peninsula, which abuts several tidal bodies of water (the Potomac River, Gunston Cove, Occoquan Bay, and Belmont Bay), is predominantly held in public ownership, with over 6,000 acres preserved by several governing agencies. This area contains a National Wildlife Refuge, a State Park, a Regional Park, a Special Recreation Management Area managed by the Bureau of Land Management, and the historic Gunston Hall Plantation, which is owned and operated by the Commonwealth of Virginia.

Publicly-owned land is also prevalent along the County's tidal Occoquan River shoreline above Belmont Bay. Mount Vernon, which is not under government control but is owned and maintained by the Mount Vernon Ladies Association, also contains a substantial tidal shoreline area. Conditions along the County's nontidal shoreline are similar, with more than 5,000 acres along the shoreline of the Occoquan Reservoir under the ownership of the Northern Virginia Regional Park Authority (NVRPA) and substantial portions of the nontidal Potomac River shoreline in County or federal ownership (with approximately 700 acres of land along the nontidal Potomac River shoreline in Fairfax County protected by NVRPA). Fairfax Water has implemented a Shoreline Easement Policy that establishes what may be permitted within its flood easement immediately adjacent to and surrounding the Occoquan Reservoir.

The extent of public ownership of shoreline areas within Fairfax County affords significant protection to these areas that might not otherwise exist. This pattern of ownership also serves to provide opportunities for public recreational access to the shoreline and limits private shoreline

access and erosion control issues to relatively small areas of the County's tidal shoreline. Finally, the character of public ownership of much of the County's shoreline serves to remove many of these areas from local land use control. The County retains approval authority over development proposals on Regional Park land but does not have such authority over actions proposed on state and federal lands. The County participates in the review of land use proposals on state and federal lands but does not possess the ultimate authority over land use decisions on these properties.

Because of development that has already occurred along the County's tidal shoreline and the extent of publicly owned tidal shoreline areas, there are relatively few vacant or underutilized residential properties remaining in these areas. The nature and implications of this characteristic as they relate to tidal shoreline access issues are addressed later in this section of the report. Figure 27 displays existing land uses near the County's tidal shoreline.

TIDAL SHORELINE EROSION

INTRODUCTION

The northernmost extent of Fairfax County's tidal shoreline is along Cameron Run at the Alexandria City boundary. The tidal shoreline continues southward along Cameron Run, Hunting Creek, and the Potomac River and its embayments along and near the George Washington Memorial Parkway, Fort Hunt Park, Mount Vernon, Fort Belvoir, Pohick Bay Regional Park, Mason Neck State Park, and the Mason Neck National Wildlife Refuge. The tidal shoreline extends up the Occoquan River up to a point a short distance downstream of the lowermost of the two dams on the River. The Occoquan Reservoir, which is referenced elsewhere in this report, is located in the nontidal area upstream of the upper dam.

Webster's New Collegiate Dictionary defines "shoreline" as "the line where a body of water and the shore meet." While the actual location of this contact point in tidal areas will vary with the tide, the tidal shoreline is, for mapping purposes, typically the point of contact at mean low water. The tidal shoreline is subject to the littoral dynamics of tidal flow, wave action, prevailing currents and fetch.

The physical stability and the integrity of the shoreline are essential to water quality protection. It is with this in mind that the authors of the Chesapeake Bay Preservation Area Designation and Management Regulations sought to protect the water quality of the Bay and its tidal tributaries by designating the tidal shoreline as a primary component of the Resource Protection Area. The tidal shoreline is, therefore, a core component of the County's Resource Protection Area designation.

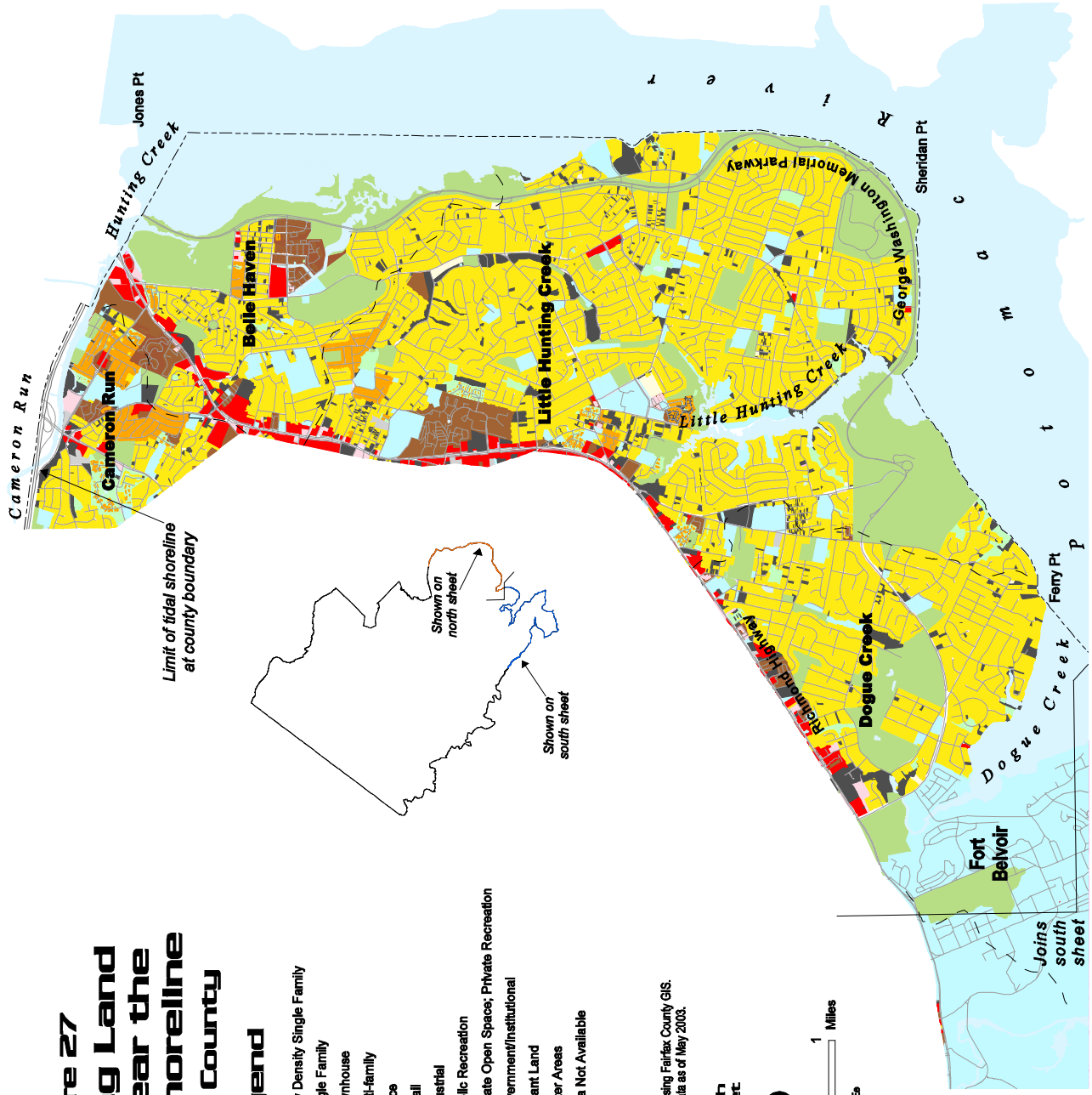
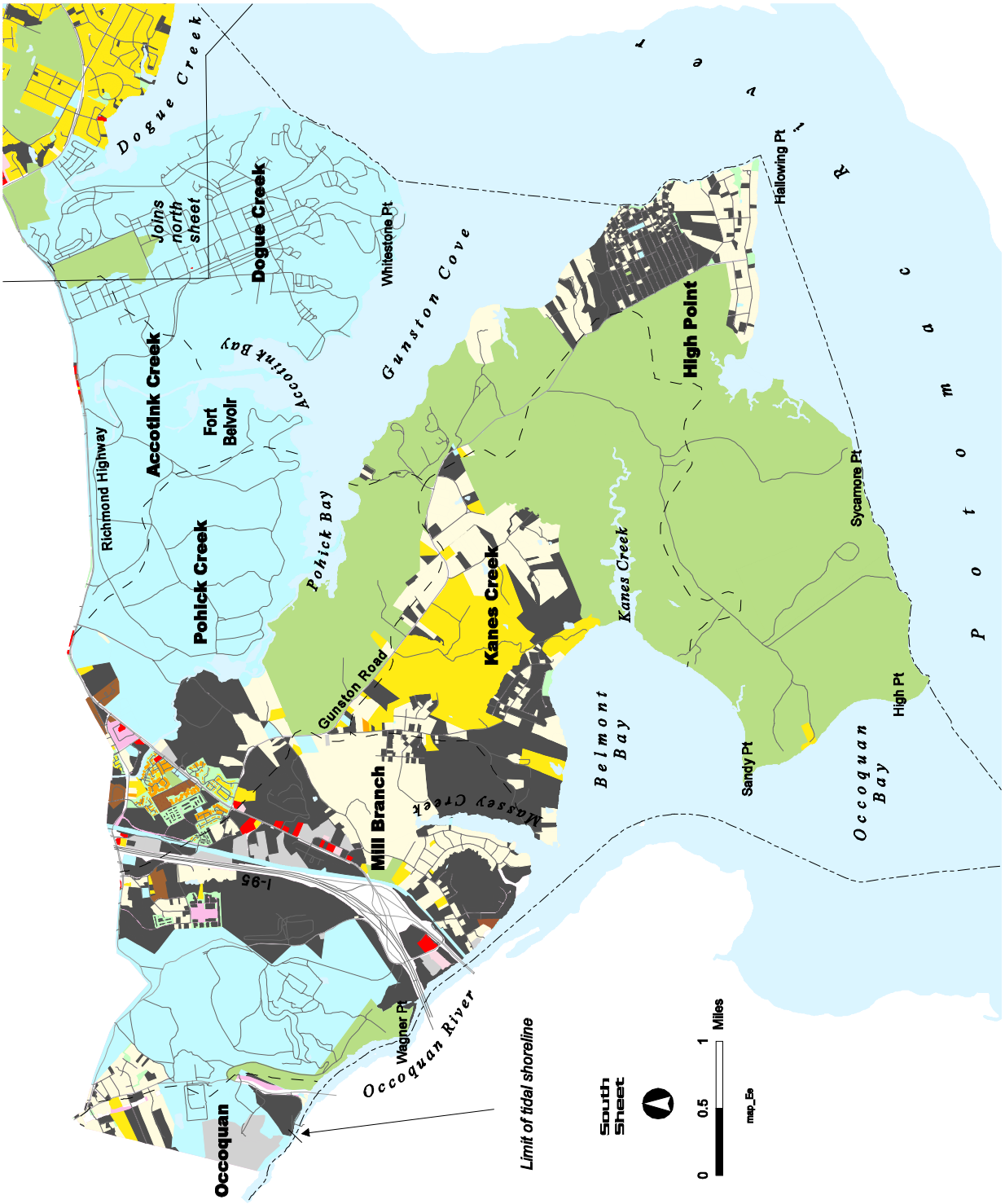


Figure 27
Existing Land Use Near the Tidal Shoreline
Fairfax County


Dogue Creek
Joins north sheet
Dogue Creek
Accotink Creek
Accotink Bay
Fort Belvoir
Richmond Highway
Pohick Creek
Pohick Bay
Gunston Cove
Whitestone Pt
Gunston Road
Kanes Creek
Kanes Creek
Massey Creek
Mill Branch
I-95
Belmont Bay
High Point
Hallowing Pt
Sycamore Pt
Sandy Pt
High Pt
Occoquan Bay
Potomac River
Wagner Pt
Occoquan River
Occoquan
Limit of tidal shoreline
South Sheet
0
0.5
1
Miles
map_Es

AERIAL PHOTO ANALYSIS OF TIDAL SHORELINE CONDITIONS--OVERVIEW

A visual survey of the County's tidal shoreline was performed in February and March of 2004 using 2002-2003 aerial orthophotography and other information.[5] The goals of the survey were threefold:

- Documentation of erosion and accretion along the tidal shoreline;
- Documentation of shoreline reaches where artificial shoreline stabilization structures are located; and
- Documentation of shoreline access structures (e.g., piers, boathouses, and ramps) that exist along the County's tidal shoreline.

Results from the shoreline erosion control components of this study are discussed briefly in this section; the next section of the report presents information regarding shoreline access facilities. Results from this analysis, presented for individual segments of the tidal shoreline based on watershed boundaries, are also included in Appendix A. It is noted that the information presented herein is based solely on air photo interpretation and has not been field checked. The analysis has been conducted for planning purposes only and does not substitute for a shoreline situation report prepared by the Virginia Institute of Marine Science.

There is little historic information available that describes erosion conditions along Fairfax County's tidal shoreline. The two documents of note that address this issue are:

- The Shoreline Situation Report: Counties of Fairfax and Arlington and the City of Alexandria, Virginia Institute of Marine Science, 1979; and

- "Tidal Shoreline Erosion in Northern Virginia," prepared by the Northern Virginia Planning District Commission (NVPDC) (now the Northern Virginia Regional Commission--NVRC) in 1992.

While the NVPDC document is more current than the Shoreline Situation Report, it relied on a comparative analysis of shoreline locations as depicted on two sets of United States Geological Survey 7.5 minute topographic quadrangle maps (dating from the early 1980s and mid-1960s/early 1970s). The potential errors associated with an evaluation of shoreline changes were acknowledged in the NVPDC report, and the report stressed that its information should not be used for site-specific planning purposes. For that reason, the shoreline analysis conducted for this report is presented in Appendix A along with information from the 1979 Shoreline Situation Report rather than the 1992 NVPDC document.

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[5] The following sources and tools were used in this analysis:
Fairfax County Orthophotography, March 1997
Pictometry (oblique aerial photography), January – August, 2003
Aerial Imagery © 2002 Commonwealth of Virginia
ArcGIS 8.3
ArcView3.3
ArcCatalog

The 1979 Shoreline Situation Report describes tidal erosion through the use of the following definitions:

- Less than (<) one foot per year –slight
- Between one foot and three feet – moderate
- Greater than three feet per year – severe

The analysis conducted in 2004 for this report did not characterize rates of erosion.

The results of the analysis of shoreline erosion conditions along the County's tidal shoreline are presented in Figure 28. Figure 29 presents information regarding the locations and types of shoreline erosion control structures that have been identified in this analysis.

FACTORS RELATED TO TIDAL SHORELINE STABILITY AND SENSITIVITY

The stability of a shoreline area and/or the associated implications of stable and unstable shorelines are related to many factors, including the following:

Fetch: Webster's New Collegiate Dictionary defines fetch as "the distance along open water or land over which the wind blows" and "the distance traversed by waves without obstruction." Essentially, the fetch is the distance that the wind blows across a body of water before it hits land. The fetch affects the momentum of wave action from a constant direction. The greater the fetch, the greater the potential force of wave action on the shoreline. Along Fairfax County's tidal shoreline, the fetch is particularly significant along the southern and western shores of the Mason Neck peninsula. As can be seen in Figure 28, much of this area is experiencing erosion.

Soils: Some soils are more highly erodible than others. Detailed soil maps are generally not available for the County's tidal shoreline; it is anticipated that this information will become available upon completion of the updated soil map for the County by the Natural Resources Conservation Service. However, five soil associations have been identified along the County's tidal shoreline within the U.S. Department of Agriculture's (Soil Conservation Service) 1963 General Soil Map of the County (see Figure 10).

Topography and Slope: In general, soil erodibility increases with slope gradient. Along the tidal shoreline, bluffs and other steeply sloping land is more susceptible to erosion and structural instability than is more gradually sloping land.

Runoff from Overland Flow: Related to topography and slope as well as land use and development, both sheet flow and concentrated runoff can serve to erode near-shore areas, thereby reducing their stability.

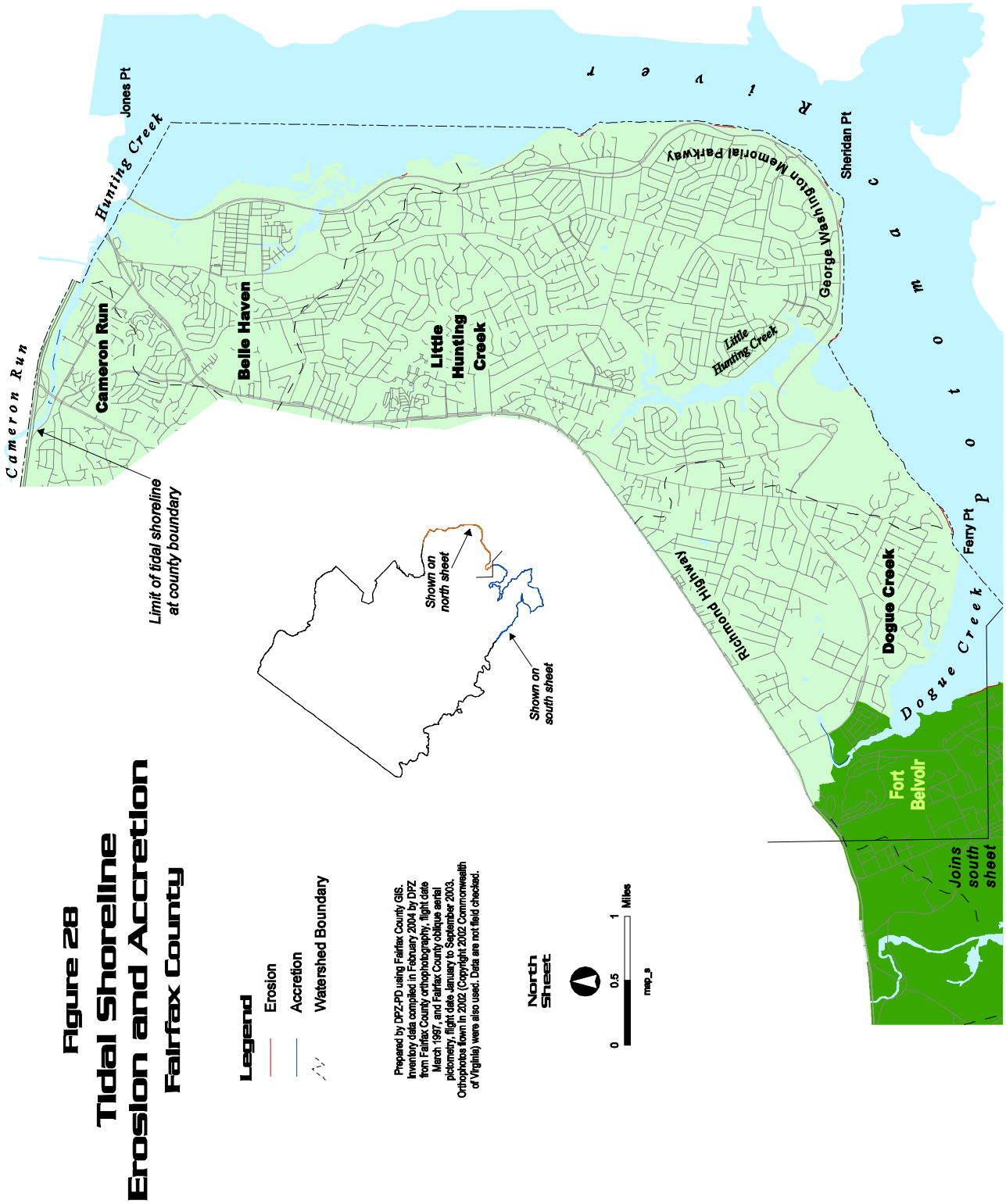
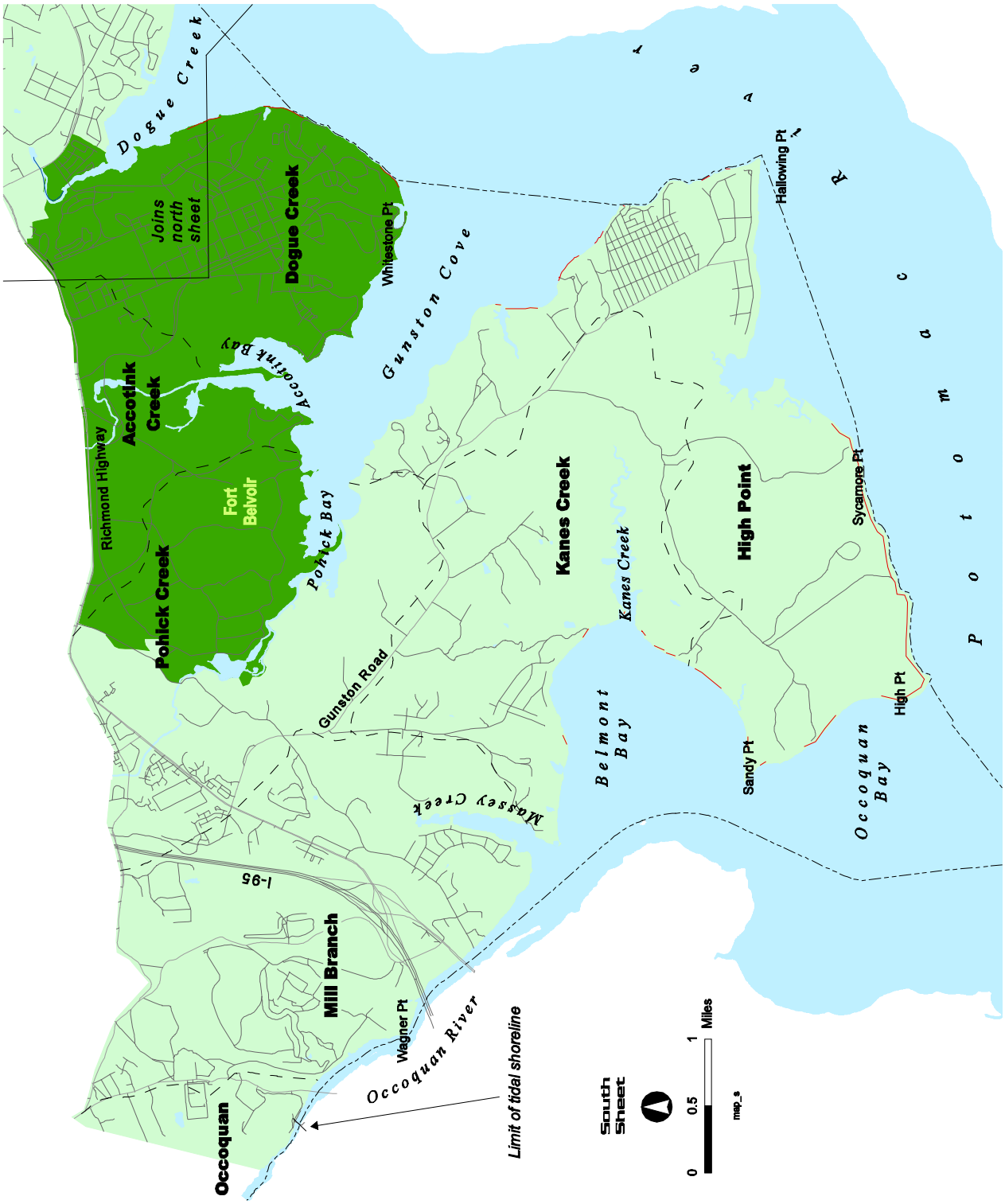


Figure 28
Tidal Shoreline
Erosion and Accretion
Fairfax County
Legend
Erosion
Accretion
Watershed Boundary
Prepared by DPZ-PD using Fairfax County GIS. Inventory data compiled in February 2004 by DPZ from Fairfax County orthophotography, flight date March 1997, and Fairfax County oblique aerial pictometry, flight date January to September 2003. Orthophotos from in 2002 (Copyright 2002 Commonwealth of Virginia) were also used. Data are not field checked.
North Sheet
0
0.5
1
Miles
map_8
Shown on north sheet
Shown on south sheet
Limit of tidal shoreline at county boundary
Cameron Run
Cameron Run
Hunting Creek
Jones Pt
Belle Haven
Little Hunting Creek
Little Hunting Creek
George Washington Memorial Parkway
Sheridan Pt
Potomac River
Richmond Highway
Dogue Creek
Dogue Creek
Ferry Pt
Fort Belvoir
Joins south sheet


Dogue Creek
Joins north sheet
Dogue Creek
Whitestone Pt
Gunston Cove
Accotink Bay
Accotink Creek
Richmond Highway
Fort Belvoir
Pohick Bay
Pohick Creek
Kanes Creek
Kanes Creek
High Point
Sycamore Pt
Hallowing Pt
Potomac River
Gunston Road
Belmont Bay
Massey Creek
Sandy Pt
Occoquan Bay
High Pt
I-95
Mill Branch
Wagner Pt
Occoquan River
Limit of tidal shoreline
Occoquan
South Sheet
0
0.5
1
Miles
map_s

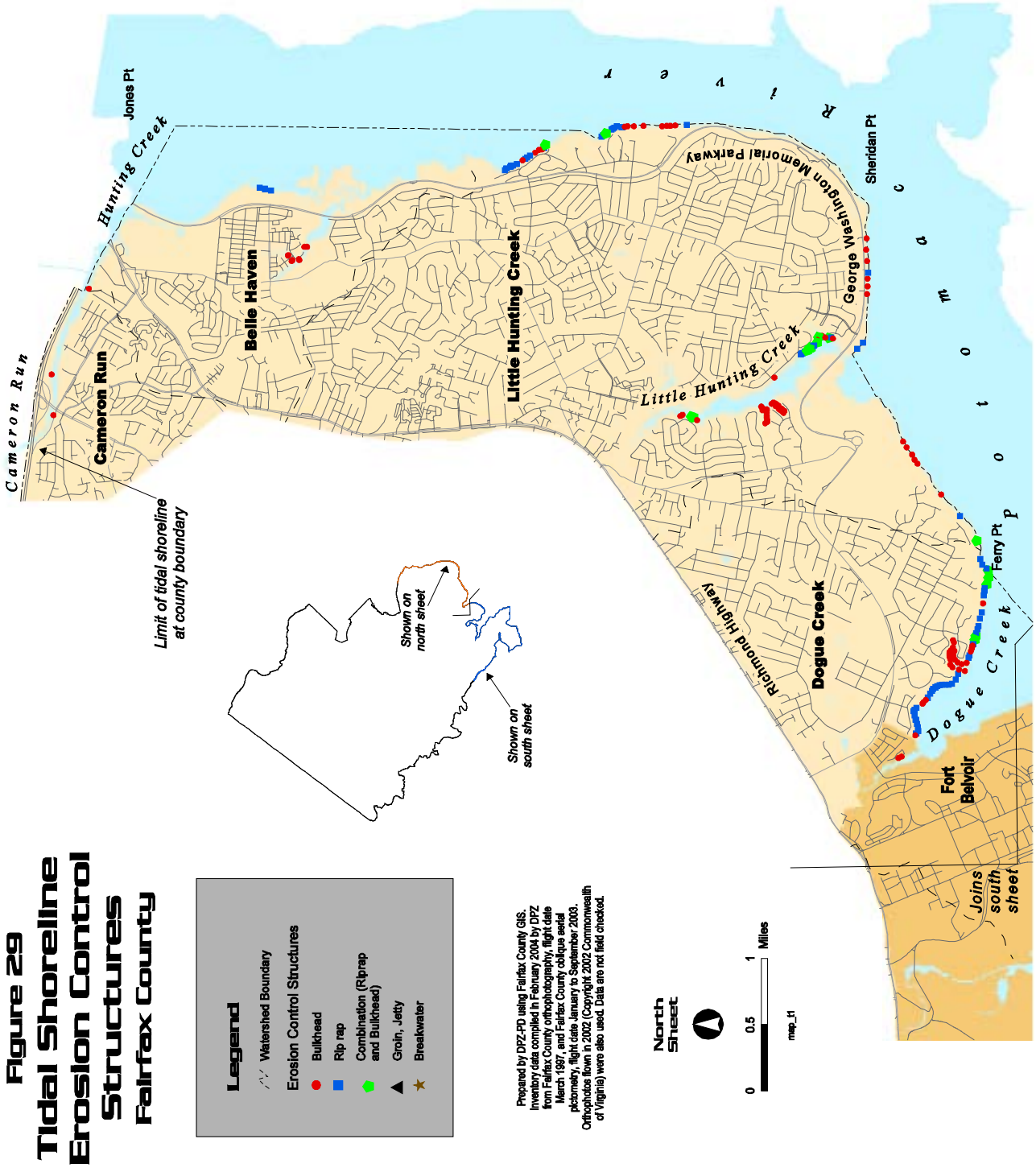
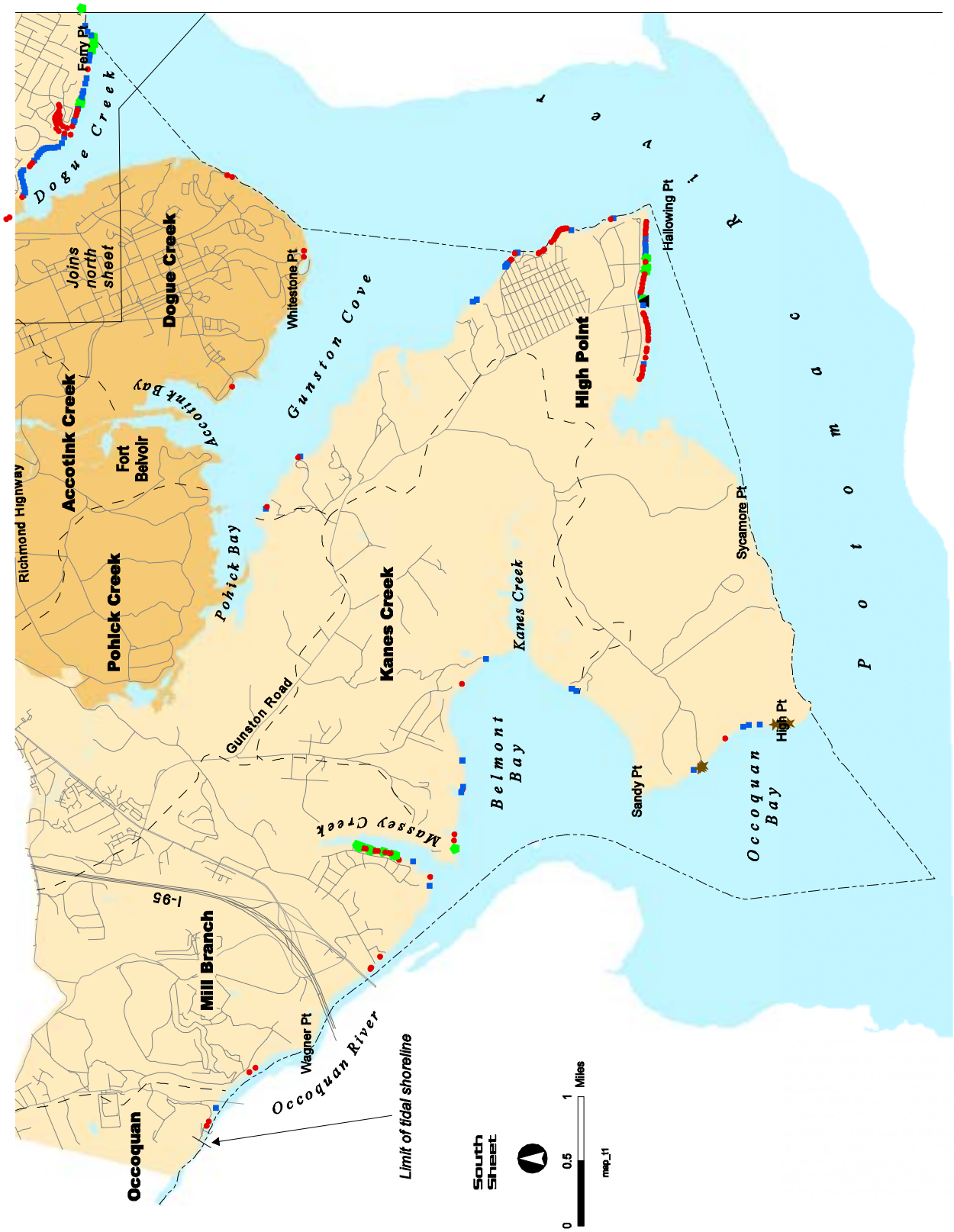


Figure 29
Tidal Shoreline Erosion Control Structures Fairfax County
Legend
Watershed Boundary
Erosion Control Structures
Bulkhead
Rip rap
Combination (Riprap and Bulkhead)
Groin, Jetty
Breakwater
Prepared by DPZ-PD using Fairfax County GIS. Inventory data compiled in February 2004 by DPZ from Fairfax County orthophotography, flight date March 1997, and Fairfax County oblique aerial pictometry, flight date January to September 2003. Orthophotos flown in 2002 (Copyright 2002 Commonwealth of Virginia) were also used. Data are not field checked.
North Sheet
0 0.5 1 Miles
map_t1
Shown on north sheet
Shown on south sheet
Limit of tidal shoreline at county boundary
Joins south sheet
Cameron Run
Cameron Run
Hunting Creek
Jones Pt
Belle Haven
Little Hunting Creek
Little Hunting Creek
George Washington Memorial Parkway
Sheridan Pt
Potomac River
Ferry Pt
Dogue Creek
Dogue Creek
Richmond Highway
Fort Belvoir


Ferry Pt
Dogue Creek
Joins north sheet
Dogue Creek
Whitestone Pt
Gunston Cove
Accotink Bay
Accotink Creek
Fort Belvoir
Richmond Highway
Pohick Bay
Pohick Creek
Gunston Road
Kanes Creek
Kanes Creek
High Point
Hallowing Pt
Sycamore Pt
Potomac River
Belmont Bay
Massey Creek
Sandy Pt
Occoquan Bay
High Pt
I-95
Mill Branch
Wagner Pt
Occoquan River
Occoquan
Limit of tidal shoreline
South Sheet
0
0.5
1
Miles
map_t1

Tidal Shoreline Erosion Control Structures Summary Table for Figure 29

(North and South Sheets)

Shoreline Erosion Control Structures By Type	Occurrences
Riprap	105
Bulkhead	182
Combination - Riprap and Bulkhead	29
Groin, Jetty	2
Breakwater	7
Total Structures	**325**

Prepared by DPZ-PD using Fairfax County GIS. Inventory data compiled in February 2004 by DPZ from Fairfax County orthophotography, flight date March 1997, and Fairfax County oblique aerial pictometry, flight date January to September 2003. Orthophotos flown in 2002 (Copyright 2002 Commonwealth of Virginia) were also used. Data are not field checked.

map_cl

Land Use and Development: Land use activities can affect the stability of a shoreline through the removal of vegetative cover that serves to protect a shoreline area from erosion. Man-made structures such as houses, utility lines, and roads can also be threatened by shoreline erosion, thereby increasing the "sensitivity" of a shoreline reach to erosion. The erosion of privately-owned yard areas can also increase pressures for artificial shoreline stabilization efforts, even if no homes or ancillary structures are threatened.

Artificial Shoreline Stabilization: Shoreline stability can be enhanced through artificial stabilization efforts; some of these efforts can rely on the planting of native species of vegetation, while others are "harder" approaches such as bulkheading and rip-rapping. Shoreline stabilization efforts along one reach of the shoreline can, however, potentially result in decreased stability of an adjacent reach and can adversely impact the habitat value of the shoreline environment. While Fairfax County is the most populous locality in Virginia, the pattern of land use along the County's tidal shoreline (with much of the shoreline in public ownership) has served to concentrate the provision of erosion control structures along a few shoreline reaches, as can be seen in Figure 29. Much of the County's shoreline remains free of erosion control structures; these structures tend to be concentrated along shoreline segments characterized by adjacent residential development.

Vegetation: The amount and type of vegetation landward or immediately adjacent to the shoreline can affect its erodibility. Vegetation can often be planted in order to enhance the stability of a shoreline reach.

Sea Level Rise: While obviously beyond local control, a rising sea level can increase shoreline erosion rates and decrease shoreline stability through increased wave action carried to higher, previously unaffected elevations along the shoreline.

Flooding and Storm Surges: Flooding is a natural occurrence along many tidal shoreline areas. However, the presence of man-made structures within areas that are susceptible to tidal flooding can increase the "sensitivity" of these near-shore areas to flooding and storm surge impacts, and storm surges and flooding can have a powerful and ultimately erosive effect on tidal shorelines. In Fairfax County, the 100-year floodplain associated with the tidal shoreline along the Potomac River and its tributary streams is at an elevation of ten feet above sea level in areas south of Old Towne Road (in the New Alexandria neighborhood) and an elevation of eleven feet above sea level in areas north of Old Towne Road to the County's border with the City of Alexandria. Most floodplain areas along the County's tidal shorelines remain free of residential, commercial, and industrial structures, and existing regulations should serve to perpetuate this condition. However, some of these areas were developed prior to the establishment of regulatory limitations. Of particular note are the Belle View and New Alexandria neighborhoods, which are located within the 100-year floodplain of the Potomac River. Two floodgates (one with a pumping station) have been constructed in this area on tributaries above Dyke Marsh to reduce the flooding from storms with a frequency less than the 100-year storm. Full protection from flooding associated with the 100-year frequency storm is not feasible. Redevelopment and infill development proposals in these established neighborhoods must receive Special Exception approval by the Board of Supervisors. Through this process, development conditions are routinely imposed in order to ensure that floodplain and structural impacts will be minimized, that requirements of the Federal Emergency Management Agency for floodproofing of commercial buildings and elevation of residential structures will be met, and that the requirements of the Virginia Uniform Statewide Building Code will be met.

AERIAL PHOTO ANALYSIS OF TIDAL SHORELINE CONDITIONS--SHORELINE EROSION AND EROSION CONTROL FINDINGS

The entire tidal shoreline analysis, divided into segments based on the locations of watershed boundaries, is presented in Appendix A. The shoreline reaches that are demonstrating active erosion consist of points of land exposed to the greatest fetch or long reaches of shoreline exposed to significant fetch. Most of the sites showing effects of erosion are located on public land and are not protected by artificial shoreline stabilization. Areas of the shoreline that are characterized by an adjacent residential land use correlate highly with shoreline stability and artificial shoreline stabilization structures.

Areas undergoing active erosion included the following: land on either side of Sheridan Point (along the George Washington Memorial Parkway); the shoreline immediately east of Ferry Point (along the Potomac River and Dogue Creek southwest of Mount Vernon); several areas on the Fort Belvoir shoreline (including two sites on the south shore of Dogue Creek that are exposed to winds out of the northeast and Whitestone Point on the north shore of Gunston Cove

on Fort Belvoir), and much of the Mason Neck peninsula. Tidal shoreline erosion appears to be particularly significant on the Mason Neck peninsula, as this peninsula had the greatest number and longest reaches of shoreline demonstrating erosion in the 2004 analysis. This finding is generally consistent with the findings reported by VIMS in the 1979 Shoreline Situation Report, although the lateral extent of the eroding shoreline has increased, most notably along the shoreline of Belmont Bay, and additional artificial shoreline stabilization structures have been constructed on the peninsula since 1979. The current findings also suggest that the tidal shoreline of the Mason Neck peninsula is the most dynamic tidal shoreline of Fairfax County despite the fact that little or no development has occurred in many places along the peninsula's shoreline.

Several of the shoreline reaches on the Mason Neck peninsula (within the Mason Neck State Park and the Mason Neck National Wildlife Refuge) appear to be undergoing the most significant erosion along the County's tidal shoreline. Several occurrences of active erosion were identified along the shoreline reach of Mason Neck facing Belmont Bay. A three hundred foot segment of shoreline adjacent to the Mason Neck State Park visitors' center on Belmont Bay was stabilized with riprap in 1999. However, additional areas of active erosion were cited in the 2004 evaluation that had been not cited in the 1979 Shoreline Situation Report. Artificial shoreline erosion control structures were not shown along the eroding reach of shoreline facing Occoquan Bay in the 1979 Shoreline Situation Report. However, the 2004 analysis revealed that a number of breakwaters and several areas of rip rap revetment had been placed along the Occoquan Bay side of the peninsula.

The residential area of Hallowing Point, located along the Potomac River shoreline in the southeastern portion of Mason Neck, is characterized by the same soil associations as those which are found along the eroding areas of Mason Neck State Park and the Mason Neck Wildlife Refuge. However, the segment of the shoreline that is adjacent to the Hallowing Point community is almost entirely stabilized with rip rap, bulkheads, or a combination of both. Shoreline stabilization structures appear to be effective, as no active erosion was noted along the Potomac River adjacent to the Hallowing Point area in either the 2004 analysis or in the 1979 Shoreline Situation Report.

Small areas of shoreline accretion were identified in the 2004 analysis along Cameron Run (perhaps as a result of sediment deposition associated with road construction in this area) and in a narrow segment of the tidal portion of Dogue Creek just south of Richmond Highway.

The following conclusions can be derived from this analysis regarding shoreline erosion:

- The watershed segments that appear to have the greatest amounts of erosion are the segments located in the Mason Neck State Park; Fort Belvoir; and certain areas along the George Washington Memorial Parkway;

- Shoreline reaches characterized by physical points of land exposed to the longest fetch are likely to have the greatest erosion; and

- The shoreline reaches with the greatest amounts of residential development – Little Hunting Creek, the east shore of Dogue Creek, the Hallowing Point neighborhood, the Harborview neighborhood- are areas with the greatest occurrence of artificial shoreline stabilization and least amounts of erosion.

SHORELINE ACCESS

INTRODUCTION

Efforts to preserve the cultural, historic, and environmental resources along the County's tidal shoreline have been pursued for many decades at the federal, state, regional, and local levels. A discussion earlier in this report makes note of Fairfax County's unique pattern of tidal shoreline ownership when compared with the rest of Virginia, with more than 60% of the County's tidal shoreline in some form of public ownership (compared with less than 1% statewide). Through efforts that have been pursued at all levels of government, ample access and opportunity for enjoyment of the tidal shoreline area is provided in Fairfax County.

Shoreline-related recreational opportunities and other recreational opportunities related to water resources in Fairfax County extend into nontidal areas of the County as well. The public ownership of much of the shoreline of the nontidal Potomac River and nontidal Occoquan Reservoir has been noted earlier. In addition, Fairfax Water has implemented a Shoreline Easement Policy that establishes what may be permitted within its flood easement immediately adjacent to and surrounding the Occoquan Reservoir.

The County's Park Authority owns more land in the County (over 23,000 acres) than any other single entity. Much of this land is located along the County's network of streams, which is estimated by the Park Authority to be an aggregate of 980 miles in length. The Park Authority's Stream Valley Park network contains approximately 7,000 acres of land located along 767 miles of streams. Through the application of the County's Environmental Quality Corridor (EQC) policy (described later in this document) and other acquisition efforts by the County's Park Authority, the stream valley park network will continue to grow.

The County's Policy Plan calls for the provision of a "comprehensive network of trails and sidewalks . . . as an integral element of the overall transportation network." The Countywide Trails Plan, which has been incorporated within the Comprehensive Plan, identifies a broad, interconnected network of trails proposed for areas throughout the County, including major regional trail systems such as the Mount Vernon Trail, the Washington and Old Dominion Trail, the Potomac Heritage National Scenic Trail (a proposed 704-mile trail that would link the Chesapeake Bay with the Allegheny Highlands in Pennsylvania), the Cross County Trail, and others. The Countywide Trails Plan also identifies many Stream Valley Trails, trails and sidewalks along major highways, and other paved and natural surface or stone dust trails. Approximately 1,600 miles of trails have been constructed in the County; Fairfax County Park

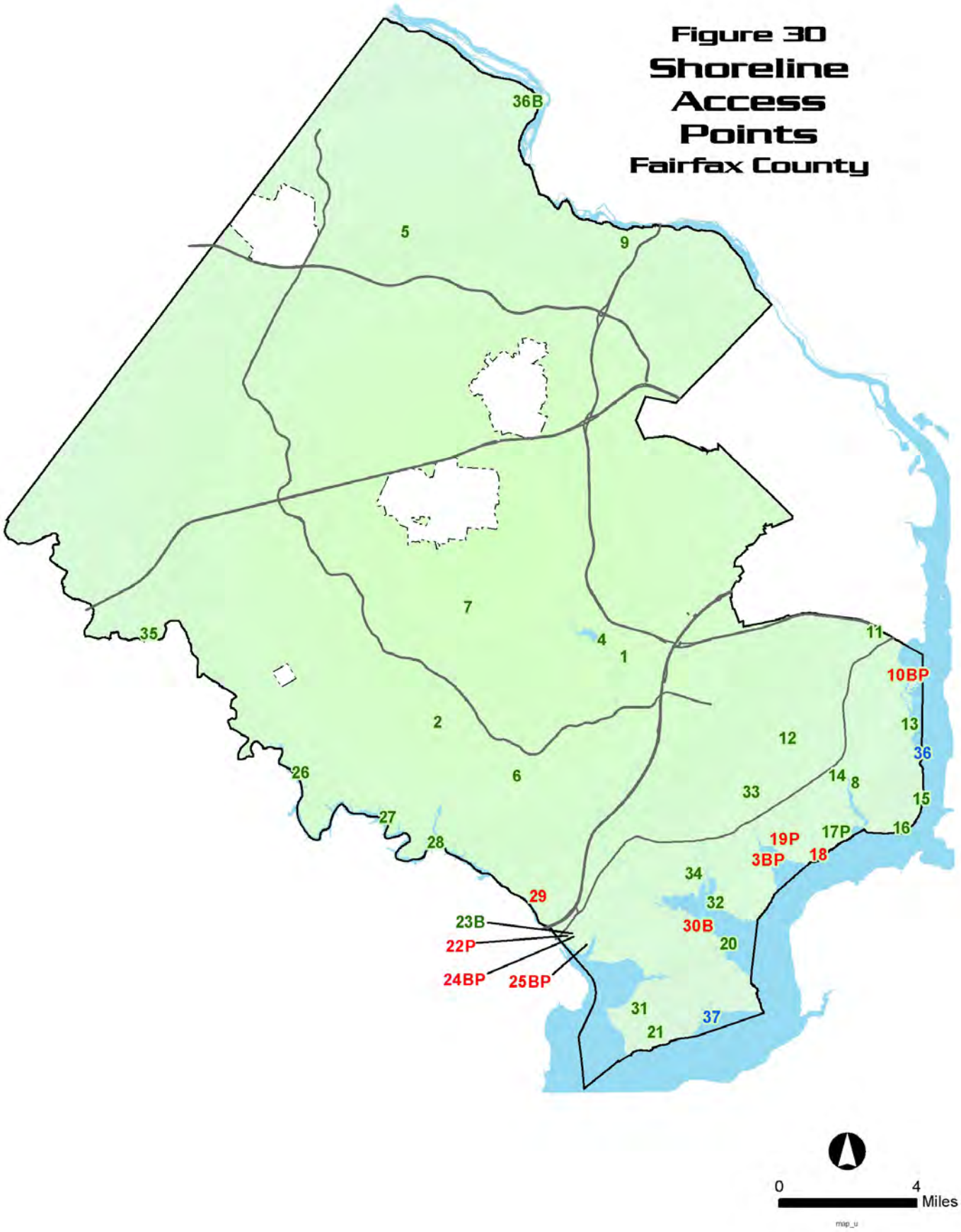


Figure 30
Shoreline Access Points
Fairfax County
36B
5
9
7
35
4
1
11
10BP
2
12
13
36
26
6
14
8
33
15
27
28
19P
17P
16
3BP
18
34
29
32
23B
30B
22P
20
24BP
25BP
31
37
21
0
4
Miles

Legend

(For Figure 30)

Symbology

General access points are shown in green	34
Tidal marinas are shown in red	29
Potential access areas identified in the Chesapeake Bay Public Access Plan, 1990 are shown in blue	37
Sites with boat ramps in tidal areas are designated with a "B" suffix	30B
Marinas with pump-outs are designated with a "P" suffix	22P

Description of Individual Sites

Tidal Marinas

Number	Site Name	Use	General Location
3BP	Dogue Creek Marina	Boat Ramp, Fishing, Boat Rental, Dry Storage	Fort Belvoir
10BP	Belle Haven Marina	Marina, Boat Launch, Fishing, Hiking	Alexandria
18	Mansion House Yacht Club	Marina	Alexandria
19P	Mount Vernon Yacht Club	Marina	Alexandria
22P	Fairfax Yacht Club, Occoquan River	Marina, Boat Launch, Fishing, Hiking	Mason Neck
24BP	Captain John's Beach Marina, Occoquan River	Boat Launch, Boat Ramp, Marina	Mason Neck
25BP	Harborview Marina	Marina	Massey Creek
29	Occoquan Regional Park	Marina, Boat Launch, Fishing	Mason Neck
30B	Pohick Bay Regional Park	Marina, Boat Ramp, Boat Rental, Fishing	Mason Neck

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General Access Points
(Including Non-tidal Marinas)

Number	Site Name	Use	General Location
1	Brookfield	Fishing	Springfield
2	Burke Lake and Golf Course	Boat Rentals, Fishing	Fairfax Station
4	Lake Accotink	Marina, Tour Boat, Boat Launch, Boat Rentals	Springfield
5	Lake Fairfax	Tour Boat, Boat Rentals, Fishing, Hiking	Reston
6	Lake Mercer	Fishing, Hiking	Fairfax Station
7	Lakeside	Fishing, Hiking	Fairfax Station
8	Little Hunting Creek	Hiking	Alexandria
9	Scotts Run Nature Preserve	Fishing, Hiking	McLean
11	Huntington Park	Hiking	Alexandria
12	Huntley Meadows Park	Wetland Walkway, Hiking	Alexandria
13	Dyke Marsh	Wetland Walkway, Hiking	Alexandria
14	Martin Luther King Jr. Park	Hiking	Alexandria
15	George Washington Memorial Parkway	Hiking	Mt. Vernon
16	Fort Hunt Park	Hiking, Biking	Mt. Vernon
17P	Mount Vernon on the Potomac (Mt. Vernon Ladies Association)	Tour Boat	Alexandria
20	Gunston Hall Plantation	Nature Study	Mason Neck
21	Mason Neck National Wildlife Refuge	Hiking, Biking, Canoe Rental	Mason Neck
23B	Colchester Dock, Occoquan River	Boat Launch, Boat Ramp, Fishing	Mason Neck
26	Bull Run Marina	Crew, Boat Launch, Hiking, Fishing	Clifton
27	Fountainhead Regional Park	Boat Launch, Marina, Boat Rental	Fairfax Station
28	Sandy Run Regional Park	Crew	Fairfax Station
31	Mason Neck State Park	Fishing, Hiking, Camping	Mason Neck
32	Tompkins Basin Area	Fishing, Hiking	Fort Belvoir
33	Jackson Miles Abbot Wildlife and Wetlands Refuge	Fishing, Hiking	Fort Belvoir
34	Accotink Bay Wildlife Refuge and Environmental Education	Fishing, Hiking	Fort Belvoir
35	Route 28 (Bull Run/NVRPA)	Fishing, Hiking, Canoeing	Centreville
36B	Riverbend Park	Fishing, Hiking, Boat Ramp, Nature Study	Great Falls

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Potential Access Areas in Fairfax County Identified in the Chesapeake Bay Public Access Plan, 1990

Number	Site Name	Public Access Plan Remarks
36	Northeastern Fairfax-Potomac River	"Publicly Accessible, Marina Slips & Boat Launch Area Needed"
37	Belmont Bay to Gunston Cove	"Publicly Accessible, Marina Slips & Boat Launch Area Needed"

Notes:

Tidal and non-tidal access points are both shown.

The Public Access Plan also identified a potential new marina at Fort Belvoir. However, Fort Belvoir is no longer proposing this marina. A potential access site was also identified at Colchester Dock, which is listed as site number 23 above.

Marinas equipped with a pump-out facility are registered with the Virginia Department of Health's Marina Program. Marinas with forty-nine slips or more are required to maintain such facilities. Marinas with less than forty-nine slips are participating voluntarily.

Information is not provided for the cities of Alexandria, Fairfax, and Falls Church, or for the towns of Clifton, Herndon, and Vienna. Prepared by DPZ - PD using Fairfax County GIS. Data are not field checked.

Sources:

1) *Register of Parks and Facilities 2000* (Fairfax County Park Authority)
2) *Public Access Guide - Chesapeake Bay, Susquehanna River, and tidal tributaries* (map, Chesapeake Bay Program, 2000)
3) *Regional Parks* (Web site, Northern Virginia Regional Park Authority)
4) *Chesapeake Bay Public Access Plan, 1990* (Chesapeake Bay Program)
5) *Chesapeake Bay Gateways - Map and Guide* (National Park Service and Chesapeake Bay Program, 2000)
6) Aerial Imagery Analysis, Fairfax County 1997, 2002, 2003 flights.
7) Claire Blanchard, Northern Virginia Regional Park Authority, Personal Communications.

Authority staff estimates that approximately 180 miles of trails provide hiking and bicycling access to stream valley areas.

Opportunities for passive (or "low impact") recreational access to the County's tidal shoreline and nontidal waters are abundant, and demands for such access are substantial as well. Citizen preference surveys that are periodically conducted by the Fairfax County Park Authority consistently show a high level of support for preservation of open space in the County. Open space areas provide great environmental benefits but also provide opportunities for passive recreation, such as trails and nature and cultural education programs. Efforts are expected to continue to preserve open spaces for environmental benefits and to provide passive recreation opportunities for current and future generations. With respect to more active recreational access along the tidal shoreline, there are a number of facilities providing public or broadly-available private boating access. An inventory of such facilities, compiled by County staff from a number of sources, is provided in Figure 30. The 2002 Virginia Outdoors Plan identifies a significant demand for water-based recreational opportunities (including facilities for boating) in Northern Virginia. The 1995 Potomac River Public Access Plan, prepared by the Northern Virginia Planning District Commission (now the Northern Virginia Regional Commission) reaches similar conclusions.

An analysis of Figure 30 indicates that the County is served by a significant number of marinas and boating related facilities. However, it must be noted that not all boating related tidal access facilities are identical to one another; some are equipped with sanitary sewage pump-out facilities, while some are not. Access to marinas that are equipped with such pump-out facilities is an important need for vessels that have on-board toilet facilities or that are capable of making trips of a long duration.

In 1992, Congress enacted the Clean Vessel Act (CVA) in order to reduce the vessel discharge of sewage into open waters. At the time CVA was adopted by Congress, competitive grant money was made available to facilitate and assist states in providing dumping stations for portable toilets as well as pump-out facilities for boaters. The Commonwealth of Virginia administers the Clean Vessel Act through the Virginia Department of Health's Marina Program. The program seeks to ensure that all marinas in the Commonwealth are equipped with appropriate sanitary waste disposal facilities. Marinas that have 49 boat slips or less are exempt from the requirement to maintain a pump-out facility. Marinas with fifty slips or more must maintain pump-out facilities, which are inspected by the state or local health department on an annual basis. Of the nine marinas located along the Fairfax County's tidal shoreline, six are equipped to meet the sanitary requirements as established by the Virginia Marina Program and the Clean Vessel Act and have been issued certificates to operate by the Virginia Department of Health. The remaining three marinas are exempt from the pump-out facility requirement.

AERIAL PHOTO ANALYSIS OF TIDAL SHORELINE CONDITIONS--POINTS OF ACCESS

As part of the aforementioned visual survey of the County's tidal shoreline using aerial orthophotography, the types, numbers, and locations of shoreline access structures (including piers, walkways, ramps, boathouses/gazebos/wharfs, and marinas) were noted, both on public

and private properties. The results of this analysis are presented in Figure 31. As expected, an analysis of the data reveals a strong correlation between shoreline access structures and adjacent residential land uses.

SITING OF NEW BOATING FACILITIES ALONG THE TIDAL SHORELINE

Figure 30 suggests that Fairfax County is relatively well served by marinas with tidal waterway accessibility and services. Further, there are a number of additional boating access points in Prince William County that are near Fairfax County and that may be used by County residents. However, the 1990 Chesapeake Bay Public Access Plan (prepared by the Chesapeake Bay Program) includes the following discussion:

- "Demand for recreational use of the Potomac River and its associated tidal estuaries is extremely high. The George Washington Memorial Parkway, along with the large publicly-owned lands located in the southeastern portion of the county, offer numerous opportunities for passive recreation. However, public boating access is limited. Where possible, appropriate specific access sites should be identified and provided.

- There is a need to find an additional boating access in the northeastern section of the county on the Potomac River or along its tributaries.

- Expansion of boating access or development of new facilities is needed on Belmont Bay and along the Potomac River to the Gunston Cove section of the river.

- Currently, the total capacity of commercial and public marina slips is approximately 550 slips. This number of slips does not meet the demand for the rapidly expanding population of the area. Most of these slips are at yacht clubs which serve only their members. Additional commercial slips are needed to help meet the demand for the general public's boater population."

The 2002 Virginia Outdoors Plan likewise identifies a significant need for water-based recreational activities in Northern Virginia, including facilities for swimming, boating, and fishing and the development of water trails. The report recommends that "boating, fishing and beach access to the Potomac and Occoquan Rivers should be increased significantly" and that the Belle Haven Marina be improved and continue to operate as "a popular and valuable amenity in an area lacking in water access sites."

Based on this published information, there is a clear demand for new or expanded public boating access along the County's tidal shoreline. However, the pattern of land use and ownership in this area will limit substantially the options available for siting new marinas and ramps. Land use and ownership patterns along the tidal shoreline have been largely established; much of the shoreline is in public ownership, and much of the privately owned component of the shoreline has been developed to the extent allowed by current zoning and to the extent recommended by

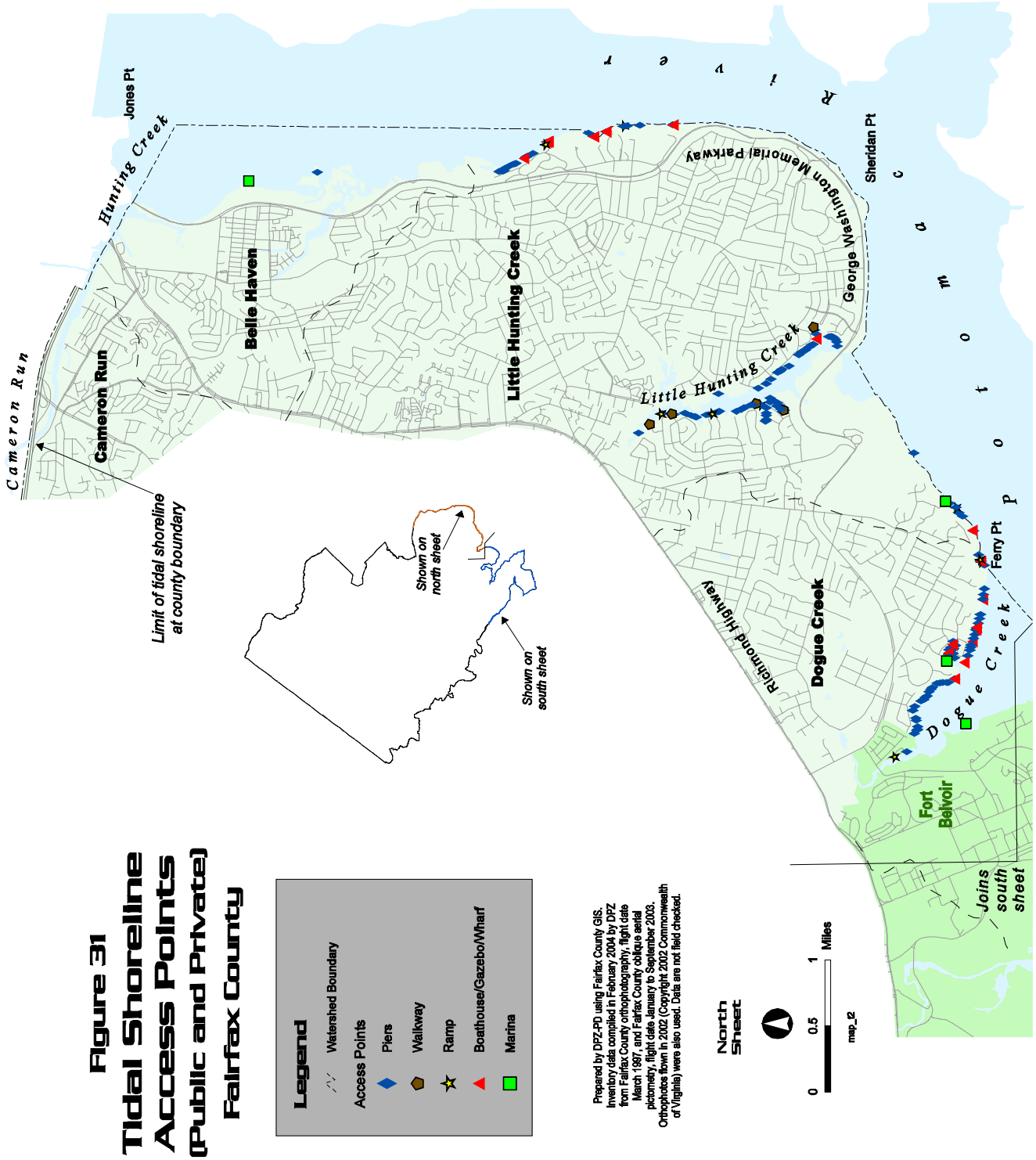
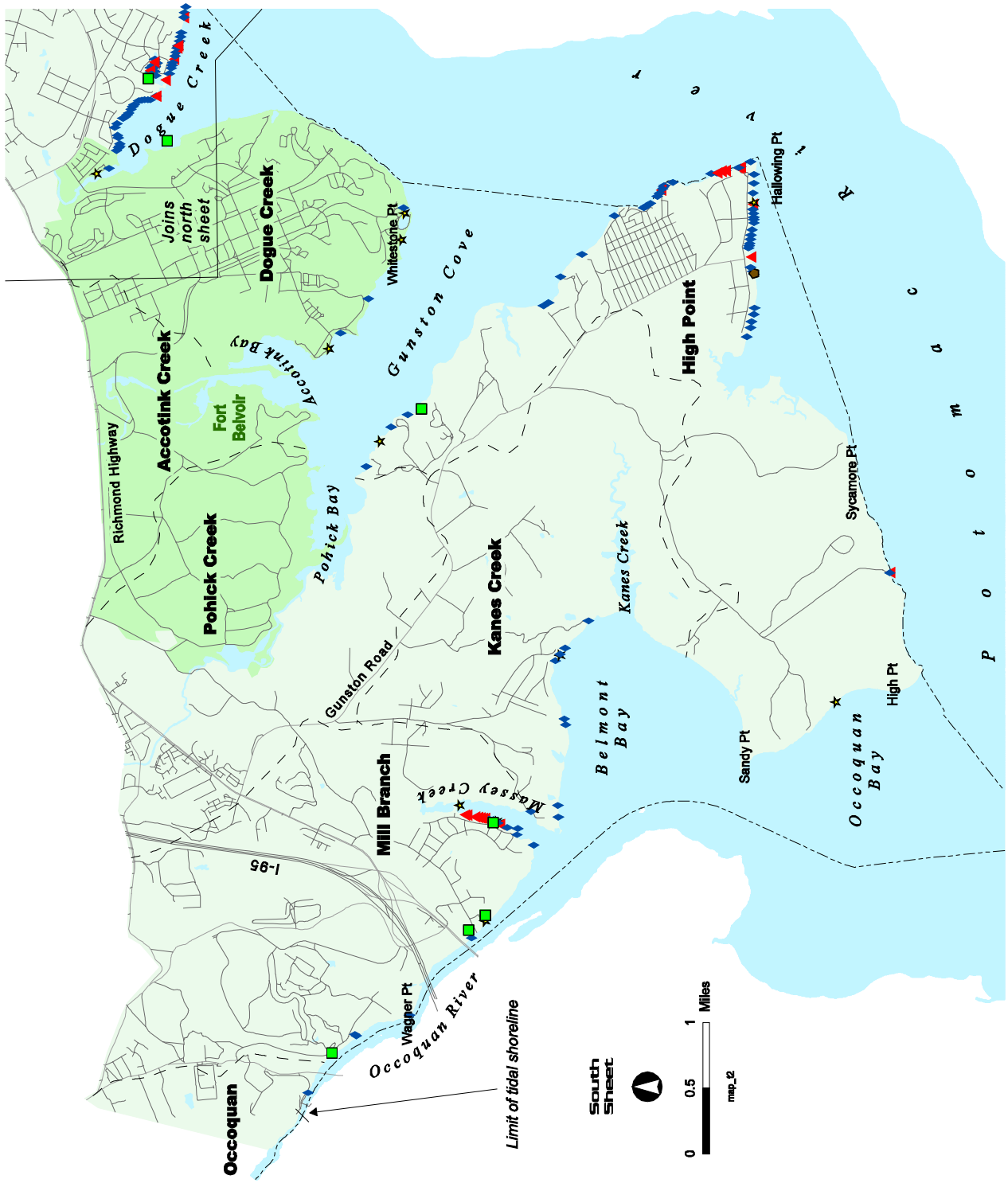


Figure 31
Tidal Shoreline Access Points (Public and Private) Fairfax County


Dogue Creek
Joins north sheet
Dogue Creek
Accotink Creek
Fort Belvoir
Accotink Bay
Richmond Highway
Pohick Creek
Pohick Bay
Whitestone Pt
Gunston Cove
Kanes Creek
Kanes Creek
Gunston Road
Mill Branch
Massey Creek
I-95
Occoquan
Wagner Pt
Occoquan River
Limit of tidal shoreline
Belmont Bay
High Point
Hallowing Pt
Sycamore Pt
Sandy Pt
High Pt
Occoquan Bay
Potomac River
South Sheet
0
0.5
1
Miles
map_2

Tidal Shoreline Access Points
Summary Table for Figure 31

(North and South Sheets)

Shoreline Access Points By Type	Occurrences
Boat Ramps	22
Boathouse or Gazebo	33
Marina	12
Piers	214
Wetland Walkway	6
Wharf	1
Total Access Points	**288**

Prepared by DPZ-PD using Fairfax County GIS. Inventory data compiled in February 2004 by DPZ from Fairfax County orthophotography, flight date March 1997, and Fairfax County oblique aerial pictometry, flight date January to September 2003. Orthophotos flown in 2002 (Copyright 2002 Commonwealth of Virginia) were also used. Data are not field checked.

map_t2

the Comprehensive Plan. While it is possible that new marina facilities could be proposed on properties that have already been developed, it is more likely that such efforts would focus on properties that have not been developed or that have not been developed to their Comprehensive Plan potential ("underutilized" land). It is also possible that the National Park Service, U.S. Army, Commonwealth of Virginia, or Northern Virginia Regional Park Authority could, in the future, consider the provision of new boating access facilities on their properties. However, for state and federal properties, the processes through which these facilities could be developed would fall outside of the County's regulatory authority.

Figure 32 identifies vacant and underutilized privately-owned properties that are located near the tidal shoreline. As can be seen in this figure, such properties are not prevalent. Further, it is not likely that all of the "underutilized" parcels will be subject to future development; landowners may be content with their existing uses even though they could increase development densities on their properties. It should be noted that a number of the larger vacant and underutilized properties shown on the Mason Neck peninsula are located within County Agricultural and Forestal Districts, indicating that agricultural/forestry uses remain viable on these properties. Finally, it should be recognized that many of the vacant and underutilized parcels shown in Figure 32 would not meet, or would have difficulty meeting, Zoning Ordinance standards for commercial marinas, docks, and boating facilities (a two acre minimum lot size; a minimum 100-foot separation between structures and nonriparian lot lines; and a minimum 50-foot separation between off-street parking or loading spaces and adjacent residentially-zoned property).

Most of the vacant and underutilized parcels identified in Figure 32 are zoned either R-E (Residential Estate—one dwelling unit per two acres) or R-2 (two dwelling units per acre). Within both of these zoning districts, commercial marinas, docks, and boating facilities are allowed only through the approval of a Special Exception by the County's Board of Supervisors; private, nonprofit marinas, docks, and boating facilities are allowed only through the approval of a Special Permit by the County's Board of Zoning Appeals. Both of these processes involve a comprehensive review of development proposals for consistency with a broad range of Comprehensive Plan policies, including land use compatibility, environmental, and transportation policies. Both processes also require public hearings (two in the case of the Special Exception process—one before the Planning Commission and one before the Board of Supervisors). As such, a broad range of issues, including environmental and community concerns, will be considered for any proposal to establish a new commercial or nonprofit marina, dock, or other boating facility on private property in Fairfax County.

General guidance on the siting of boating access facilities has been developed by the Virginia Marine Resources Commission (VMRC) as well as by the Chesapeake Bay Program (in its Public Access Technical Report). The "General Siting Criteria" in VMRC's Subaqueous Guidelines include the following:

- "The physical dimensions and characteristics of the water body should be compatible with the size of the marina and the type of vessels it will house…"

- "Marinas must have sufficient upland areas to provide all the necessary parking, stormwater management BMP's, fuel, and sanitary facilities without filling wetlands or subaqueous bottom."

- "All marinas should be located in areas with good natural flushing to minimize the build-up of organic material and other pollutants on the bottom."

- "Marinas should not be sited close to areas of very high natural resource value . . ."

- "Projects that by their cumulative impact will result in dense concentrations of boats in one area will be critically evaluated as to their impacts on natural resources; however, in densely populated areas, concentration of slips in a single facility must be justified to prevent disturbance at undeveloped shorelines."

The Center for Coastal Resources Management of the Virginia Institute of Marine Science worked with a team of planners, environmental regulators, scientists, and geographic information experts to develop an algorithmic tool known as the "Marina Suitability Tool." This interactive tool uses the VMRC marina siting guidance and provides a ranking system for locating marinas based on a number of important criteria, such as the presence or absence of submerged aquatic vegetation, shellfish beds, wetlands, and riparian forests. Ultimately, the ranking system generates an evaluation of habitat, water quality, and design as well as a cumulative evaluation of these three parameters. While this tool can assist in the evaluation of site suitability for new marina facilities, it is not intended to serve as a substitute for an on-site physical inspection and

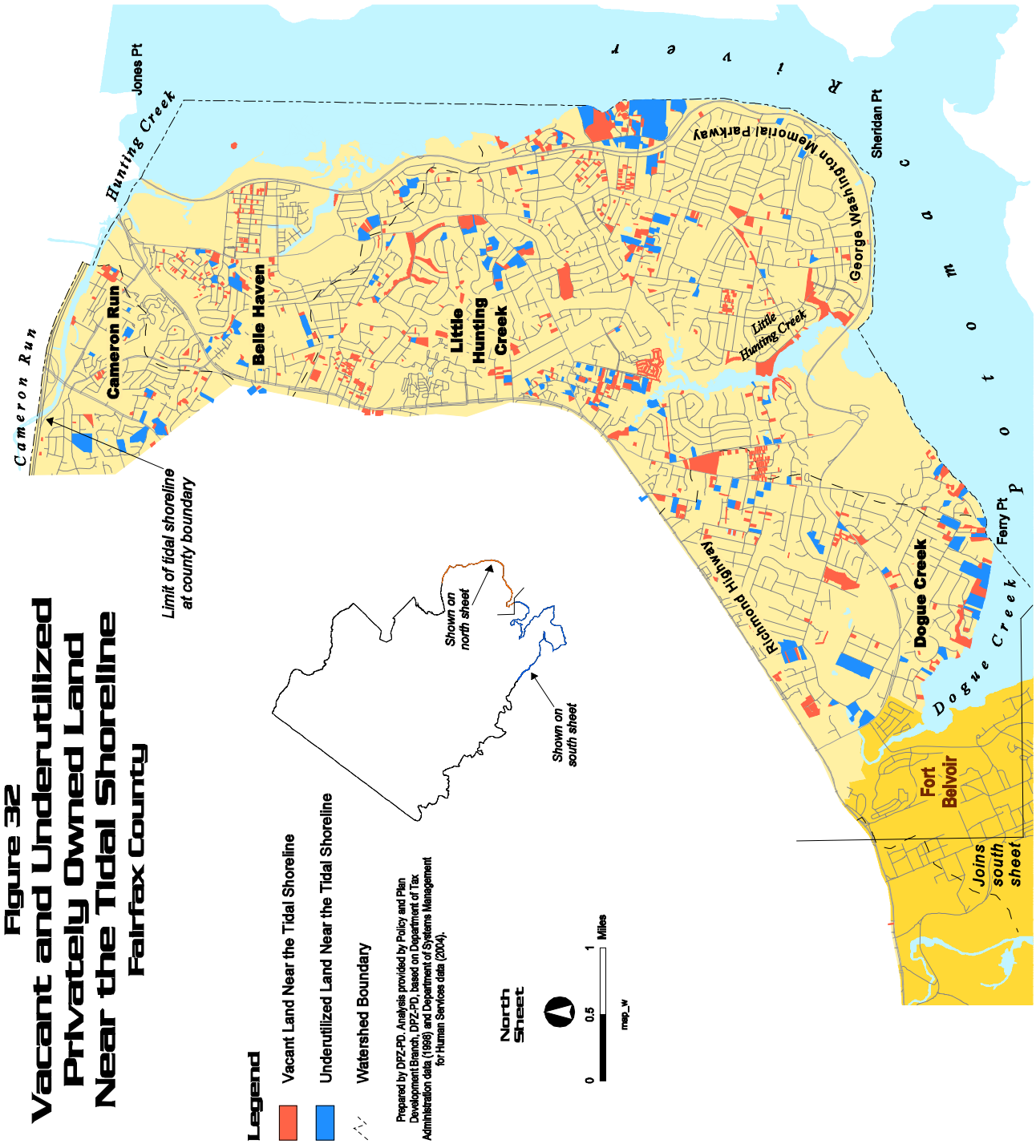
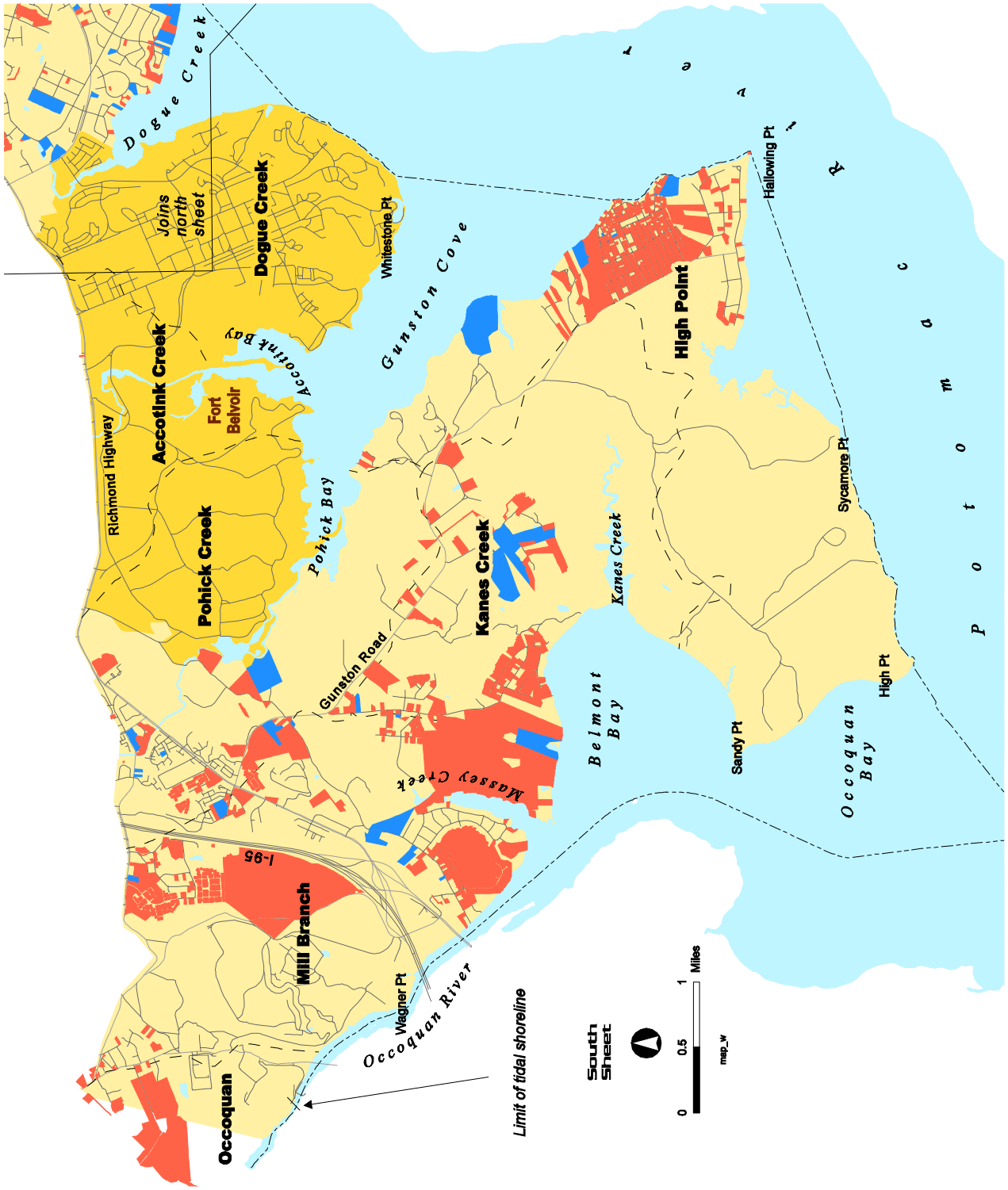


Figure 32
Vacant and Underutilized
Privately Owned Land
Near the Tidal Shoreline
Fairfax County
Legend
Vacant Land Near the Tidal Shoreline
Underutilized Land Near the Tidal Shoreline
Watershed Boundary
Prepared by DPZ-PD. Analysis provided by Policy and Plan Development Branch, DPZ-PD, based on Department of Tax Administration data (1998) and Department of Systems Management for Human Services data (2004).
North Sheet
0
0.5
1
Miles
map_w
Shown on north sheet
Shown on south sheet
Limit of tidal shoreline at county boundary
Cameron Run
Cameron Run
Hunting Creek
Jones Pt
Belle Haven
Little Hunting Creek
Little Hunting Creek
George Washington Memorial Parkway
Sheridan Pt
Potomac River
Richmond Highway
Dogue Creek
Dogue Creek
Ferry Pt
Fort Belvoir
Joins south sheet


Dogue Creek
Joins north sheet
Dogue Creek
Whitestone Pt
Gunston Cove
Accotink Bay
Accotink Creek
Fort Belvoir
Richmond Highway
Pohick Bay
Pohick Creek
Gunston Road
Kanes Creek
Kanes Creek
Massey Creek
Belmont Bay
Sandy Pt
Occoquan Bay
High Pt
Sycamore Pt
Hallowing Pt
High Point
Potomac River
I-95
Mill Branch
Wagner Pt
Occoquan River
Occoquan
Limit of tidal shoreline
South Sheet
0
0.5
1
Miles
map_w

evaluation. The "Marina Suitability Tool" can be accessed on the Center's Web site at: http://ccrm.vims.edu/mgttools.html.

The Chesapeake Bay Program's "Chesapeake Bay Area Public Access Technical Assistance Report" contains guidelines to assist localities in the siting and design of new boating access facilities as well as guidelines addressing other forms of shoreline access, such as beach/swimming areas, pier and bank fishing access, and access to natural areas. The focus of the guidelines addressing boating access is on launch ramps as opposed to marina facilities, although some considerations are related to marinas (e.g., sewage disposal facilities). A series of environmental considerations (including but not limited to topography, shoreline erosion conditions, soils and substrate materials, wave characteristics, significant habitat areas, water quality impacts, wetlands, cultural resources, and submerged aquatic vegetation) is identified, as are lists of desirable and undesirable site characteristics that focus both on environmental considerations and vehicular access concerns. Guidance addressing site design issues including area requirements, water depth and subsurface conditions, vehicular considerations, pedestrian considerations, sewage disposal facilities, and stormwater management, among other items, is also provided. ■

WATER QUALITY POLICIES, REGULATIONS, AND INITIATIVES

Fairfax County has several policies and regulatory mechanisms addressing water quality issues. On June 21, 2004, the County's Board of Supervisors adopted an Environmental Excellence 20-year Vision Plan, also referred to as the "Environmental Agenda." This policy document provides guidance on decisions and initiatives addressing a broad range of environmental issues; in all, forty policy statements are addressed within the following six broad areas:

- Growth and Land Use;
- Air Quality and Transportation;
- Water Quality;
- Solid Waste;
- Parks, Trails, and Open Space; and
- Environmental Stewardship.

The Environmental Excellence 20-year Vision Plan has been referred to County staff for follow-up action.

Aside from the Environmental Excellence 20-year Vision Plan, policy guidance is provided in the County's "Policy Plan," which is the Countywide policy element of the County's Comprehensive Plan and which incorporates this document by reference. Key objectives and policies related to water quality protection can be found in the Environment and Public Facilities sections of the document. Of particular note are the following:

- The Environmental Quality Corridor (EQC) policy (see Objective 9 of the Environment section), which recommends protection and restoration of environmentally-sensitive lands, including 100-year floodplains, steep slopes (gradients of 15% or greater) in stream valleys, wetlands connected to stream valleys, minimum buffer areas, and upland habitats that augment the habitats and buffers provided by stream valleys. The identification and protection of EQCs occurs through negotiations with developers during the zoning process (the reviews of rezonings, special exceptions, special permits, variances, and related applications); EQCs are typically broader in area, and often extend upstream from, areas afforded protection through the County's Floodplain Regulations and Resource Protection Area requirements. This policy has been effective in preserving and restoring sensitive lands as identified during the zoning process; however, EQC protection is not required by regulation, and therefore this policy is not implemented for "by right" development (development that is pursued, by right, through existing zoning).

By-right development is, however, subject to land development regulations as described elsewhere in this report.

- An objective to "Prevent and reduce pollution of surface and groundwater resources" and to "protect and restore the ecological integrity of streams in Fairfax County" (see Objective 2 of the Environment section). Policies under this objective include, but are not limited to, support for the following:

    - The provision of stormwater management best management practices;
    - The minimization of applications of fertilizers, pesticides, and herbicides;
    - The siting of stormwater management facilities outside of stream valley EQCs unless the facilities are designed to provide a regional function or the EQCs have been significantly degraded;
    - The limiting of erosion and sedimentation from construction activities;
    - The retrofitting of stormwater quantity control facilities to provide water quality functions;
    - The protection of groundwater resources from detrimental land use activities; and
    - The application of a variety of better site design and low impact development techniques to reduce stormwater runoff volumes and peak flows, to increase groundwater recharge, to increase preservation of undisturbed areas, and to minimize the impacts that new development and redevelopment projects may have on the County's streams.

- Background discussion and an objective to "Protect the Potomac Estuary and the Chesapeake Bay from the avoidable impacts of land use activities in Fairfax County" (see Objective 3 of the Environment section).

- An objective recommending conservation and restoration of tree cover on developed and developing sites (see Objective 10 of the Environment section).

- An objective supporting the use of open space/conservation easements as tools to preserve environmental resources (see Objective 11 of the Environment section).

- An objective supporting a "comprehensive drainage improvement and stormwater management program" in order to "maximize property protection and environmental benefits throughout the watershed" (see Objective 36 of the Public Facilities section).

- An objective supporting "a system of drainage facilities that prevents or minimizes structure flooding, stream degradation and traffic disruption in an efficient, cost effective and environmentally sound manner." (see Objective 37 of the Public Facilities section).

- Recently-adopted Plan guidance as follows:

    - A policy supporting watershed management planning (see Objective 2 of the Environment section).

- A policy supporting the optimization of water quality controls for redevelopment consistent with revitalization goals (see Objective 2 of the Environment section).

- A policy supporting the remediation of development and redevelopment sites that have been subject to contamination by toxic substances or other hazardous materials (and referencing the need to ensure that unacceptable health or environmental risks will not occur as a result of contamination associated with nearby properties) (see Objective 2 of the Environment section).

- A policy supporting the conclusions and recommendations of this Supplement (see Objective 3 of the Environment section).

- A policy incorporating the Chesapeake Bay Preservation Areas map into the Comprehensive Plan (see Objective 3 of the Environment section).

- A policy supporting State guidance regarding tidal shoreline erosion control (see Objective 3 of the Environment section).

- A policy supporting State and Chesapeake Bay Program guidance regarding tidal shoreline access facilities (see Objective 3 of the Environment section).

The objectives and related policies in the Public Facilities section, as well as the County's overall stormwater management program, are undergoing review (see the discussion later in this report). It is possible that the current emphasis on regional stormwater management approaches will be revised per this effort.

The objectives and related policies in the Public Facilities section, as well as the County's overall stormwater management program, are undergoing review (see the discussion later in this report). It is possible that the current emphasis on regional stormwater management approaches will be revised per this effort.

As noted earlier, the Fairfax County Park Authority owns more land in the County (over 23,000 acres) than any other single entity. The Parks and Recreation section of the Policy Plan contains a number of objectives and policies that are supportive of water quality protection and restoration, including the preservation of ecologically-sensitive lands, the establishment of an integrated network of greenways, and the acquisition of stream valley areas. The Fairfax County Park Authority's Park Policy Manual contains more detailed objectives and policies, including statements supporting the protection of riparian corridors and water quality. In 2004, the Fairfax County Park Authority adopted its first Natural Resource Management Plan; this document is discussed later within this section.

Key water quality protection regulatory efforts include the following (note: some of these discussions have been excerpted from the County's Web site):

- The Chesapeake Bay Preservation Ordinance (Chapter 118 of the Fairfax County Code): As noted earlier in this report, the County's Chesapeake Bay Preservation Ordinance requires the provision of riparian buffer areas around all perennial streams and requires development and redevelopment throughout the County to achieve water quality performance standards. The Ordinance also requires soil and water quality conservation planning activities on agricultural lands. The amendment of the Ordinance in 2003 served to increase, by approximately 30%, the extent of Resource Protection Areas in Fairfax County.

- The Floodplain Regulations of the Zoning Ordinance: These Regulations limit uses that can occur within County-defined floodplain areas, which include all areas that would be flooded by the rainfall event that is expected to occur, on average, once every 100 years, for any stream that collects drainage from an area greater than 70 acres. As noted earlier in this report, minor floodplains are associated with streams with drainage areas between 70 and 360 acres, and other floodplains, with drainage areas greater than 360 acres, are commonly referred to as "major floodplains." A limited number of types of uses are permitted in major floodplains without the need of a Special Exception approval by the Board of Supervisors. There are no explicit limitations on the types of uses allowed in minor floodplains; however, all uses in floodplains must meet stringent use limitations, including a requirement that these uses not increase flooding either upstream or downstream of the use. Minimization of disturbance to the floodplain and environmental factors can also be considered in any determination as to whether a proposed use in a floodplain should be permitted. These use limitations have the effect of limiting substantially the extent of disturbance pursued in floodplain areas. It should also be noted that major floodplains are included in the County's Resource Protection Area Designation as set forth in the Chesapeake Bay Preservation Ordinance.

- Zoning: In 1982, the County rezoned roughly two-thirds of the area (nearly 41,000 acres) of the County's portion of the Occoquan Watershed to the R-C District, which allows no more than one dwelling unit per five acres of land. This was done in recognition of the relationship between land use intensity and water quality. Other low density areas did not have their zoning established for the purpose of water quality protection, but the low density character of these areas, as maintained through the zoning requirements, has been shown to be correlated with high quality conditions of streams in these areas.

- Best Management Practice (BMP) requirements: Concurrent with the 1982 rezoning, the County established a "Water Supply Protection Overlay District" (WSPOD) in its Zoning Ordinance consisting of the entirety of its portion of the Occoquan Watershed. Stormwater management best management practices (BMPs) were required for all new development exceeding a density of one dwelling unit per five acres; a 50% phosphorus reduction requirement was established. This formalized in the Zoning Ordinance a BMP requirement that had been implemented in 1980 with a requirement in the Public Facilities Manual. The combination of land use and structural controls was pursued in order to protect one of the County's major sources of drinking water from degradation associated with nonpoint source pollutants. In 1993, the County established a jurisdiction-wide BMP requirement through the Chesapeake Bay Preservation Ordinance.

However, BMP requirements in the WSPOD (which have been incorporated into the broader Ordinance) remain more stringent than BMP requirements elsewhere in the County.

- The Public Facilities Manual (PFM): This manual sets forth the guidelines that govern the design of all public facilities that must be constructed to serve new development within Fairfax County. In this context, public facilities include certain facilities that serve a public purpose by mitigating the off-site impacts of development (e.g., stormwater management facilities) even though such facilities are privately maintained. Requirements to comply with the PFM are incorporated into the County's Subdivision Ordinance and Zoning Ordinance. Amendments to the PFM are approved by the Board of Supervisors subsequent to public hearings before the Planning Commission and Board. Prior to Planning Commission consideration, proposed PFM amendments are considered by the County's Engineering Standards Review Committee, which has been established by the Board of Supervisors to provide technical, economic, and environmental reviews and assessments of matters relating to the design and provision of public facilities. The PFM contains performance and design standards addressing a broad range of engineering and environmental issues. Of particular note with respect to water resource issues are: policies and detailed guidance regarding the detention of stormwater runoff; the policy and requirements for adequate drainage (commonly known as the "adequate outfall" policy) requiring drainage controls sufficient to protect downstream properties from erosion and flooding; and stormwater runoff quality control criteria (including phosphorus removal efficiencies) for various types of BMP facilities).

- Regulation of septic systems: All on-site sewage disposal facilities are regulated by Chapter 68.1 of the Fairfax County Code (Individual Sewage Disposal Facilities). This Chapter incorporates the State Board of Health's Sewage Handling and Disposal Regulations and adds a number of requirements that extend beyond those of the State's Regulations, some of which track requirements of the Chesapeake Bay Preservation Ordinance. Of particular note are pump-out requirements (systems must be pumped-out at least once every five years, and pump-out notifications must be provided to the Health Department); flow diversion requirements (flow must alternate between equally sized drainfields, allowing each absorption area to "rest" for approximately one year, thereby providing for recovery of these areas); and reserve absorption site requirements (newly established lots must now provide 100% reserve absorption sites). The County's on-site sewage disposal requirements were strengthened considerably with the adoption of an amendment to Chapter 68.1 on July 7, 2003.

- Erosion and Sediment Control: Chapter 104 of the Code of the County of Fairfax, Erosion and Sediment Control, has been adopted to conserve and protect the land, water, air, vegetation and other natural resources of Fairfax County and to alleviate erosion, sedimentation, and other harmful effects of land-disturbing activities on neighboring land and streams by ensuring that the owner of the property on which land-disturbing activities are to be carried out provides adequate controls against erosion and sedimentation and takes necessary measures to preserve and protect trees and other vegetation. This chapter of the County Code requires that no person may engage in land-

disturbing activity in Fairfax County until they have submitted to the County a conservation plan for the land-disturbing activity and the plan has been reviewed and approved by the Director of the Department of Public Works and Environmental Services (DPWES) or his designee. The plan must explain and illustrate the measures and standards that are to be taken to control erosion and sedimentation. During construction, the project is inspected by County staff to ensure that the controls are properly installed and maintained in accordance with County standards.

DPWES continues to focus efforts on making improvements that will further enhance the quality of review and inspection services associated with erosion and sediment control. Many recommendations of the Infill and Residential Development Study conducted by the County in 2000 have been implemented; these changes have strengthened the County's policies and have also increased flexibility by allowing more innovative and effective measures for the control of erosion. DPWES is increasing efforts to: stay abreast of innovations and technology in controlling erosion; strengthen County regulations; train staff; and provide educational information to industry and citizen groups. DPWES has established a 24 hour hotline that citizens can call to report possible illegal land-disturbing activities or violations of the County's erosion and sediment control requirements.

- Wetlands Zoning Ordinance (Chapter 116 of the Fairfax County Code): This chapter requires approval from the County's Wetlands Board for certain uses within tidal wetland areas. County staff and the Wetlands Board relies on guidance from the Virginia Marine Resources Commission (VMRC) and Virginia Institute of Marine Sciences (VIMS) in issuing recommendations and decisions regarding activities requiring permits. This document and related text in the Comprehensive Plan serve to incorporate VIMS guidance on tidal wetland activities into the Plan by reference.

The County has a comprehensive array of programs and initiatives aimed at reducing point source and nonpoint source pollution of the County's waters. It is not the intent of this document to serve as a catalog of these efforts. However, a few efforts are of particular note:

- The County recently completed a comprehensive perennial stream mapping effort to identify all perennial streams in the County. The field protocol that was established in support of this effort has been endorsed by the Department of Conservation and Recreation's Division of Chesapeake Bay Local Assistance for use by other jurisdictions subject to the Chesapeake Bay Preservation Act.

- In recognition of the changing character of development that is occurring in the County (from development on large, vacant tracts of land to infill development and redevelopment) and on the unique issues associated with these changes, the County published an "Infill and Residential Development Study" report in July, 2000. The report outlined a series of recommendations regarding policy and regulatory changes recommended to better address site design, neighborhood compatibility, traffic/transportation, tree preservation, stormwater management, and erosion and sediment control concerns associated with infill development. The report was accepted

by the County's Board of Supervisors in January, 2001, and efforts to implement the 35 recommendations of the report are continuing. A more detailed discussion of the stormwater management and erosion and sediment control recommendations is provided later in this report.

- County policy provides support for the application of better site design and low impact development techniques where appropriate, and County staff is reviewing its stormwater management policies, practices, and requirements in order to incorporate standards for the application of these techniques. Commitments to these design techniques, where appropriate, are sought through negotiations with developers during the course of zoning reviews.

- The Northern Virginia Soil and Water Conservation District (NVSWCD), which is funded primarily by Fairfax County, is leading a project to explore the incorporation of low impact development (LID) concepts on a 55-acre site in the Laurel Hill area of the County. The effort will include the installation and monitoring of LID techniques as well as public outreach. NVSWCD has also sited and designed a rain garden within an existing multifamily residential community; the facility was constructed with the assistance of the Virginia Department of Forestry and the County's Maintenance and Stormwater Management Division.

- The County completed a baseline evaluation of the ecological health of its stream system (the Stream Protection Strategy Program) and intends to update this evaluation on a continuing basis, as described earlier in this report.

- Also as noted earlier in this report, the County has collected an extensive set of baseline stream condition information to support watershed protection and restoration efforts. A Stream Physical Assessment Report was published in February, 2004.

- The County is developing watershed management plans for all 30 of its watersheds. These plans will serve to provide an assessment of management needs and to prioritize solutions within each watershed. The overall goal for the development of these plans is to provide a consistent basis for the evaluation and implementation of solutions for protecting and restoring the ecological quality of the County's streams and watersheds. The County has developed an extensive public involvement campaign to engage and involve the community in this effort. Steering committees consisting of stakeholder organizations and individuals are overseeing the development of the watershed management plans, and numerous public meetings have been, and will be, held to develop community-based solutions to water quality concerns. The County has received the National Association of Counties 2004 Achievement Award for its Watershed Management Program.

- The County conducts inspection and maintenance programs for stormwater management systems to ensure their effectiveness.

- The County has conducted a number of stormwater control retrofit projects to incorporate water quality control measures into existing stormwater management facilities. Shallow wetland marshes have been established in a number of facilities to increase their water quality and ecological values.

- The County has partnered with NVSWCD and community organizations on streambank stabilization projects using "soft-engineering" techniques.

- Through a partnership among Fairfax County, NVSWCD, the Natural Resources Conservation Service, and two citizens groups, leading-edge technology was used to restore and stabilize a severely degraded and eroding stream channel to a natural, self-sustaining condition. The principles of applied fluvial geomorphology and soil bioengineering techniques were used to analyze, design, and install the project. The stream was reconfigured into a gently meandering stream that is stable. The erosive velocity of the flow has been slowed, and natural vegetation stabilizes the stream banks.

- In 2002, the County's Board of Supervisors directed staff to review the use of regional stormwater management ponds as well as other types of stormwater controls as watershed management tools. A staff subcommittee has undertaken a comprehensive evaluation of the County's stormwater management policies and practices and has issued a series of recommendations to address a broad scope of stormwater management issues. In short, the subcommittee has concluded that regional ponds play a role in the County's stormwater management program but that they ought to be considered as only one of many tools available to address site-specific stormwater management needs. There has also been a recognition of a need to design regional stormwater management facilities, and the stormwater management system in general, to better integrate ecological, economic, and social considerations and for a more complete incorporation of better site design and stormwater management practices into the overall program. In all, the County's Regional Pond Subcommittee has developed a "unified position" on regional ponds and other watershed management tools and has issued 61 specific recommendations pertaining to this issue. The Subcommittee recommendations are undergoing further consideration.

- Fairfax County participates in the regional Occoquan Basin Nonpoint Pollution Management Program, which is coordinated and directed by the Northern Virginia Regional Commission (NVRC). Program participants include local governments, Fairfax Water, the Upper Occoquan Sewage Authority, the Occoquan Watershed Monitoring Laboratory, the Prince William County Service Authority, and the Virginia American Water Company. In addition, one person represents several soil and water conservation districts, including NVSWCD. NVRC maintains the Occoquan Basin Computer Model, which is used to assess management actions that may be needed to ensure the continued viability of the Occoquan Reservoir as a high quality source of drinking water. The Occoquan Nonpoint Source Technical Advisory Committee (TAC) is presently undertaking a multi-year project to prepare a watershed management plan for the entirety of the Occoquan Watershed, of which 17% is located in Fairfax County.

- In March, 2002, the Board of Supervisors recognized the 20-year anniversary of the Occoquan "downzoning" action by designating 2002 as the "Occoquan Watershed Year." As part of this celebration, the Board established the New Millennium Occoquan Watershed Task Force to examine the impacts of increasing population, stormwater management, and other challenges in the watershed and to present its findings and recommendations to the Board. On January 27, 2003, the Task Force presented its report, which contained 29 recommendations addressing a broad range of issues, including the maintenance of the integrity of the downzoning action, the protection of streams in the watershed, the maintenance of regional policies affecting the reservoir, the enhancement of efforts to establish open space easements in the watershed, the review of standards and guidelines addressing special permit, special exception, and public uses, support of watershed management planning efforts, support for tree preservation and restoration efforts, support for the study of establishing an onsite sewage disposal system management authority, increased citizen involvement, continued regional coordination, support for stormwater management and erosion and sediment control recommendations from the Infill and Residential Development Study, and implementation and reporting. Many of the recommendations supported the continuation of ongoing efforts; others recommended new actions. Efforts are under way to address these recommendations; an implementation plan was presented to the Board of Supervisors by County staff on July 7, 2003.

- The County has acquired, through purchase, land transfer, and dedication, substantial areas of new park land. Of particular note are recent acquisitions in the Laurel Hill area and in the far western portion of the County; 878 acres of the 3,200 acre Laurel Hill site (the property that once housed facilities operated by the District of Columbia Department of Corrections) have been dedicated to the Fairfax County Park Authority's Laurel Hill Park, and it is anticipated that an additional 300 acres will soon be dedicated. Additional acreage that is designated as parkland is for Regional Park purposes and will be managed by the Northern Virginia Regional Park Authority at Occoquan Regional Park. In western Fairfax County, over 3,000 acres of newly acquired and existing parkland have been assembled in the Cub Run and Bull Run Watersheds and will be planned comprehensively under the title of "Sully Woodlands." Planning efforts are under way for both Laurel Hill and Sully Woodlands.

- In 2004, the Fairfax County Park Authority (FCPA) adopted its first Natural Resource Management Plan. This document is aimed at ensuring that agency-wide efforts will be coordinated consistent with FCPA's resource preservation-related policies. The following seven elements are included in this Plan: Natural Resource Management Planning; Vegetation; Wildlife; Water Resources; Air Quality; Human Impact on Parklands; and Education. Each of these elements presents a series of strategies for pursuit by FCPA in support of its overall resource preservation mission ("to set aside public spaces for and assist citizens in the protection and enhancement of environmental values, diversity of natural habitats . . . to guarantee that these resources will be available to both present and future generations . . ."). Strategies throughout this document commit to the stewardship and enhancement of natural resources. The Water Resources element references a number of the recent water resource initiatives in the County (e.g., Infill and

Residential Development Study; Watershed Planning; Stream Assessment Project; Regional Pond Subcommittee) and presents a series of strategies addressing issues including: water quality and stream valley protection; water resource inventorying, monitoring, and assessment; coordination with other governmental and nonprofit entities to protect and enhance water resources; and ensuring that adverse water quality impacts of new or renovated FCPA facilities are reduced through the incorporation of best management practices, low impact development techniques, and other innovative techniques.

- The County has developed a partnership with the Northern Virginia Conservation Trust to facilitate and promote the protection of environmentally sensitive lands through the acquisition of open space easements.

- Fairfax County has pursued substantial upgrades to the Noman M. Cole, Jr. Pollution Control Plant in order to reduce point source nutrient pollutant discharges into Pohick Creek, which is a tributary of the Potomac River. As noted earlier in this document, the recent plant upgrades have incorporated biological nutrient removal (BNR); the plant now removes almost 100% of the ammonia from plant influent wastewater, and the plant's effluent has been certified to be free of toxics by an independent lab, as required by the facility's VPDES permit. The County also participates in the regional Upper Occoquan Sewage Authority (UOSA) water reclamation facility, which discharges treated wastewater into the Occoquan Reservoir with total phosphorus concentrations well below its permitted limit of 0.1 mg/l.

- Strategic planning efforts have been undertaken or are under way at the sub-agency, agency, and interagency levels to ensure that County staff efforts are in line with, and actively support, the County staff's Vision and Core Purpose statements. Included in these statements is the following: "Practicing Environmental Stewardship: Local government, business, community organizations, and residents seek ways to use all resources wisely and to protect and enhance the County's natural environment and open space. As a result, residents feel good about their quality of life and embrace environmental stewardship as a personal and shared responsibility."

- As part of the strategic planning effort, the County's Department of Public Works and Environmental Services has, through its stormwater business area, developed a strategic plan for the County's stormwater management efforts; a focus of this plan is a recognition of a need to improve the ecological health of the County's watersheds while optimizing the resources that are available for stormwater management efforts and identifying new resources that will be necessary to meet increasing demands on the program. Efforts are under way to implement actions identified in this plan.

- The County pursues a number of mechanisms to engage the community on stormwater management issues and on the broader scope of environmental issues. Of particular note are the watershed management planning outreach efforts described earlier. Also of note are numerous efforts by the Northern Virginia Soil and Water Conservation District (NVSWCD). The District recently won awards from the National Association of

Conservation Districts for its Web site (which focuses largely on water resource protection issues) and "Conservation Currents" newsletter.

- NVSWCD sponsors neighborhood education programs about the dangers of dumping pollutants (e.g., yard debris, fertilizer, used motor oil, chemicals, animal waste, trash, etc.) in storm drains. The information and education program culminates with the stenciling of a reminder message on the face of several drains throughout the neighborhood.

- NVSWCD has an extensive Volunteer Stream Monitoring Program that supplements other County monitoring efforts and that broadens citizen involvement in stormwater management and watershed management issues.

- A Municipal Separate Storm Sewer System (MS4) permit pursuant to the Clean Water Act and State Water Control Law was issued by the Virginia Department of Environmental Quality (VDEQ) to Fairfax County in 1997 and was reissued in 2002. This permit authorizes all existing and new stormwater discharges to waters of the State from those portions of the stormwater management system owned or operated by the County. The permit requires both dry and wet weather screening of the County's stormwater management system to detect the presence of illicit connections to the system, to investigate and address known areas in the County that are contributing excessive levels of pollutants to the system, and to identify and possibly investigate industrial and other high-risk areas to determine if they are contributing substantial pollutant loads to the system. The County's permit requires the submission of an annual report outlining the County's stormwater management program achievements; many of the activities noted herein have been incorporated into the annual reports and the overall permit. ■

ANALYSIS AND RECOMMENDATIONS

As noted earlier in this report, the Chesapeake Bay Local Assistance Board (CBLAB) has determined that the County's Comprehensive Plan is consistent with the Chesapeake Bay Preservation Act and Chesapeake Bay Preservation Area Designation and Management Regulations, subject to a condition that the County undertake and complete recommendations addressing several issues. This section of the report provides a brief analysis of considerations associated with these issues and presents a series of recommended actions to address each of the major issues identified by CBLAB. The following five key subject areas are identified: Water Pollution Sources; Infill Development; Redevelopment; Shoreline Erosion Control; and Shoreline Access. Each recommended action is numbered, with the numbers continuing sequentially from one subject area to the next. The intent of the recommendations is to identify actions that are related to the issues identified by CBLAB (as discussed in this report) or that are associated with related Comprehensive Plan policy and not otherwise addressed through other County initiatives. As noted in the previous section of this report, there are a number of environmental initiatives that have been pursued recently by the County, and many of these initiatives have presented a series of recommended policy and/or implementation actions. Of particular note are: the Board of Supervisors' recently adopted Environmental Agenda/Environmental Excellence 20-year Vision Plan; the Infill and Residential Development Study (discussed below); the Regional Pond Subcommittee report; the report of the New Millennium Occoquan Watershed Task Force; and ongoing watershed management planning efforts. While many of the recommendations in this report reference, overlap with, or parallel these efforts, it is not the intent of this section to comprehensively repeat the many water quality recommendations that have been identified (and, in the case of watershed management planning, continue to be identified).

Policy issues have been addressed through an amendment to the Policy Plan that has been considered concurrently with this Comprehensive Plan supplement. As such, the focus of the recommendations in this section is on actions that can serve to support adopted County policies. The new policies that have been considered concurrently with this supplement include the following:

- A policy supporting watershed management planning and recommending the consideration of any adopted or endorsed watershed management plan as a factor in making land use decisions;

- A policy recommending optimization of stormwater management and water quality controls and practices for redevelopment consistent with revitalization goals;

- A policy recommending: (1) remediation of development and redevelopment sites that have been subject to contamination by toxic substances or other hazardous materials to the extent that they will not present unacceptable health or environmental risks for the specific uses proposed for these sites, and (2) that unacceptable health or environmental risks will not occur as a result of contamination associated with nearby properties;

- A policy incorporating the map of Chesapeake Bay Preservation Areas presented earlier in this report (Figure 5) into the Plan by reference;

- A policy supporting the analysis and recommendations presented in this document;

- A policy recommending that tidal shoreline erosion control practices follow guidelines of the Virginia Marine Resources Commission, the Virginia Institute of Marine Science, and the Shoreline Erosion Advisory Service and that a hierarchy or preferred shoreline erosion control practices be followed that is generally consistent with guidance endorsed by the Department of Conservation and Recreation's Division of Chesapeake Bay Local Assistance;

- A policy recommending that tidal shoreline access structures follow guidelines of the Chesapeake Bay Program and Virginia Marine Resources Commission; and

- A policy supporting wetland mitigation efforts that are pursued near the area(s) of impact.

Appendix B presents this and other Comprehensive Plan text that is related to water quality protection and identifies the linkages between the actions recommended in this section and Comprehensive Plan policy.

WATER POLLUTION SOURCES

FINDINGS

Water resources in Fairfax County are vulnerable to contamination and degradation from both point and nonpoint sources. The primary threat to the County's water resources is associated with stormwater runoff from developed and developing areas. However, significant reductions in nutrient loads from both point and nonpoint sources will need to be pursued in Fairfax County in support of regional efforts to restore habitats for living resources in the Potomac River and the Chesapeake Bay (the Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy for the Shenandoah and Potomac River Basins). Where the County contributes to point source waste loads in other jurisdictions (i.e., discharges from sewage treatment plants at Blue Plains, in the City of Alexandria, and in Arlington County), contributions to plant upgrades or other efforts to counter increasing pollutant loads associated with continued increases in wastewater volumes generated in the County may be needed. The consideration of efforts that may be needed to support the Tributary Strategy effort falls beyond the scope of this document; however, it should be recognized that this effort will be an expensive one with significant implications to Fairfax County, in terms of the funding that will be needed to support pollutant load reductions and perhaps in terms of future growth and development in the County and region.

Most of Fairfax County has been developed, and relatively little land remains vacant. While redevelopment can be anticipated in many areas of the County, the prevailing character of land use over much of the County is, and will remain, a stable one. Stormwater management controls for new development and redevelopment can, therefore, only assist efforts to reduce pollutant

loads in a relatively limited manner. Rather, water quality improvement efforts that fall outside the realm of governmental regulation, including voluntary stewardship efforts on the part of residential, business, and institutional land owners, will become increasingly important, as will proactive efforts to provide water quality controls in areas where such controls have been lacking. The County's watershed management planning initiative will serve to identify opportunities to pursue water quality improvement projects as well as projects to improve the ecological vitality of the County's streams. The watershed management planning effort should also encourage a broader stewardship ethic through increased citizen involvement in watershed initiatives. Indeed, the program's receipt of the National Association of Counties' 2004 Achievement Award attests to the breadth of this effort. Substantial additional educational efforts, however, will probably be needed to reach a broader cross-section of the County's land owners and managers.

Fairfax County contains significant areas of publicly-owned land; federally-owned properties (e.g., U.S. Army Fort Belvoir, the George Washington Memorial Parkway, Washington Dulles International Airport) are of particular note, but significant areas are also owned and managed by the Northern Virginia Regional Park Authority and the State. Development on state and federal lands generally falls outside of the County's regulatory authority; however, environmentally-sensitive development practices are as important on these properties as they are on properties that are subject to County approval. In addition, development activities in adjacent jurisdictions can affect the quality of the County's water resources, and the County therefore has an interest in activities that occur beyond its borders.

Fairfax County does not contain substantial areas characterized by traditional "heavy" industrial uses. Those activities that do have significant discharges into the surface water system are subject to permitting requirements and enforcement by Virginia's Department of Environmental Quality. Facilities that use or store significant quantities of hazardous materials or that store petroleum products in underground storage tanks are well regulated at the County, State, and federal levels. Further, the County's Policy Plan contains a policy recommending protection of water resources through the maintenance of high standards for discharges from point sources, and it is not anticipated that a significant number of new point source dischargers will be established within Fairfax County in the future. However, if a facility subject to VPDES permitting is also the subject of a request for a zoning approval, it would be prudent to review the facility's permit compliance status during the course of the review of the zoning application and to ensure that any shortcomings in facility performance are remedied. Further, while underground storage tanks are well regulated, residential heating oil tanks are not subject to registration requirements, and the Virginia Department of Environmental Quality has indicated that a significant proportion of the total number of petroleum releases in Fairfax County is related to residential heating oil tanks. This issue cannot be resolved through land use controls or policies; absent strengthened regulation of these tanks, increased outreach and education efforts would probably be needed to improve the maintenance and monitoring of these tanks.

An issue of more significant concern regarding hazardous materials and underground storage tanks is that of residual contamination associated with past activities on a site. This concern is discussed in the analysis of redevelopment issues.

As noted earlier, one emerging water resource issue related to land use concerns, as highlighted in the recent report of the New Millennium Occoquan Watershed Task Force, concerns on-site sewage disposal systems. Specifically, this concern relates to the increasing number of technologically advanced, but maintenance-intensive, on-site sewage disposal systems that are coming into use. An interagency County staff subcommittee has begun to explore solutions to issues posed by these new systems, including a review of the feasibility of establishing a self-supporting authority to provide for the maintenance of on-site sewage disposal systems.

As evidenced by the results presented within the Stream Protection Strategy Baseline Study, the Countywide Stream Physical Assessment, and the annual Stream Water Quality Report, water resources throughout the County have been stressed by the effects of land use and development. A direct correlation between watershed imperviousness and the ecological integrity of streams in Fairfax County has been identified. Adverse stream conditions such as bank erosion, obstructions, dump sites, and insufficient riparian buffers have been documented throughout the County. Fecal coliform bacteria concentrations typically exceed regulatory standards, and a growing list of "impaired waters" in Fairfax County is being compiled by VDEQ. At the regional level, substantial and costly efforts will be needed to restore high quality living resource conditions to the Chesapeake Bay and its tidal tributaries, and Fairfax County will need to contribute to this regional effort.

The County's Policy Plan recognizes the need to "prevent and reduce pollution of surface and groundwater resources," to "protect and restore the ecological integrity of streams in Fairfax County," and to protect the Potomac Estuary and the Chesapeake Bay from the avoidable impacts of land use activities in Fairfax County." While water resource issues affecting the County are numerous, efforts are under way to address these issues. The County has initiated a comprehensive watershed management planning program to identify stream restoration needs and strategies and to establish priorities for action. Coordinated efforts are under way to develop strategies to address fecal coliform bacteria pollution in Accotink Creek and Four Mile Run, and similar efforts will need to be pursued for other impaired waters in and near the County. The County will continue to devote significant resources to the enforcement of its erosion and sediment control requirements. Further, the County is in the process of reviewing its stormwater management requirements to identify changes that will be needed to optimize the effectiveness of these requirements in protecting and restoring the County's water resources. Policies have been adopted to support better site design and low impact development techniques where appropriate, and discussions are continuing as to how to integrate these techniques more completely into the County's regulatory framework.

Other efforts of note include the recent adoption of Policy Plan language to support wetland compensation and mitigation efforts near the area(s) of wetland impacts. Staff from the Fairfax County Department of Public Works and Environmental Services has coordinated with the U.S. Army Corps of Engineers to identify watershed restoration opportunities in Fairfax County that can be sought as compensation for wetland losses in the County based on the recently-completed Countywide Stream Physical Assessment project. The County is participating in and closely tracking efforts to develop basin-wide strategies to reduce nutrient and sediment inputs into the Potomac River and Chesapeake Bay. The County also participates in the regional Occoquan

Basin Nonpoint Pollution Management Program and the Four Mile Run Watershed Management Program coordinated through the Northern Virginia Regional Commission.

The protection of the County's tree cover can also be considered as a significant water quality strategy; trees can intercept and slow considerable quantities of rain water, thereby reducing stormwater runoff, associated erosion, and the conveyance of nonpoint source pollutants. In addition, trees and forests, particularly where interconnected in large, contiguous areas and corridors, provide considerable wildlife habitat benefits. The County is currently identifying and mapping the locations and extents of all native forest communities present in Northern Virginia, including upland and riparian forests. The delineation of forest communities will allow the County to identify vegetation that is becoming rare or endangered on a global or local basis and to consider this information in land use decisions and watershed management planning efforts. This information could also be used to establish specific tree cover goals and strategies (that could be watershed based) in order to optimize the benefits of tree cover and forests.

The County has identified a large number of storm drainage projects that are needed to remedy drainage and environmental concerns. As the watershed management planning, TMDL development and implementation, and basin-wide strategies at the regional level are developed, this list can be expected to grow, and the already substantial hurdle of funding will become even more of a challenge. While policy decisions regarding funding mechanisms extend beyond the purview of this document, the County will need to consider how resources can be obtained to address a multitude of water resource protection and restoration needs and how to optimize these resources. Meanwhile, the Policy Plan has been amended to incorporate policy support for the County's primary nonpoint source initiative (watershed management planning), and to support the consideration of watershed management plans as a factor in land use decisions. Continued efforts are recommended to ensure:

- that the County's information base supports water resource management initiatives;
- that the County's stormwater management practices and requirements (e.g., regional ponds, low impact development measures, adequate outfall requirements) support water resource protection and restoration to the extent possible;
- that the County's staffing levels are adequate to meet state-mandated erosion and sediment control review and inspection requirements and adequate to protect downstream properties and the County's natural resources from erosion and sedimentation associated with land-disturbing activities; and
- that the County participates in regional water resource management initiatives.

WATER POLLUTION SOURCES: RECOMMENDATIONS

1. If and when facilities that are subject to Virginia Pollutant Discharge Elimination System (VPDES) permits request zoning approvals, coordinate with the Virginia Department of Environmental Quality to identify any shortcomings in permit compliance and seek remedies to any such shortcomings.

2. Review the County's current approach to adequate outfall and revise if necessary to ensure protection of downstream resources when development occurs. If determined to be appropriate, prepare an amendment to the Public Facilities Manual to revise adequate outfall requirements.

3. Complete watershed management plans for all 30 of the County's watersheds.

4. Watershed management plans are currently being developed, and it can be anticipated that these plans will ultimately be adopted by the Board of Supervisors. Develop a mechanism to ensure that zoning and Plan amendment proposals will be reviewed within the context of adopted watershed management plans; establish standard operating procedures to ensure that the necessary interagency coordination occurs.

5. Implement the recommendations of adopted watershed management plans as funding allows. Establish a mechanism to prioritize and track actions on recommendations for capital improvement projects. Once a sufficient number of watershed management plans have been completed, establish a work program for the consideration of policy and regulatory changes to address policy actions recommended in adopted watershed management plans.

6. Explore the feasibility and desirability of establishing a self-supporting funding mechanism to provide for the implementation of projects recommended through the watershed management planning process. Present recommendations regarding funding mechanisms to the Board of Supervisors for consideration.

7. Consider the establishment of an obtainable tree cover goal for Fairfax County and/or some or all watersheds within Fairfax County. Prepare a recommended process to develop such a goal (or goals) for consideration by the Board of Supervisors.

8. Coordinate with the Natural Resources Conservation Service and the Northern Virginia Soil and Water Conservation District on the completion of a revised soil survey for Fairfax County.

9. Continue participation in the regional Occoquan Watershed management program.

10. Coordinate with neighboring jurisdictions to foster cooperation on regional water resource issues and request the participation of neighboring jurisdictions on applicable watershed management planning efforts. Continue to review and provide comments on development proposals outside of the County's boundaries that can affect the County's natural resources.

11. Continue to analyze and comment on land use and development activities proposed on federal, state, or other publicly-owned land that falls outside of the County's regulatory authority; through such comments and associated coordination, encourage development designs and practices that are consistent with the Comprehensive Plan.

12. Explore the feasibility and desirability of establishing a self-supporting authority to provide for the management of on-site sewage disposal systems. Present recommendations regarding such an authority to the Board of Supervisors.

13. Amend the Public Facilities Manual to incorporate standards for Low Impact Development Best Management Practices (BMPs) and other innovative BMP practices as appropriate.

14. Consider whether changes to County policies regarding the placement of Low Impact Development BMP practices should be revised to allow for a broader application of such practices on individual privately-owned lots. Present recommendations regarding this matter to the Board of Supervisors.

15. Review the County's policies and Code requirements to determine if changes to the Public Facilities Manual, Zoning Ordinance, and/or other Code requirements would be appropriate consistent with Policy k of Objective 2 in the Environment section of the Policy Plan (supporting the application of better site design and low impact development techniques). Prepare appropriate amendments to these requirements for consideration by the Planning Commission and Board of Supervisors.

16. Contingent on the availability of sufficient funding, retrofit existing stormwater management facilities to enhance their water quality and quantity control functions; continue to retrofit dry stormwater management facilities as wetland BMP facilities.

17. Ensure that appropriate interagency coordination occurs in order to improve the consideration of stormwater management, BMP, and adequate outfall issues during the zoning process.

18. Ensure that appropriate interagency coordination occurs in order to improve the consideration of stormwater management, BMP and adequate outfall issues during the Plan amendment process.

19. Revisit the current policy supporting the use of regional stormwater management facilities in light of the approach recommended in the March, 2003 report entitled "The Role of Regional Ponds in Fairfax County's Watershed Management." Prepare an amendment to the Comprehensive Plan to revise County policy as it relates to regional facilities for consideration by the Planning Commission and Board of Supervisors.

20. Coordinate with the Virginia Department of Environmental Quality and other entities as appropriate on the development of TMDLs and implementation plans for impaired waters in Fairfax County.

21. Coordinate with appropriate state agencies on the development of nutrient and sediment reduction strategies for the Shenandoah and Potomac River Basin.

22. Continue to pursue implementation of recommendations presented in the report of the New Millennium Occoquan Watershed Task Force.

23. Ensure that sufficient resources continue to be dedicated to the enforcement of erosion and sediment control requirements.

24. Continue to implement the County's infiltration abatement program to maintain the integrity of the County's sanitary sewer network.

25. Inform authorities responsible for wetland regulation of the County policy supporting wetland compensation and mitigation efforts near the area(s) of impact and request their consideration in implementing this policy through their permitting processes.

26. Continue existing nonpoint source pollution education efforts and, contingent on the availability of resources, strengthen outreach efforts to improve the land stewardship ethic among owners and managers of land in Fairfax County. Consistent with recommendations presented by the New Millennium Occoquan Watershed Task Force, pursue strengthened partnerships with appropriate public, nonprofit, and citizen organizations, encourage growth in the network of organizations and citizens groups concerned with and/or actively involved in watershed and water quality issues, sponsor/partner on an increased number of efforts to promote water quality and natural resource protection, and expand existing outreach and education programs.

27. Contingent on the availability of resources, strengthen outreach efforts to property owners with residential heating oil tanks to encourage improved maintenance, monitoring, and operation of these tanks.

28. Conduct concurrent reviews and public hearings for exceptions from Chesapeake Bay Preservation Ordinance requirements in conjunction with other land use approval processes involving public hearings before the Planning Commission and Board of Supervisors.

INFILL DEVELOPMENT

FINDINGS

As noted in the first section of this report, the amount of vacant land in the County has decreased steadily as population and employment have increased. In 2003, only 11.1% of the County's zoned land was vacant, and large, contiguous blocks of vacant land are no longer prevalent. More and more, new development is characterized by the "infill" of new construction on relatively small parcels of vacant or underutilized land in established, developed areas. Redevelopment of older areas is also becoming more common. The Infill and Residential Development Study was initiated by the Board of Supervisors in May, 1999 in recognition of the unique challenges posed by infill development. A study report was published in July, 2000, and the recommendations of this report were accepted by the Board of Supervisors subsequent to a

public hearing that was held on January 22, 2001. One of the major thematic areas covered by the report addressed stormwater management and erosion and sediment control. The effectiveness of policies and practices regarding stormwater management and erosion and sediment control were reviewed with regard to their effectiveness in minimizing impacts of stormwater runoff on downstream properties, limiting the impacts of stormwater management facilities on neighborhoods, ensuring that developers are accountable for impacts from their developments, and upgrading existing inadequate facilities. Some of the recommendations presented included:

- An enhanced erosion and sediment control program involving improvements in education, policy, regulations, and enforcement as well as implementation of innovative practices;

- Adoption of policies regarding innovative BMP practices in order to reduce impact during development and allow greater flexibility in the engineering of proposed sites;

- Improved consideration of proposed storm water management facilities by implementing a technical review of certain components during the rezoning process;

- Enhanced requirements and better definitions for design professionals for evaluating the adequacy of stream channels for increased runoff due to new developments during the design process;

- Identification and survey of water impoundments downstream of a proposed development that could be impacted by a proposed development, and assignment of accountability for impact resolution;

- Adoption of a program to retrofit existing non-water quality control facilities to perform this function as well; and

- Development of a BMP monitoring program.

Other sections of the Infill and Residential Development Study addressed site compatibility, tree preservation, and traffic and transportation. While water quality considerations were not the primary factor influencing the recommendations that were issued in these sections of the report, a number of recommendations in these sections have water quality implications. Of particular note are the following:

- Revisions to the Residential Development Criteria of the Policy Plan (which have been used to assess residential density during the review of zoning applications)—these criteria include a consideration of environmental resources and impacts;

- Consideration of whether cluster development should be allowed “by-right”—the Board of Supervisors did not accept or reject a staff position on this issue, but State legislation

adopted subsequent to the Board's consideration of the Infill and Residential Development Study has required action to be taken to address this issue.

- Consideration of how "open space" is defined in the Zoning Ordinance to ensure that open space that is identified on development plans provides neighborhood benefits such as recreational opportunities or tree preservation.

- Revision to the method of calculating required stormwater retention in the Public Facilities Manual to provide an incentive for additional tree preservation.

- Support for the use of conservation easements on common open space areas to provide for the protection, in perpetuity, of forested areas.

Implementation of these recommendations is continuing; some of the recommendations have been implemented, while others are in progress. Recently, substantial progress has been made in the following key areas:

- Improvement in the ability of County staff to enforce erosion and sediment control requirements through the development of a "Violation Matrix." This matrix provides staff with a better tool to enforce erosion and sediment control requirements and provides industry with a more predictable path toward resolution of violations.

- Continued analysis of measures and methods to improve the efficiency and capabilities of erosion and sediment controls, including the drainage area to temporary inlets and the use of devices such as the Faircloth Floating Skimmer, chemical erosion prevention products, and bonded fiber matrix products.

- Establishment of a committee comprised of staff and industry professionals, in conjunction with the Engineers and Surveyors Institute, (ESI) to review and evaluate the current adequate outfall provisions. It is intended that this effort will result in recommendations for policy and regulatory changes to improve how the County addresses issues associated with storm drainage outfalls from developed and developing sites.

- Adoption of an amendment to the Zoning Ordinance to require more detailed information during the zoning process regarding stormwater management facilities and outfall conditions. In conjunction with the implementation of the strengthened submission requirements, staff is developing an internal review process that will ensure a more rigorous consideration of stormwater management, adequate outfall, and water quality issues during the zoning process.

- Adoption of an amendment to the Policy Plan to revise the Residential Development Criteria. These revised criteria include strengthened guidance regarding water quality issues, including a consideration of impacts to off-site properties, the provision of state-of-the-art stormwater management measures, and the pursuit of better site design and low

impact development techniques.

- Adoption of an amendment to the Policy Plan to promote the use of open space/conservation easements as tools to preserve environmental resources.

- Adoption of an amendment to the Zoning Ordinance to allow cluster subdivisions "by-right" in certain residential zoning districts, subject to performance criteria ensuring preservation of environmentally-sensitive areas such as floodplains and adjacent steeply sloping areas and requiring tree cover requirements to be met through tree preservation where appropriate.

One of the conditions imposed by the Chesapeake Bay Local Assistance Board in its review of the County's Comprehensive Plan for conformance with the Chesapeake Bay Preservation Area Designation and Management Regulations was the following: "The County shall revise the Plan, where appropriate, to develop policies that address the recommendations that affect water quality as outlined in the 'Infill and Residential Development Study'." While it is recognized that the implementation of recommendations in this study is not yet complete, such efforts are continuing. Further, remaining implementation tasks related to the recommendations of the Infill and Residential Development Study relate to regulatory and procedural issues. The Policy Plan has been amended to incorporate revised residential development criteria and to support the use of open space/conservation easements, and the existing policy framework within the Policy Plan supports the remaining tasks.

Another concern related to infill development projects is the potential for soil and/or groundwater contamination associated with past and/or current activities on adjacent properties. While it is not generally the responsibility of a developer to remediate contamination caused by current or past uses on an adjacent or nearby property, it is appropriate to ensure that any development that occurs on an infill site will not present unacceptable health or environmental risks, either to workers on the site or to occupants of the developed site. A policy to this effect (more broadly applicable to all development sites) has been incorporated into the Environment section of the County's Policy Plan; site investigations may be needed in cases in order to identify potential contaminants on infill development sites.

INFILL DEVELOPMENT: RECOMMENDATIONS

Many of the recommendations above that address water pollution sources also address infill development; some were referenced directly in the Infill and Residential Development Study. These recommendations are not repeated here.

29. Continue to implement the recommendations of the Infill and Residential Development Study as accepted by the Board of Supervisors on January 22, 2001.

30. Incorporate Virginia Department of Environmental Quality (VDEQ) data regarding leaking storage tanks into the Department of Planning and Zoning's environmental assessment application to ensure that contamination on or near sites where such

releases have occurred is considered appropriately during the consideration of infill development and redevelopment proposals during the zoning process. (Same as #32)

31. Coordinate with VDEQ regarding the acquisition of information regarding other releases of contaminants (e.g., the Volunteer Remediation Program) in order to better screen for potential site contamination issues during the zoning process. (Same as #33)

REDEVELOPMENT

FINDINGS

As noted earlier in this report, the character of development in Fairfax County has changed substantially over time. Infill development on relatively small parcels of vacant and underutilized land in established, developed areas has become common, and redevelopment of older areas, either through wholesale neighborhood consolidation and redevelopment or through redevelopment on individual lots or parcels, is becoming a more common occurrence. Redevelopment is actively encouraged in many areas; in fact, the revitalization of older commercial and residential areas of the County is established as one of the Board of Supervisors 19 "Goals for Fairfax County." The County has established Commercial Revitalization Districts and Areas and has developed specific zoning provisions and Comprehensive Plan guidance for these areas. Redevelopment is considered to be a welcome result of the economic vitality of Fairfax County and is, under appropriate circumstances, embraced and encouraged by the County. However, redevelopment presents an entirely new set of concerns and opportunities beyond those typically associated with new development, and these concerns and opportunities cut across environmental, economic, and social lines.

From an environmental perspective, redevelopment offers significant opportunities to support the restoration of areas that have been degraded by previous development. There are opportunities to convert sites that are now largely impervious with no water quality controls to economically vibrant developments on sites with reduced impervious cover and new stormwater management and water quality controls. Efforts to reduce the effective impervious cover of these sites through the application of "better site design" practices can also be considered. Further, efforts to restore segments of degraded streams and their riparian buffer areas may be possible, even in some of the most intensely developed areas of the County. The County's Policy Plan supports the restoration of the County's streams, the restoration of degraded Environmental Quality Corridors, the reduction of pollution of surface and groundwater resources, and the application of better site design techniques on redevelopment sites. In addition, broader guidance recognizing water quality opportunities associated with redevelopment has been incorporated into the Plan. From a regulatory perspective, the County's Chesapeake Bay Preservation Ordinance requires reductions in phosphorus runoff for redevelopment projects; however, there is no parallel requirement addressing stormwater quantity controls.

Another concern related to redevelopment projects is the potential for residual soil and/or groundwater contamination associated with past activities on the subject properties. It is appropriate to ensure that any development that occurs on a redevelopment site will not present

unacceptable health or environmental risks, either to workers on the site or to occupants of the developed site. A policy to this effect has been incorporated into the Environment section of the County's Policy Plan. The concern in this area is two-fold:

(1) There may be no obvious signs of contamination on a property that has, in fact, been contaminated by past activities; and

(2) Risk factors associated with sites that have been "cleaned up" can change as these sites are redeveloped; what may be an acceptable level of risk for a commercial or industrial use, for example, may not be acceptable for a residential or other more sensitive use.

The first concern can be addressed through site investigations focusing on historical uses of properties and, if appropriate, soil and/or groundwater monitoring. While these investigations are not required by the County Code, they are typically sought during the zoning process on sites where the potential for releases of contaminants has been identified. The incorporation of VDEQ data regarding leaking storage tanks (both open and closed cases involving underground or above ground tanks), as presented earlier in this document, would assist in this effort.

With respect to properties on which redevelopment is proposed, County staff typically requests, during the zoning process, site investigation information and/or commitments where there is evidence or concern of potential site contamination; such requests have been made where there is physical evidence of contamination on a site (e.g., odors; stressed vegetation; staining of soil; empty 55-gallon drums) and even in some cases where the proposed nature of the change in zoning (e.g., from industrial to residential) evokes concerns about site history and potential implications with respect to the proposed use. Typically, the Department of Planning and Zoning coordinates such requests with the County's Fire and Rescue and Health Departments. The consideration of DEQ data regarding open and closed cases regarding leaking storage tanks would further assist in this effort, as would broader coordination with DEQ on the identification of sites for which there are records of past contamination (e.g., the State's Voluntary Remediation Program.)

REDEVELOPMENT: RECOMMENDATIONS

Many of the recommendations identified earlier (addressing water pollution sources) also address redevelopment. These recommendations are not repeated here.

32. Incorporate Virginia Department of Environmental Quality (VDEQ) data regarding leaking storage tanks into the Department of Planning and Zoning's environmental assessment application to ensure that contamination on or near sites where such releases have occurred is considered appropriately during the consideration of infill development and redevelopment proposals during the zoning process. (Same as #30)

33. Coordinate with VDEQ regarding the acquisition of information regarding other releases of contaminants (e.g., the Volunteer Remediation Program) in order to better screen for potential site contamination issues during the zoning process. (Same as #31)

34. Develop recommendations for amendments to the County Code and/or Public Facilities Manual, as applicable, to consider the establishment of stormwater management requirements for redevelopment that will provide for reduced stormwater runoff peak volumes on developed sites that are currently not adequately served by such measures. Draft these recommendations in a manner that will allow for the consideration of whether to require redevelopment sites to achieve a certain reduction in peak volumes rather than allowing them to achieve the same hydrologic conditions that existed prior to redevelopment. The County already has a BMP requirement for redevelopment (a 10% reduction in phosphorus runoff compared with pre-redevelopment conditions); a requirement that is similar in nature to the BMP requirement could be pursued for stormwater quantity control.

SHORELINE EROSION CONTROL

FINDINGS

In order to update existing published information regarding shoreline erosion and erosion controls along the County's tidal shoreline, recent aerial photographs of the County's tidal shoreline area were analyzed. Areas experiencing active shoreline erosion were noted, as were shoreline erosion control structures. Shoreline erosion rates, however, were not determined. In general, the shoreline reaches along which active erosion was identified are characterized by exposure to a significant fetch. Artificial shoreline erosion control structures are concentrated in residential areas.

Guidance regarding appropriate responses to shoreline erosion has been provided by the Virginia Marine Resources Commission (VMRC) and by the Department of Conservation and Recreation's Division of Chesapeake Bay Local Assistance, which has endorsed a hierarchy of shoreline erosion control approaches established by the Hampton Roads Planning District Commission. The VMRC guidelines recommend that shoreline stabilization structures only be pursued where there is "active detrimental shoreline erosion which cannot be otherwise controlled" and that such structures be constructed in a manner that minimizes wetlands impacts. The County has recently incorporated the VMRC and Chesapeake Bay Local Assistance/Hampton Roads Planning District Commission guidance, by reference, into its Comprehensive Plan. The Wetlands Board should be advised of this policy guidance; ideally, the owners of property along the tidal shoreline should also be made aware of this policy, as well as other environmental policies and regulations affecting shoreline erosion controls.

The VMRC guidance does not provide a definition of "active detrimental shoreline erosion." The interpretation of this term, therefore, is a subjective one that is left to the applicable regulatory authority to make. Consideration should be given to developing a definition of this term that can be applied by the County's Wetlands Board in its reviews of shoreline stabilization proposals.

The Shoreline Situation Report that included an evaluation of Fairfax County's tidal shoreline was last produced by the Virginia Institute of Marine Science (VIMS) in 1979. While the

Northern Virginia Planning District Commission (now the Northern Virginia Regional Commission) published a document in 1992 that assessed shoreline erosion and erosion controls along the tidal shoreline of the County, the method of identifying shoreline erosion was based on map analyses rather than field studies. An update of the VIMS report based on field investigations would be useful in providing a current assessment of the conditions of the County's tidal shoreline.

SHORELINE EROSION CONTROL: RECOMMENDATIONS

35. Coordinate with State agencies, the Fairfax County Wetlands Board, and representative stakeholders, to develop recommended guidance for consideration by the Board of Supervisors regarding "active, detrimental shoreline erosion" for application as a County policy.

36. In coordination with State agencies, and contingent upon the availability of necessary resources, develop a process and related educational materials to ensure that tidal shoreline property owners are aware of information and advice pertaining to best shoreline stabilization practices as set forth and/or provided by the Virginia Institute of Marine Science, the Virginia Marine Resources Commission, and the Shoreline Erosion Advisory Service. As part of this effort, ensure that tidal shoreline property owners are provided information regarding the requirements of the Chesapeake Bay Preservation Ordinance, the Wetlands Zoning Ordinance, the Erosion and Sedimentation Control Ordinance and the Floodplain Regulations of the Zoning Ordinance.

37. Advise the Wetlands Board of the newly adopted policy regarding tidal shoreline erosion control/stabilization practices and request that Wetlands Board decisions be consistent with this policy.

38. Request that the Virginia Institute of Marine Science (VIMS) update the Shoreline Situation Report and the Tidal Shoreline Marsh Inventory for Fairfax County's tidal shoreline. Ideally, this effort would include the following:

    - Identify areas where tidal wetlands and riparian forest buffers adjacent to tidal wetlands can be restored;

    - Identify invasive plant species along the tidal shoreline and assist in developing ways to reduce invasive plant areas and restore native plants and submerged aquatic vegetation (SAV) to improve habit value and enhance water quality protection;

    - Conduct field studies of shoreline erosion rates along sensitive reaches of the County's shoreline in order to better characterize the nature and extent of shoreline erosion than is possible from a review of published reports and an analysis of aerial photography; and

- Conduct an analysis of physical conditions relating to shoreline erosion potential (e.g., soils, fetch, storm surge, slopes) along individual reaches of the County's tidal shoreline in order to characterize the susceptibility of each reach to erosion.

39. Continue to coordinate the review of all projects requiring approval of the County's Wetlands Board with the Department of Public Works and Environmental Services to ensure that all applicable regulatory requirements of the Chesapeake Bay Preservation Ordinance, the Erosion and Sedimentation Control Ordinance, and the Floodplain Regulations of the Zoning Ordinance are addressed and where appropriate that the applicant is aware of the need for additional permits and approvals. (Same as #40)

SHORELINE ACCESS

FINDINGS

Fairfax County is unique in Virginia with respect to the character of land use along its shoreline areas. Over 60% of the County's tidal shoreline is publicly owned, as is much of the shoreline of the nontidal Potomac River, much of the shoreline of the Occoquan Reservoir, and much of the County's network of stream valleys. Although there are some exceptions (notably Fort Belvoir), much of the publicly-owned shoreline is accessible to the public. A variety of recreational opportunities are provided at various parks in these areas, including hiking, bicycling, picnicking, sight seeing, bird watching, fishing, and boating. Further, the County has established an extensive stream valley park system as well as a substantial network of trails and has adopted Comprehensive Plan policy, and an associated Countywide Trails Plan, recommending a "comprehensive network of trails and sidewalks . . . as an integral element of the overall transportation network." While demand surveys identify a continued demand for environmental protection and passive (or "low impact") recreation opportunities, there are substantial opportunities for passive recreation along the County's shorelines.

A number of marinas are present along the County's tidal shoreline. Most of these marinas are equipped with sewage pump-out facilities, although such facilities are not required for the smaller marinas. It would be desirable to inform boaters of the marinas in the County that provide pump-out facilities and to advise owners and operators of the other marinas of funding opportunities that may arise that might cause them to consider constructing such facilities. It should be noted, however, that most operators of private marinas that have pump-out facilities only wish to offer the service to their own club or homeowners association members. The operators of these marina facilities do not wish to advertise their pump-out capabilities to the general boating population; typically, this is due to staffing and maintenance issues. Currently, only two marinas offer sewage pump-outs to the general boating public.

Private points of access to the County's tidal shoreline are concentrated in areas where residential development is adjacent to the shoreline; this pattern can be expected to persist into the future.

The 1990 Chesapeake Bay Public Access Plan highlighted a shortage of publicly-available boating access opportunities along the County's tidal shoreline, and it is likely, based on

continuing population growth in the County, that demand for such access has increased since that Plan was published. The siting of new publicly-accessible tidal shoreline boating access facilities will be limited substantially by the availability of property. Vacant and underutilized privately-owned properties are not prevalent along the tidal shoreline. In addition, many of these properties would not meet, or would have difficulty meeting, Zoning Ordinance standards for commercial marinas, docks, and boating facilities. Further, any proposal for a commercial or private/nonprofit marina, dock, or boating facility would require approval of either a Special Exception or a Special Permit; a broad range of environmental concerns, and possibly community concerns as well, would be considered in any such process.

While the pursuit of new boating access facilities along the County's shoreline will be limited by site availability issues, a broad suite of environmental considerations can be addressed for any proposed facility. Guidelines produced by the Virginia Marine Resources Commission and the Chesapeake Bay Program provide a template for the evaluation of the environmental suitability of any site for which such access may be proposed, and the County has recently incorporated this guidance, by reference, into its Comprehensive Plan. These guidelines can, therefore, be applied in any consideration of new boating access facilities by the Board of Supervisors or Board of Zoning Appeals. The Wetlands Board should be advised of this policy guidance; ideally, the owners of property along the tidal shoreline should also be made aware of this policy and other environmental policies and regulations affecting the shoreline area.

As noted earlier, a majority of the County's shoreline is publicly-owned. One or more public agencies may propose new boating access facilities along the tidal shoreline at some time in the future. While the County may not have approval authority over such decisions, it could, through the application of the policy referencing VMRC and Chesapeake Bay Program guidelines, seek to influence such decisions.

SHORELINE ACCESS: RECOMMENDATIONS

40. Continue to coordinate the review of all projects requiring approval of the County's Wetlands Board with the Department of Public Works and Environmental Services to ensure that all applicable regulatory requirements of the Chesapeake Bay Preservation Ordinance, the Erosion and Sedimentation Control Ordinance, and the Floodplain Regulations of the Zoning Ordinance are addressed and where appropriate that the applicant is aware of the need for additional permits and approvals. (Same as #39)

41. In coordination with State agencies, and contingent upon the availability of necessary resources, develop a process and related educational materials to ensure that tidal shoreline property owners are aware of information and advice pertaining to boating access best practices as set forth and/or provided by the Virginia Institute of Marine Science, the Virginia Marine Resources Commission, the Shoreline Erosion Advisory Service, and the Chesapeake Bay Program. As part of this effort, ensure that tidal shoreline property owners are aware of the requirements of the Chesapeake Bay Preservation Ordinance, the Wetlands Zoning Ordinance, the Erosion and Sedimentation Control Ordinance and the Floodplain Regulations of the Zoning Ordinance.

42. Advise the Wetlands Board of the newly adopted policy regarding tidal shoreline access structures and request that Wetlands Board decisions be consistent with this policy.

43. Ensure that any new marinas that are constructed in Fairfax County will be fully in compliance with Chapter 570, Sanitary Regulations for Marinas and Boat Moorings, as promulgated by the Virginia Department of Health of the Commonwealth of Virginia. This Chapter implements the federal Clean Vessel Act through the Virginia Marina Program.

44. As funding opportunities arise, advise owners and operators of marinas that are exempt from sanitary waste pump-out facility requirements of funding opportunities that may be available to provide such facilities.

45. Contingent on the availability of necessary resources, pursue an outreach program in order to ensure that boaters are made aware of the available marina facilities in the County that are registered by the Commonwealth, that maintain current certificates to operate, and that have sanitary waste pump-out facilities that are available for general public use. ■

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General References

(Note: Much of the information reported in this Supplement was provided through personal communications. Please see the list of acknowledgements at the beginning of this report for a list of people who contributed information, ideas, criticisms, and suggestions in the development and review of this document.)

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Web Site References

(These were the Web sites that were referenced during the preparation of this supplement in 2004)

(Note: Information obtained from links to related materials as provided on these sites was also consulted.)

Center for Watershed Protection: http://www.cwp.org

Chesapeake Bay Foundation: http://www.cbf.org

Chesapeake Bay Program: http://www.chesapeakebay.net

Fairfax County Web Sites:

About Our County: Maps, Facts & Stats: http://www.fairfaxcounty.gov/aboutfairfax
Chesapeake Bay Preservation Ordinance Amendments:
http://www.fairfaxcounty.gov/dpwes/environmental/cbay/
Comprehensive Plan: http://www.fairfaxcounty.gov/dpz/comprehensiveplan
Countywide Stream Physical Assessment:
http://www.fairfaxcounty.gov/dpwes/watersheds/psa-update.htm
Environmental Excellence for Fairfax County: A 20-Year Vision:
http://www.fairfaxcounty.gov/dpwes/environmental/env_excel.htm
Fairfax County Code: http://fairfaxcounty.gov/countycode
Fairfax County Flood Plains:
http://www.fairfaxcounty.gov/maps/nofind/metadata/floodPlain.htm
Floodplain Information: http://www.fairfaxcounty.gov/dpwes/navbar/faqs/floodplains.htm
Fun Facts About Fairfax County: http://www.fairfaxcounty.gov/opa/funfacts.htm
Noman M. Cole, Jr. Pollution Control Plant:
http://www.fairfaxcounty.gov/dpwes/utilities/wwtrmnt_0600.htm
Occoquan Watershed: http://www.fairfaxcounty.gov/dpwes/environmental/owshed1.htm
Overcoming Problems with Marine Clay:
http://www.fairfaxcounty.gov/dpwes/publications/marineclay.htm
Perennial Stream Mapping Project:
http://www.fairfaxcounty.gov/dpwes/watersheds/perennial.htm
Public Facilities Manual:
http://www.fairfaxcounty.gov/dpwes/publications/pfm/pfm_main.htm
Ratings of Soils for Urban Development in Fairfax County:
http://www.fairfaxcounty.gov/dpwes/environmental/soilrating.htm
Regional Ponds (Subcommittee report):
http://www.fairfaxcounty.gov/dpwes/watersheds/ponds.htm
Stream Protection Strategy:
http://www.fairfaxcounty.gov/dpwes/environmental/sps_main.htm
Stream Water Quality Annual Report:
http://www.fairfaxcounty.gov/service/hd/strannualrpt.htm
Superfund Amendment and Reauthorization Act (SARA) Title III & Community Right-to-Know: http://www.fairfaxcounty.gov/ps/es/saratitle.htm

Wastewater Collection and Sewer Line Maintenance:
http://www.fairfaxcounty.gov/gov/dpwes/utilities/wwcoll_0600.htm
Wastewater Treatment Overview:
http://www.fairfaxcounty.gov/dpwes/utilities/sansys_0600.htm
Watersheds: http://www.fairfaxcounty.gov/dpwes/watersheds/default.htm
Zoning Ordinance: http://www.fairfaxcounty.gov/dpz/zoningordinance/

Fairfax County Convention & Visitors Bureau: History of Fairfax County, Virginia:
http://www.visitfairfax.org/history.htm

Fairfax County Economic Development Authority—Fairfax County Fact Sheets:
http://www.fairfaxcountyeda.org/press.cfm#Fairfax%20County%20Fact%20Sheets

Fairfax County Watershed Planning Project: http://www.fairfaxcounty-watersheds.net/default.aspx

Fairfax Joint Local Emergency Planning Committee: http://www.lepcfairfax.org

Fairfax Water Web Sites:
Home Page: http://www.fairfaxwater.org/
Tours and Speakers: http://www.fairfaxwater.org/outreach/tours.htm
Water Conservation Tips: http://www.fairfaxwater.org/outreach/conservation.htm
Updates to the Occoquan Shoreline Easement Policy:
http://www.fairfaxwater.org/current/shoreline_easement.htm

Low Impact Development Center: http://www.lowimpactdevelopment.org/

Metropolitan Washington Council of Governments Web Sites:
Home Page: http://mwcog.org
Water Supply and Drought Awareness Plan: Potomac River System:
http://www.mwcog.org/environment/water/watersupply/drought_plan.asp
Wise Water Use Campaign:
http://www.mwcog.org/environment/water/watersupply/wisewater.asp

National Park Service, Potomac Heritage National Scenic Trail:
http://www.nps.gov/gwmp/vapa/pht.htm

New River Notes, Fifteenth Census of the United States: 1930. Agriculture—Virginia:
http://www.ls.net/~newriver/va/vaag.htm

Northern Virginia Regional Commission Web Sites:
Four Mile Run TMDL Resource Page: http://www.novaregion.org/tmdlresource.htm
Occoquan Basin Nonpoint Pollution Management Program:
http://www.novaregion.org/occoquan.htm

Northern Virginia Regional Park Authority: http://www.nvrpa.org/

Northern Virginia Soil and Water Conservation District: http://www.fairfaxcounty.gov/nvswcd/

Southeast Regional Climate Center: http://www.dnr.state.sc.us/climate/sercc/index.html

United States Army Corps of Engineers--Joint Permit Application Glossary of Terms:
http://www.nao.usace.army.mil/regulatory/jpaglossary.htm

United States Department of Agriculture. NASS: Fact Finders for Agriculture—2002 Census of Agriculture, County Profile, Fairfax, Virginia:
http://www.nass.usda.gov/census/census02/profiles/va/cp51059.PDF

Virginia Department of Conservation and Recreation, Division of Chesapeake Bay Local Assistance Web Sites:
Home Page: http://www.cblad.state.va.us
Riparian Buffer Modification and Mitigation Guidance Manual:
http://www.cblad.state.va.us/ripbuffstat.cfm

Virginia Department of Environmental Quality Web Sites:
Aboveground Storage Tanks: http://www.deq.virginia.gov/tanks/asts.html
Home Heating Oil Tanks: http://www.deq.virginia.gov/tanks/hoho.html
Petroleum Program: http://www.deq.virginia.gov/tanks
Superfund Amendments and Reauthorization Act (SARA) Title III:
http://www.deq.state.va.us/sara3
Total Maximum Daily Loads: http://www.deq.state.va.us/tmdl/homepage.html
Underground Storage Tanks: http://www.deq.virginia.gov/tanks/usts.html

Virginia Department of Health:
Division of Wastewater Engineering/Marina Program:
http://www.vdh.state.va.us/marina/index.asp
Office of Drinking Water: http://www.vdh.state.va.us/dw/index.asp

Virginia Institute of Marine Science Web Sites:
Home Page: http://www.vims.edu/
Center for Coastal Resources Management—Marina Suitability Tool:
http://ccrm.vims.edu/mgttools.html

Virginia Marine Resources Commission: http://www.mrc.state.va.us

Virginia Outdoors Plan, 2002: http://www.dcr.state.va.us/prr/vopfiles.htm

Virginia Secretary of Natural Resources--Tributary Strategies:
http://www.naturalresources.virginia.gov/Initiatives/TributaryStrategies/index.cfm

APPENDIX A:
Analysis of Tidal Shoreline Segments in Fairfax County: Erosion Conditions and Erosion Controls

Shoreline segments are defined based on watersheds; watershed boundaries in tidal areas are shown in Figures 27, 28, 29, 31, and 32.

1979 shoreline erosion citations have been taken from the Shoreline Situation Report: Counties of Fairfax and Arlington and the City of Alexandria, Virginia Institute of Marine Science, 1979.

2002-3 shoreline erosion, accretion/sedimentation, and shoreline structure information is based on reviews of aerial photography by the Fairfax County Department of Planning and Zoning.

Cameron Run Tidal Shoreline Watershed Segment

Primary Waterways: Cameron Run and Hunting Creek

Adjacent existing land uses – vacant land, retail, industrial, office, public open space/recreation, government/institutional, multi-family residential

Fetch: no significant fetch

Soils: Lunt-Hilly and Steep land, loamy and gravelly sediments-Beltsville association (19)

Shoreline Erosion 2002-2003 (% of Fairfax County total tidal shoreline): none identified

Shoreline Erosion 1979: none cited

Shoreline Erosion Control Structures 2002-2003: 2

Other Shoreline Structures – access, etc. 2002-2003: 0

Accretion/Sedimentation 2002-2003 (% of Fairfax County total tidal shoreline): .4%

Belle Haven Tidal Shoreline Watershed Segment

Primary Waterways: Hunting Creek, Potomac River

Adjacent existing land uses: multi-family residential, retail, public open space/recreation

Fetch: no significant fetch

Soils: Lunt-Hilly and Steep land, loamy and gravelly sediments-Beltsville (19)

Shoreline Erosion 2002-2003 (% of Fairfax County total tidal shoreline): .06% **–** one occurrence cited along the George Washington Memorial Parkway

Shoreline Erosion 1979: no occurrences cited

Shoreline Erosion Control Structures 2002-2003: 12

Other Shoreline Structures – access, etc. 2002-2003: 2

Accretion/Sedimentation 2002-2003: none identified

Little Hunting Creek Tidal Shoreline Watershed Segment

Primary Waterways: Little Hunting Creek and the Potomac River

Adjacent existing land uses: public open space/recreation, single-family residential, government/institutional, vacant land, private open space/recreation

Fetch: no significant fetch occurs within the creek; however, Sheridan Point is exposed to open Potomac River with a fetch caused by winds out of the WSW at 3.8 nautical miles

Soils: Matapeake- Mattapex-Woodston (20)

Shoreline Erosion 2002-2003 (% of total Fairfax County tidal shoreline): .94% **–** Within the creek, no erosion was identified; two separate occurrences of erosion were identified at the mouth of the creek on both the east and on the west sides. Two separate occurrences of erosion were identified on either side of Sheridan Point; two additional occurrences of erosion were identified traversing north along the Potomac River. All the occurrences of erosion were located along the National Park Service Property of the George Washington Memorial Parkway.

Shoreline Erosion 1979: none cited

Shoreline Erosion Control Structures 2002-2003: 99

Other Shoreline Structures – access, **etc. 2002-2003**: 110

Accretion/Sedimentation 2002-2003: none identified

Dogue Creek Tidal Shoreline Watershed Segment

Primary Waterways: Dogue Creek, Gunston Cove (north shore), Accotink Bay (east shore), Potomac River

Adjacent existing land uses: single-family residential, vacant land, retail, government/institutional

Fetch: there is not significant fetch within the creek; however, at Ferry Point, which is on the north shore at the mouth of the creek, fetch is caused by winds from the SW at 3 nautical miles; and the fetch at the south bank of the mouth of Dogue Creek is caused by prevailing winds from ENE over 4.1 nautical miles; at the north shore of Gunston Cove the fetch at Whitestone Point is caused by winds out of the SSE at 3.0 nautical miles

Soils: Matapeake- Mattapex-Woodston (20); Hilly and Steep land, loamy and gravelly sediments-Woodstown-Matapeake (21); Beltsville-Elkton-Sassafras (23)

Shoreline Erosion 2002-2003 (% of total Fairfax County tidal shoreline): 1.1% –north shore of Gunston Cove east of Whitestone Point, Fort Belvoir–erosion identified; two other segments of shoreline on the south bank of Dogue Creek–erosion identified; erosion identified immediately east of Ferry Point

Shoreline Erosion 1979: north shore of Gunston Cove east of Whitestone Point, Fort Belvoir – moderate erosion cited; moderate erosion cited immediately east of Ferry Point

Shoreline Erosion Control Structures 2002-2003: 76

Other Shoreline Structures – access, etc. 2002-2003: 72

Accretion/Sedimentation 2002-2003 (% of total Fairfax County tidal shoreline): .7% – small amount identified at the head of the creek south of Route 1

Accotink Creek Tidal Shoreline Watershed Segment

Primary Waterways: Accotink Bay, Gunston Cove

Adjacent existing land use: government/institutional

Fetch: no significant fetch within Accotink Bay

Soils: Hilly and Steep land, loamy and gravelly sediments-Woodstown-Matapeake (21)

Shoreline Erosion 2002-2003 (% of total Fairfax County tidal shoreline): none identified

Shoreline Erosion 1979: none cited

Shoreline Erosion Control Structures 2002-2003: 0

Other Shoreline Structures – access, etc. 2002-2003: 0

Accretion/Sedimentation 2002-2003: none cited

Pohick Creek Tidal Shoreline Watershed Segment

Primary Waterways: Pohick Bay, Gunston Cove

Adjacent existing land uses: government/institutional, public open space/recreation, vacant land

Fetch: Pohick Bay – no significant fetch, however, significant fetch is caused by winds out of NW at 8 nautical miles along the south shoreline of Gunston Cove

Soils: Hilly and Steep land, loamy and gravelly sediments-Woodstown-Matapeake (21)

Shoreline Erosion 2002-2003 (% of total tidal shoreline): none identified

Shoreline Erosion 1979: none cited

Shoreline Erosion Control Structures 2002-2003: 0

Other Shoreline Structures – access, etc. 2002-2003: 0

Accretion/Sedimentation 2002-2003: none identified

High Point Tidal Shoreline Watershed Segment

Primary Waterways: Belmont Bay, Occoquan Bay, Potomac River and Gunston Cove

Adjacent existing land uses: low density single-family residential, vacant land, public open space/recreation, private open space/recreation,

Fetch:

- South shore of Belmont Bay to Sandy Point- no significant fetch affects this shoreline;
- Sandy Point to High Point: shoreline is NNW- SSE – winds blowing out of the SSW approach Sandy Point at 4.8 nautical miles and the winds blowing out of the southwest approach High Point over 11.5 nautical miles;
- The shoreline reach from High Point to Hallowing Point with Sycamore Point situated midway in the reach is affected by a fetch of 6.8 nautical miles from winds out of WSW; and
- Southern shore, mouth of Gunston Cove- winds approach the shoreline from the NW over 8 nautical miles.

Soils: Mattapeake- Mattapex-Woodston (20); Hilly, steep, land, loamy gravelly sediments; Woodston-Mattapeake (21)

Shoreline Erosion 2002-2003 (% of total Fairfax County tidal shoreline): 1.9%

- Sandy Point to High Point: several occurrences of erosion identified
- High Point to Sycamore Point: erosion identified throughout the entire reach
- Sycamore Point to Hallowing Point: none identified
- Southern shore, mouth of Gunston Cove: several instances of erosion identified

Shoreline Erosion 1979:

- Sandy Point to High Point: several occurrences of moderate erosion cited
- High Point to Sycamore Point: moderate erosion cited throughout the entire reach
- Sycamore Point to Hallowing Point: none cited
- Southern shore, mouth of Gunston Cove: several instances of moderate erosion cited

Shoreline Erosion Control Structures 2002-2003: 95

Other Shoreline Structures – access, etc. 2002-2003: 61

Accretion/Sedimentation 2002-2003: none identified

Kanes Creek Tidal Shoreline Watershed Segment

Primary waterway: Belmont Bay

Adjacent existing land uses: public open space/recreation, low density single-family residential, single-family residential, vacant land, private open space/recreation

Fetch: not significant

Soils: Hilly and Steep land, loamy and gravelly sediments-Woodstown-Matapeake (21)

Shoreline Erosion 2002-2003 (% of total Fairfax County tidal shoreline): .5%

Shoreline Erosion 1979: none cited

Shoreline Erosion Control Structures 2002-2003: 11

Other Shoreline Structures – access, etc. 2002-2003: 10

Accretion/Sedimentation 2002-2003: none identified

Mill Branch Tidal Shoreline Watershed Segment

Primary waterways: Massey Creek and Occoquan River

Adjacent existing land uses: low density single-family residential, single-family residential, multi-family residential, public open space/recreation, private open space/recreation, vacant land, industrial

Fetch: not significant

Soils: *east of I-95* - Lunt-Hilly and Steep land, loamy and gravelly sediments-Beltsville association (19), Matapeake- Mattapex-Woodston (20), Hilly and Steep land, loamy and gravelly sediments-Woodstown-Matapeake (21); *west of 95* – Rowland-Bermudian-Bowmansville (1), Appling-Louisburg-Colfax (7)

Shoreline Erosion 2002-2003: none identified

Shoreline Erosion 1979: none cited

Shoreline Erosion Control Structures 2002-2003: 27

Other Shoreline Structures – access, etc. 2002-2003: 32

Accretion/Sedimentation 2002-2003: none identified

Occoquan Tidal Shoreline Watershed Segment

Primary Waterway: Occoquan River

Adjacent existing land use: government/institutional, vacant land, public open space/ recreational

Fetch: no significant fetch in the Occoquan River

Soils: Appling-Louisburg-Colfax (7)

Shoreline Erosion 2002-2003: none identified

Shoreline Erosion 1979: none cited

Shoreline Erosion Control Structures 2002-2003: 3

Other Shoreline Structures – access, etc. 2002-2003: 1

Accretion/Sedimentation 2002-2003: none identified

APPENDIX B:
Relationship between Recommendations of the Chesapeake Bay Supplement and Comprehensive Plan Policy

Within this Chesapeake Bay Supplement, 42 recommended actions (including three that are each stated twice) in five broad topical areas have been made. These recommendations propose actions that are related to implementation of Comprehensive Plan policy. This Appendix places each of these recommendations into the broader context of Comprehensive Plan policy; relevant citations are provided from the Environment section of the Policy Plan, and each recommendation is identified after the policy or policies it is intended to support. Comprehensive Plan text from the 2011 Edition of the Policy Plan is provided in black print; changes to the Environment section of the Plan that have been adopted concurrently with the adoption of this Chesapeake Bay Supplement are provided in green print, with strike-throughs and underscores to reflect the changes that have been made. Chesapeake Bay Supplement recommendations are provided in italicized blue print.

Objective 2: **Prevent and reduce pollution of surface and groundwater resources. Protect and restore the ecological integrity of streams in Fairfax County.**

9. *Continue participation in the regional Occoquan Watershed management program.*

10. *Coordinate with neighboring jurisdictions to foster cooperation on regional water resource issues and request the participation of neighboring jurisdictions on applicable watershed management planning efforts. Continue to review and provide comments on development proposals outside of the County's boundaries that can affect the County's natural resources.*

11. *Continue to analyze and comment on land use and development activities proposed on federal, State, or other publicly-owned land that falls outside of the County's regulatory authority; through such comments and associated coordination, encourage development designs and practices that are consistent with the County's Comprehensive Plan.*

17. *Ensure that appropriate interagency coordination occurs in order to improve the consideration of stormwater management, BMP, and adequate outfall issues during the zoning process.*

18. *Ensure that appropriate interagency coordination occurs in order to improve the consideration of stormwater management, BMP and adequate outfall issues during the Plan amendment process.*

20. *Coordinate with the Virginia Department of Environmental Quality and other entities as appropriate on the development of TMDLs and implementation plans for impaired waters in Fairfax County.*

22. *Continue to pursue implementation of recommendations presented in the report of the New Millennium Occoquan Watershed Task Force.*

24. Continue to implement the County's infiltration abatement program to maintain the integrity of the County's sanitary sewer network.

26. Continue existing nonpoint source pollution education efforts and, contingent on the availability of resources, strengthen outreach efforts to improve the land stewardship ethic among owners and managers of land in Fairfax County. Consistent with recommendations presented by the New Millennium Occoquan Watershed Task Force, pursue strengthened partnerships with appropriate public, nonprofit, and citizen organizations, encourage growth in the network of organizations and citizens groups concerned with and/or actively involved in watershed and water quality issues, sponsor/partner on an increased number of efforts to promote water quality and natural resource protection, and expand existing outreach and education programs.

27. Contingent on the availability of resources, strengthen outreach efforts to property owners with residential heating oil tanks to encourage improved maintenance, monitoring, and operation of these tanks.

29. Continue to implement the recommendations of the Infill and Residential Development Study as accepted by the Board of Supervisors on January 22, 2001.

Policy b. Update BMP requirements as newer, more effective strategies become available.

13. Amend the Public Facilities Manual to incorporate Low Impact Development Best Management Practices (BMPs) and other accepted innovative BMP practices as appropriate.

Policy d. Preserve the integrity and the scenic and recreational value of stream valley EQCs when locating and designing storm water detention and BMP facilities. In general, such facilities should not be provided within stream valley EQCs unless they are designed to provide regional benefit or unless the EQCs have been significantly degraded. When facilities within the EQC are appropriate, encourage the construction of facilities that minimize clearing and grading, such as embankment-only ponds, or facilities that are otherwise designed to maximize pollutant removal while protecting, enhancing, and/or restoring the ecological integrity of the EQC.

19. Revisit the current policy supporting the use of regional stormwater management facilities in light of the approach recommended in the March, 2003 report entitled "The Role of Regional Ponds in Fairfax County's Watershed Management." Prepare an amendment to the Comprehensive Plan to revise County policy as it relates to regional facilities for consideration by the Planning Commission and Board of Supervisors.

Policy e. Update erosion and sediment regulations and enforcement procedures as new technology becomes available. Minimization and phasing of clearing and grading are the preferred means of limiting erosion during construction.

23. Ensure that sufficient resources continue to be dedicated to the enforcement of erosion and sediment control requirements.

Policy f. Where practical and feasible, retrofit older stormwater management facilities to perform water quality functions to better protect downstream areas from degradation.

16. Contingent on the availability of sufficient funding, retrofit existing stormwater management facilities to enhance their water quality and quantity control functions; continue to retrofit dry stormwater management facilities as wetland BMP facilities.

Policy h. Protect water resources by maintaining high standards for discharges from point sources.

1. If and when facilities that are subject to Virginia Pollutant Discharge Elimination System (VPDES) permits request zoning approvals, coordinate with the Virginia Department of Environmental Quality to identify any shortcomings in permit compliance and seek remedies to any such shortcomings.

Policy j. Regulate land use activities to protect surface and groundwater resources.

2. Review the County's current approach to adequate outfall and revise if necessary to ensure protection of downstream resources when development occurs. If determined to be appropriate, prepare an amendment to the Public Facilities Manual to revise adequate outfall requirements.

12. Explore the feasibility and desirability of establishing a self-supporting authority to provide for the management of on-site sewage disposal systems. Present recommendations regarding such an authority to the Board of Supervisors.

Policy k. For new development and redevelopment, apply better site design and low impact development (LID) ~~low impact site design~~ techniques such as those described below, and pursue commitments to reduce stormwater runoff volumes and peak flows, to increase groundwater recharge, and to increase preservation of undisturbed areas. In order to minimize the impacts that new development and redevelopment projects may have on the County's streams, some or all of the following practices should be considered where not in conflict with land use compatibility objectives:

- Minimize the amount of impervious surface created.
- Site buildings to minimize impervious cover associated with driveways and parking areas and to encourage tree preservation.
- Where feasible, convey drainage from impervious areas into pervious areas.
- Encourage cluster development when designed to maximize protection of ecologically valuable land.

- Encourage the preservation of wooded areas and steep slopes adjacent to stream valley EQC areas.

- Encourage fulfillment of tree cover requirements through tree preservation instead of replanting where existing tree cover permits. Commit to tree preservation thresholds that exceed the minimum Zoning Ordinance requirements.

- Where appropriate, use protective easements in areas outside of private residential lots as a mechanism to protect wooded areas and steep slopes.

- Encourage the use of open ditch road sections and minimize subdivision street lengths, widths, use of curb and gutter sections, and overall impervious cover within cul-de-sacs, consistent with County and State requirements.

- Encourage the use of innovative BMPs and infiltration techniques of stormwater management where site conditions are appropriate, if consistent with County requirements.

- Apply nonstructural best management practices and bioengineering practices where site conditions are appropriate, if consistent with County requirements.

- Encourage shared parking between adjacent land uses where permitted.

- Where feasible and appropriate, encourage the use of pervious parking surfaces in low-use parking areas.

- Maximize the use of infiltration landscaping within streetscapes consistent with County and State requirements.

13. *Amend the Public Facilities Manual, to incorporate Low Impact Development Best Management Practices (BMPs) and other accepted innovative BMP practices as appropriate.*

14. *Consider whether changes to County policies regarding the placement of Low Impact Development BMP practices should be revised to allow for a broader application of such practices on individual privately-owned lots. Present recommendations regarding this matter to the Board of Supervisors.*

15. *Review the County's policies and Code requirements to determine if changes to the Public Facilities Manual, Zoning Ordinance, and/or other Code requirements would be appropriate consistent with Policy k of Objective 2 in the Environment section of the Policy Plan (supporting the application of better site design and low impact development techniques). Prepare appropriate amendments to these requirements for consideration by the Planning Commission and Board of Supervisors.*

Policy l. Support watershed management planning and consider any watershed management plans that are adopted or endorsed by the Board of Supervisors as a factor in making land use decisions.

3. Complete watershed management plans for all 30 of the County's watersheds.

4. Watershed management plans are currently being developed, and it can be anticipated that these plans will ultimately be adopted by the Board of Supervisors. Develop a mechanism to ensure that zoning and Plan amendment proposals will be reviewed within the context of adopted watershed management plans; establish standard operating procedures to ensure that the necessary interagency coordination occurs.

5. Implement the recommendations of adopted watershed management plans as funding allows. Establish a mechanism to prioritize and track actions on recommendations for capital improvement projects. Once a sufficient number of watershed management plans have been completed, establish a work program for the consideration of policy and regulatory changes to address policy actions recommended in adopted watershed management plans.

6. Explore the feasibility and desirability of establishing a self-supporting funding mechanism to provide for the implementation of projects recommended through the watershed management planning process. Present recommendations regarding funding mechanisms to the Board of Supervisors for consideration.

9. Continue participation in the regional Occoquan Watershed management program.

10. Coordinate with neighboring jurisdictions to foster cooperation on regional water resource issues and request the participation of neighboring jurisdictions on applicable watershed management planning efforts. Continue to review and provide comments on development proposals outside of the County's boundaries that can affect the County's natural resources.

Policy m. Optimize stormwater management and water quality controls and practices for redevelopment consistent with revitalization goals.

34. Develop recommendations for amendments to the County Code and/or Public Facilities Manual, as applicable, to consider the establishment of stormwater management requirements for redevelopment that will provide for reduced stormwater runoff peak volumes on developed sites that are currently not adequately served by such measures. Draft these recommendations in a manner that will allow for the consideration of whether to require redevelopment sites to achieve a certain reduction in peak volumes rather than allowing them to achieve the same hydrologic conditions that existed prior to redevelopment. The County already has a BMP requirement for redevelopment (a 10% reduction in phosphorus runoff compared with pre-redevelopment conditions); a requirement that is similar in nature to the BMP requirement could be pursued for stormwater quantity control.

Policy n. Ensure that development and redevelopment sites that have been subject to contamination by toxic substances or other hazardous materials are remediated to the extent that they will not present unacceptable health or environmental risks for the specific uses proposed for these sites and that

unacceptable health or environmental risks will not occur as a result of contamination associated with nearby properties.

30/32. Incorporate Virginia Department of Environmental Quality (VDEQ) data regarding leaking storage tanks into the Department of Planning and Zoning's environmental assessment application to ensure that contamination on or near sites where such releases have occurred is considered appropriately during the consideration of infill development and redevelopment proposals during the zoning process.

31/33. Coordinate with VDEQ regarding the acquisition of information regarding other releases of contaminants (e.g., the Volunteer Remediation Program) in order to better screen for potential site contamination issues during the zoning process.

Objective 3: Protect the Potomac Estuary and the Chesapeake Bay from the avoidable impacts of land use activities in Fairfax County.

21. Coordinate with appropriate State agencies on the development of nutrient and sediment reduction strategies for the Shenandoah and Potomac River Basin.

Policy a. Ensure that new development and redevelopment complies with the County's Chesapeake Bay Preservation Ordinance, as applied to Chesapeake Bay Preservation Areas adopted by the Board of Supervisors as generally depicted in Figure 5 of the *Chesapeake Bay Supplement* to the Comprehensive Plan, as may be amended by the Board of Supervisors.

28. Conduct concurrent reviews and public hearings for exceptions from Chesapeake Bay Preservation Ordinance requirements in conjunction with other land use approval processes involving public hearings before the Planning Commission and Board of Supervisors

Policy b. Support the analysis and recommendations presented in the *Chesapeake Bay Supplement* to the Comprehensive Plan.

Policy c. Where tidal shoreline erosion control measures are needed, apply techniques that are consistent with the "Guidelines for Tidal Shoreline Erosion Control Measures" in the Environment Appendix.

35. Coordinate with State agencies, the Fairfax County Wetlands Board, and representative stakeholders, to develop recommended guidance for consideration by the Board of Supervisors regarding "active, detrimental shoreline erosion" for application as a County policy.

36. In coordination with State agencies, and contingent upon the availability of necessary resources, develop a process and related educational materials to ensure that tidal shoreline property owners are aware of information and advice pertaining to best shoreline stabilization practices as set forth and/or provided by the Virginia Institute of Marine Science, the Virginia Marine Resources Commission, and the Shoreline Erosion Advisory Service. As part of this effort, ensure that tidal shoreline property owners are provided information regarding the requirements of the Chesapeake Bay Preservation Ordinance, the Wetlands Zoning Ordinance, the Erosion and Sedimentation Control Ordinance and the Floodplain Regulations of the Zoning Ordinance.

37. Advise the Wetlands Board of the newly adopted policy regarding tidal shoreline erosion control/stabilization practices and request that Wetlands Board decisions be consistent with this policy.

38. Request that the Virginia Institute of Marine Science (VIMS) update the Shoreline Situation Report and the Tidal Shoreline Marsh Inventory for Fairfax County's tidal shoreline. Ideally, this effort would include the following:

- *Identify areas where tidal wetlands and riparian forest buffers adjacent to tidal wetlands can be restored;*
- *Identify invasive plant species along the tidal shoreline and assist in developing ways to reduce invasive plant areas and restore native plants and submerged aquatic vegetation (SAV) to improve habit value and enhance water quality protection;*
- *Conduct field studies of shoreline erosion rates along sensitive reaches of the County's shoreline in order to better characterize the nature and extent of shoreline erosion than is possible from a review of published reports and an analysis of aerial photography; and*
- *Conduct an analysis of physical conditions relating to shoreline erosion potential (e.g., soils, fetch, storm surge, slopes) along individual reaches of the County's tidal shoreline in order to characterize the susceptibility of each reach to erosion.*

39/40. Continue to coordinate the review of all projects requiring approval of the County's Wetlands Board with the Department of Public Works and Environmental Services to ensure that all applicable regulatory requirements of the Chesapeake Bay Preservation Ordinance, the Erosion and Sedimentation Control Ordinance, and the Floodplain Regulations of the Zoning Ordinance are addressed and where appropriate that the applicant is aware of the need for additional permits and approvals.

Policy d. Boating and other tidal shoreline access structures should be sited, designed, and constructed in a manner that minimizes adverse environmental impacts. Where County approval of tidal shoreline access structures is needed, the following guidelines should be consulted and considered in the decision-making process: the Chesapeake Bay Program's document entitled "Chesapeake Bay Area Public Access Technical Assistance Report;" and the following guidelines issued by the Virginia Marine Resources Commission: "Shoreline Development BMPs," "Wetlands Guidelines," and "Subaqueous Guidelines."

39/40. Continue to coordinate the review of all projects requiring approval of the County's Wetlands Board with the Department of Public Works and Environmental Services to ensure that all applicable regulatory requirements of the Chesapeake Bay Preservation Ordinance, the Erosion and Sedimentation Control Ordinance, and the Floodplain Regulations of the Zoning Ordinance are addressed and where appropriate that the applicant is aware of the need for additional permits and approvals.

41. In coordination with State agencies, and contingent upon the availability of necessary resources, develop a process and related educational materials to ensure that tidal shoreline property owners are aware of information and advice pertaining to boating

access best practices as set forth and/or provided by the Virginia Institute of Marine Science, the Virginia Marine Resources Commission, the Shoreline Erosion Advisory Service, and the Chesapeake Bay Program. As part of this effort, ensure that tidal shoreline property owners are aware of the requirements of the Chesapeake Bay Preservation Ordinance, the Wetlands Zoning Ordinance, the Erosion and Sedimentation Control Ordinance and the Floodplain Regulations of the Zoning Ordinance.

42. *Advise the Wetlands Board of the newly adopted policy regarding tidal shoreline access structures and request that Wetlands Board decisions be consistent with this policy.*

43. *Ensure that any new marinas that are constructed in Fairfax County will be fully in compliance with Chapter 570, Sanitary Regulations for Marinas and Boat Moorings, as promulgated by the Virginia Department of Health of the Commonwealth of Virginia. This Chapter implements the federal Clean Vessel Act through the Virginia Marina Program.*

44. *As funding opportunities arise, advise owners and operators of marinas that are exempt from sanitary waste pump-out facility requirements of funding opportunities that may be available to provide such facilities.*

45. *Contingent on the availability of necessary resources, pursue an outreach program in order to ensure that boaters are made aware of the available marina facilities in the County that are registered by the Commonwealth, that maintain current certificates to operate, and that have sanitary waste pump-out facilities that are available for general public use.*

Policy e. Support efforts to mitigate or compensate for losses of wetlands near the area(s) of impact.

25. *Inform authorities responsible for wetland regulation of the County policy supporting wetland compensation and mitigation efforts near the area(s) of impact and request their consideration in implementing this policy through their permitting processes.*

Objective 6: Ensure that new development either avoids problem soil areas, or implements appropriate engineering measures to protect existing and new structures from unstable soils.

8. *Coordinate with the Natural Resources Conservation Service and the Northern Virginia Soil and Water Conservation District on the completion of a revised soil survey for Fairfax County.*

Objective 9: Identify, protect and enhance an integrated network of ecologically valuable land and surface waters for present and future residents of Fairfax County.

Policy a: For ecological resource conservation, identify, protect and restore an Environmental Quality Corridor system (EQC). (See Figure 4.) Lands may be included within the EQC system if they can achieve any of the following purposes:

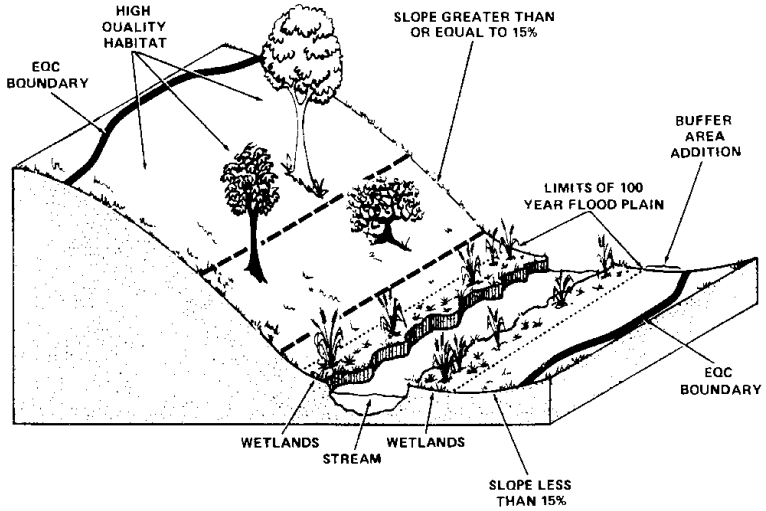
- Habitat Quality: The land has a desirable or scarce habitat type, or one could be readily restored, or the land hosts a species of special interest.

- "Connectedness": This segment of open space could become a part of a corridor to facilitate the movement of wildlife.

- Aesthetics: This land could become part of a green belt separating land uses, providing passive recreational opportunities to people.

- Pollution Reduction Capabilities: Preservation of this land would result in significant reductions to nonpoint source water pollution, and/or, micro climate control, and/or reductions in noise.

The core of the EQC system will be the County's stream valleys. Additions to the stream valleys should be selected to augment the habitats and buffers provided by the stream valleys, and to add representative elements of the landscapes that are not represented within stream valleys. The stream valley component of the EQC system shall include the following elements (See Figure 4):



A TYPICAL
ENVIRONMENTAL QUALITY CORRIDOR

Source: Fairfax County Office of Comprehensive Planning

FIGURE 4

- All 100 year flood plains as defined by the Zoning Ordinance;

- All areas of 15% or greater slopes adjacent to the flood plain, or if no flood plain is present, 15% or greater slopes that begin within 50 feet of the stream channel;

- All wetlands connected to the stream valleys; and

- All the land within a corridor defined by a boundary line which is 50 feet plus 4 additional feet for each % slope measured perpendicular to the stream bank. The % slope used in the calculation will be the average slope measured within 110 feet of a stream channel or, if a flood plain is present, between the flood plain boundary and a point fifty feet up slope from the flood plain. This measurement should be taken at fifty foot intervals beginning at the downstream boundary of any stream valley on or adjacent to a property under evaluation.

Modifications to the boundaries so delineated may be appropriate if the area designated does not benefit habitat quality, connectedness, aesthetics, or pollution reduction as described above. In addition, some intrusions that serve a public purpose such as unavoidable public infrastructure easements and rights of way are appropriate. Such intrusions should be minimized and occur perpendicular to the corridor's alignment, if practical.

8. Coordinate with the Natural Resources Conservation Service and the Northern Virginia Soil and Water Conservation District on the completion of a revised soil survey for Fairfax County.

26. Continue existing nonpoint source pollution education efforts and, contingent on the availability of resources, strengthen outreach efforts to improve the land stewardship ethic among owners and managers of land in Fairfax County. Consistent with recommendations presented by the New Millennium Occoquan Watershed Task Force, pursue strengthened partnerships with appropriate public, nonprofit, and citizen organizations, encourage growth in the network of organizations and citizens groups concerned with and/or actively involved in watershed and water quality issues, sponsor/partner on an increased number of efforts to promote water quality and natural resource protection, and expand existing outreach and education programs.

Objective 10: Conserve and restore tree cover on developed and developing sites. Provide tree cover on sites where it is absent prior to development.

7. Consider the establishment of an obtainable tree cover goal for Fairfax County and/or some or all watersheds within Fairfax County. Prepare a recommended process to develop such a goal (or goals) for consideration by the Board of Supervisors.

Policy a: Protect or restore the maximum amount of tree cover on developed and developing sites consistent with planned land use and good silvicultural practices.

Policy b: Require new tree plantings on developing sites which were not forested prior to development and on public rights of way.

Policy c: Use open space/conservation easements as appropriate to preserve woodlands, monarch trees, and/or rare or otherwise significant stands of trees, as identified by the County.

Objective 12: Improve the identification and mitigation of environmental impacts, and the monitoring and enforcement of environmental policies as applied to land disturbing activities.

8. Coordinate with the Natural Resources Conservation Service and the Northern Virginia Soil and Water Conservation District on the completion of a revised soil survey for Fairfax County.

APPENDIX 1

GUIDELINES FOR TIDAL SHORELINE EROSION CONTROL MEASURES

Measures to control erosion along the County's tidal shoreline are often pursued in order to protect adjacent property. Where County approval of tidal shoreline erosion control measures is needed, the following guidelines issued by the Virginia Marine Resources Commission should be consulted and considered in the decision-making process: "Shoreline Development BMPs," "Wetlands Guidelines," and "Subaqueous Guidelines." Consistent with these documents, shoreline protection structures should only be pursued where there is active, detrimental shoreline erosion which cannot be otherwise controlled, and such structures should be constructed in a manner that minimizes adverse wetlands impacts.

Shoreline stabilization approaches that apply biological techniques, using native plant species, are preferred where such approaches are consistent with the best available technical guidance, which may include guidance provided by the Virginia Marine Resources Commission, the Virginia Institute of Marine Science, and the Shoreline Erosion Advisory Service. Unless otherwise advised through such guidance, the following preferences, as refined from guidance developed by the Hampton Roads Planning District Commission and subsequently recommended for broader application in tidal areas by the Division of Chesapeake Bay Local Assistance of the Virginia Department of Conservation and Recreation (formerly the Chesapeake Bay Local Assistance Department), should be applied, where feasible, in determining the appropriate approaches to shoreline stabilization (with practices listed in decreasing order of preference):

Areas with Low Erosion Rates (< 1 ft/yr.)
(low energy shorelines with an average fetch exposure of <1 nautical mile)

1. Vegetative stabilization with or without bank re-grading
2. Revetments
3. Bulkheads

Areas with Moderate Erosion Rates (1- 3 ft/yr.)
(medium energy shorelines with an average fetch exposure of 1-5 nautical miles)

1. Vegetative stabilization with/or without bank grading
2. Revetments
3. Breakwaters
4. Groins*
5. Bulkheads

Areas with Severe Erosion Rates (> 3 ft/yr.)
(high energy shorelines with an average fetch exposure of > 5 nautical miles)

1. Relocation (of threatened structures)
2. Revetments
3. Breakwaters
4. Groins*
5. Seawalls

*Groins may not be appropriate in riverine conditions or where they may impede navigation.