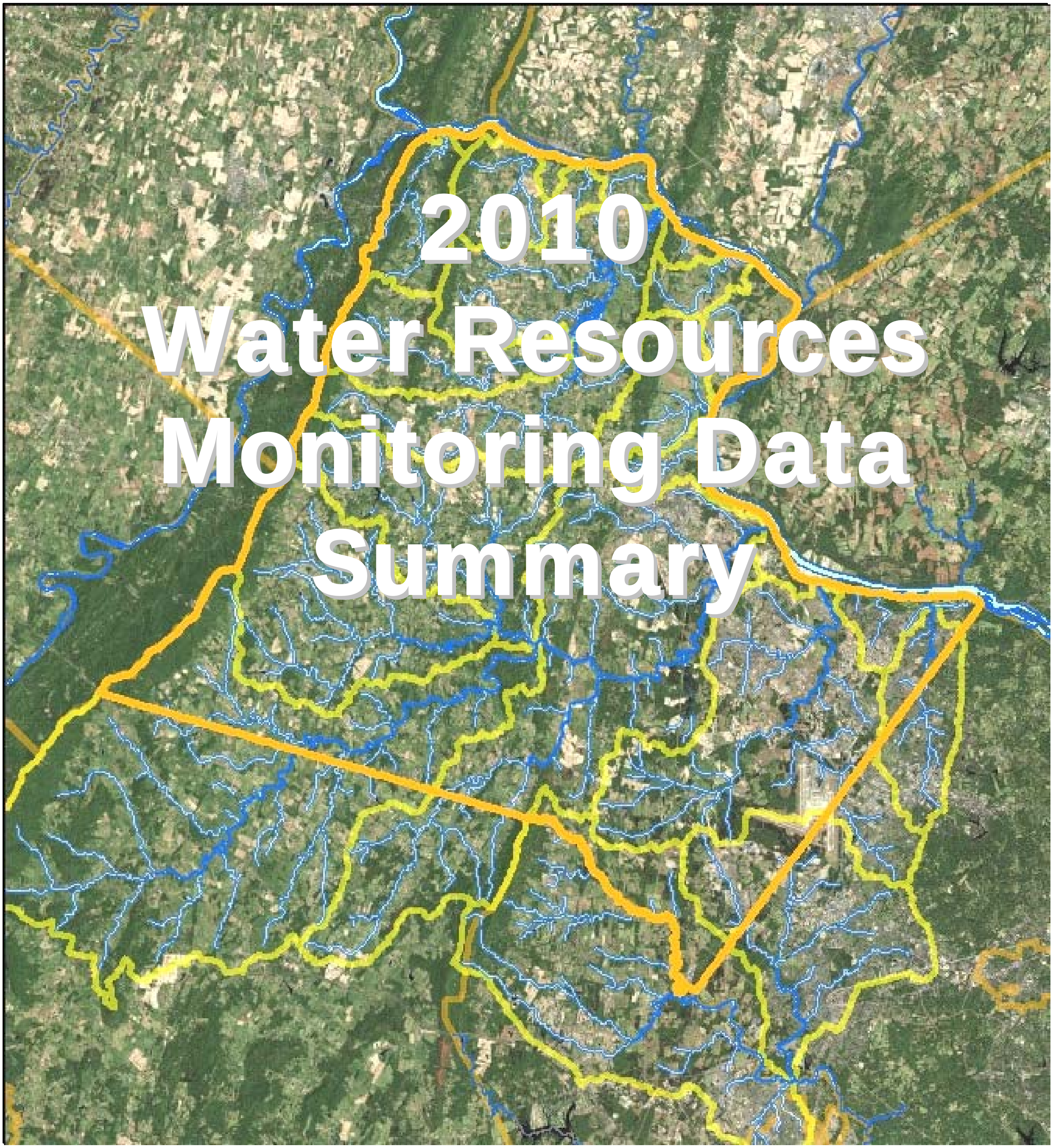
Loudoun County, Virginia

2010 Water Resources Monitoring Data Summary



Prepared by
Department of Building & Development
Engineering Division, Water Resources Team
July 2011

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ABBREVIATIONS AND ACRONYMS

cfs:	*cubic feet per second*
DEQ:	*Virginia Department of Environmental Quality*
EPA:	*U.S. Environmental Protection Agency*
MCL:	*maximum contaminant level*
mg/L:	*milligrams per Liter*
NWS-COOP:	*National Weather Service Cooperative monitoring station*
OWTS:	*On-site Wastewater Treatment System*
TDS:	*Total Dissolved Solids*
uS/cm:	*microSiemens per centimeter*
USGS:	*U.S. Geological Survey*
WRMP:	*Water Resources Monitoring Program (Loudoun County)*

DATA LIMITATIONS

While efforts have been made to insure the accuracy of the data presented in this report, Loudoun County does not assume any liability arising from the use of these data. Reliance on these data is at the risk of the user. The U.S. Geological Survey (USGS) and the National Climatic Data Center (who distribute National Weather Service data) have data quality assurance procedures in which data are considered "provisional" until they are checked and corrected as needed. Data used in this report that are provisional are:

- USGS rainfall site Limestone/Leesburg, 1/1/2004 - 12/31/2010
- USGS rainfall site Catoctin/Lovettsville, 1/1/2005 - 12/31/2010
- USGS stream gauging station North Fork Catoctin Creek, 12/1/2010 - 12/31/2010
- USGS stream gauging station Catoctin Creek (Taylorstown), 10/1/2010 - 12/31/2010
- USGS stream gauging station Limestone Branch, 12/2/2010 - 12/31/2010
- USGS stream gauging station North Fork Goose Creek , 12/1/2010 - 12/31/2010
- USGS stream gauging station Goose Creek Leesburg , 10/1/2010 - 12/31/2010

HYPERLINKS

Although not apparent in the printed version, the underlined text indicates hyperlinks to additional data and online resources that may be accessed when this document is opened in a program designed to view portable document format (pdf) files.

ACKNOWLEDGMENTS

This document was prepared by County staff members Scott Sandberg, David Ward, Dennis Cumbie, and Glen Rubis of the Water Resources Team in the Engineering Division of the Department of Building and

INTRODUCTION AND SETTING

This document summarizes data collected during various water resources monitoring activities in and adjacent to Loudoun County, Virginia, by government and volunteer organizations during calendar year 2010. Specifically, data characterizing precipitation, stream flow, groundwater levels, and surface water and groundwater quality are presented. Loudoun County Department of Building and Development either collects these data or compiles them from other sources as part of the County's Water Resources Monitoring Program (WRMP). The data are presented and discussed in two sections: water quantity – measurements of precipitation, stream flows, and groundwater levels; and water quality – the chemical and biological characteristics of stream water and groundwater.

The WRMP was initiated in 2001 to help assess the conditions of water resources in Loudoun County, which has been one of the fastest growing counties in the nation during the past decade. The current population of Loudoun is approximately 310,000 and is projected to reach almost 420,000 by 2030.

General Characteristics of Loudoun County

Loudoun County is located in Northern Virginia approximately 30 miles west of Washington, D.C. The county covers an area of 521 square miles and is bordered on the north by the Potomac River and the west by the Blue Ridge Mountains (Figure 1).

Urban and suburban development is concentrated mostly in the eastern part of the county, generally from the Town of Leesburg to Washington Dulles International Airport and the border with Fairfax County. The western portion of the county is more rural, with crop farms, pastures, vineyards, several small towns, and numerous large-lot residential subdivisions.

Loudoun Water, an entity created by a resolution of the Loudoun Board of Supervisors in 1959, owns and operates a centralized water and sewer system that serves the developed area of eastern Loudoun as shown in Figure 1. (Also see www.loudounwater.org) Outside of Loudoun Water's central system area, county residents obtain water for drinking and other uses primarily from wells. In the rural towns and several of the subdivisions, water may come from small communal water systems and sewage is treated in small waste-water treatment plants. The remaining single-family homes and businesses have on-site individual wastewater treatment systems such as a septic tank with drain field or, more recently, alternative systems.

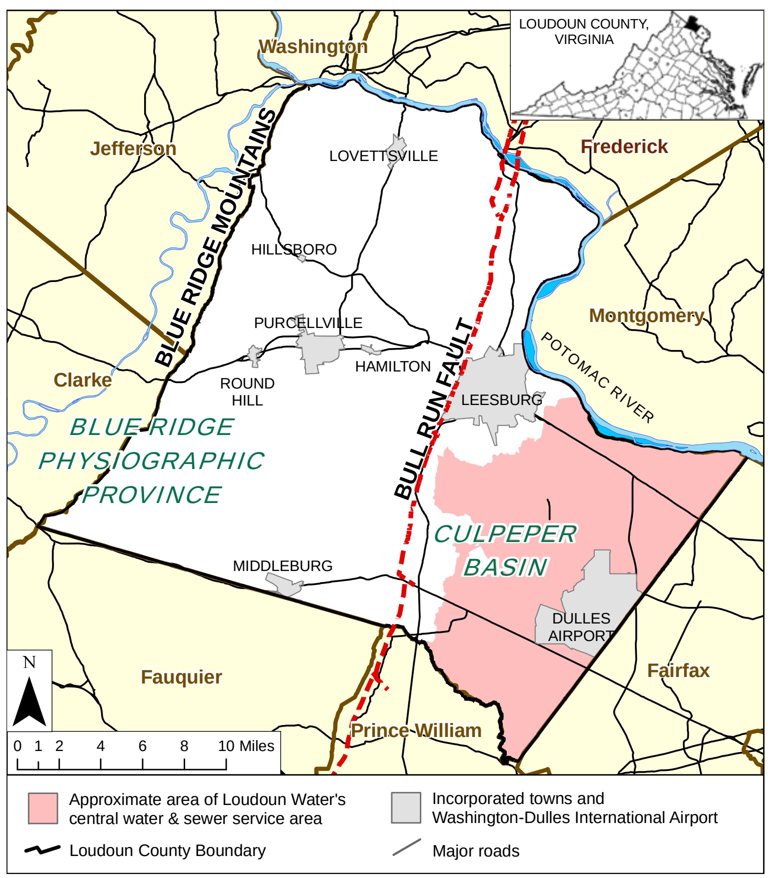

Figure 1. Major features of Loudoun County, VA.

Physiography and Geology

Loudoun County intersects two physiographic provinces which are separated by the Bull Run Fault (Figure 1). The fault separates the Culpeper Basin (a Triassic-age rift basin) of the Piedmont Province on the east from the Blue Ridge Province on the west. The Culpeper Basin is comprised of sedimentary rocks and sedimentary-derived metamorphic rocks, both which may include intrusions of dense, igneous diabase rock. The north-eastern area of the county, generally from the Town of Leesburg northward, is underlain by limestone conglomerate rock (the Leesburg Member of the Balls Bluff Siltstone) and has the surface features and hydrogeologic characteristics of a karst environment. Western Loudoun is underlain by metamorphic rocks derived from both sedimentary and igneous parent material. Bedrock in the county is covered by regolith (unconsolidated sediments and soils) that is commonly between 20 and 50 feet thick, but ranges from 0 to more than 90 feet thick. Soils are generally less permeable in eastern Loudoun compared to western Loudoun.

Watersheds

Watersheds are defined by topography and drain all of the surface water in an area to a single location such as a stream or lake. They are often used to delineate areas for monitoring, analyzing, and managing water resources. Watersheds can be defined at many different scales but the watershed scale that is most convenient for county-wide investigations in Loudoun is based on the 17 watershed areas shown in Figure 2. The majority of the county is covered by three major drainage areas that empty into the Potomac River by way of the following stream systems: Goose Creek, Catoctin Creek, and Broad Run.

The eastern and southern borders of the county share watersheds with the neighboring counties of Fairfax, Prince William and Fauquier. The upper reaches of Broad Run and Sugarland Run watersheds lie to the east in Fairfax County and Goose Creek originates to the southwest in Fauquier County, but all three streams/ watersheds drain into Loudoun County and, ultimately, the Potomac River.

The southeastern region of Loudoun includes the headwaters of Bull Run and Cub Run. These streams drain out of Loudoun County to the south and are tributaries to the Occoquan River which eventually discharges into the Potomac River.

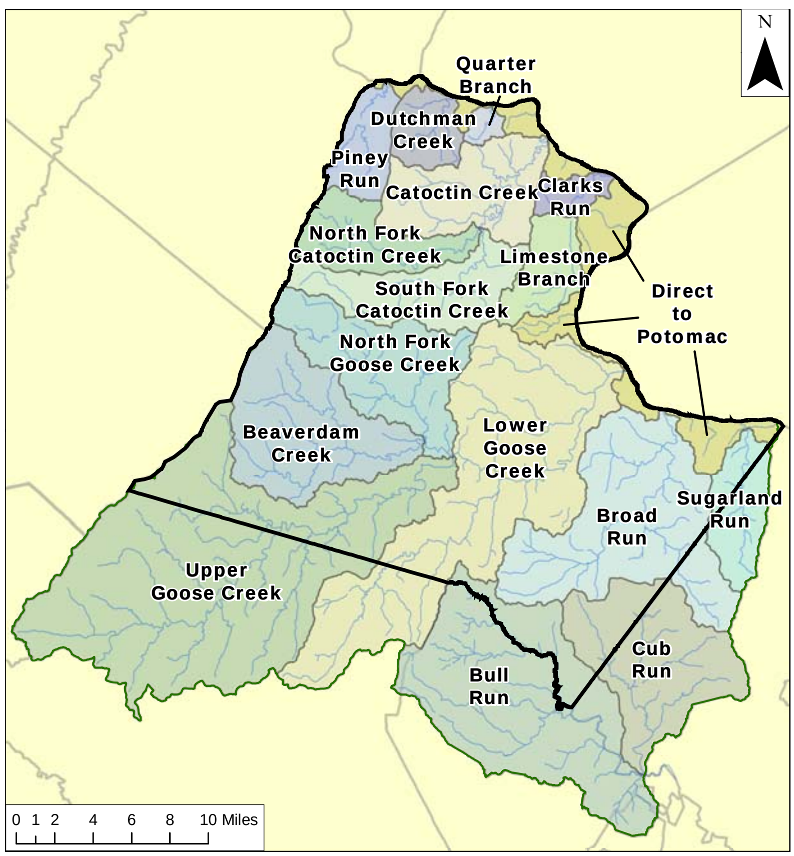

Figure 2. Watersheds and streams in and adjacent to Loudoun County, VA.

WATER QUANTITY

This section presents information on the quantity of water resources with data on precipitation, stream flows, and groundwater levels in Loudoun County during calendar year 2010.

Precipitation

Total annual precipitation was slightly below normal during 2010, with 39.1 inches recorded at Dulles Airport. Precipitation data used in the WRMP are obtained from six monitoring sites in or adjacent to the county (Figure 3). Four precipitation stations are part of the National Weather Service's (NWS) cooperative monitoring network and two rain gauges are operated by the U.S. Geologic Survey (USGS). The NWS sites have relatively long periods of record with one having nearly continuous data since 1930 (Table 1). The two USGS rain gauges have mostly continuous data records beginning in 2004 and 2005.

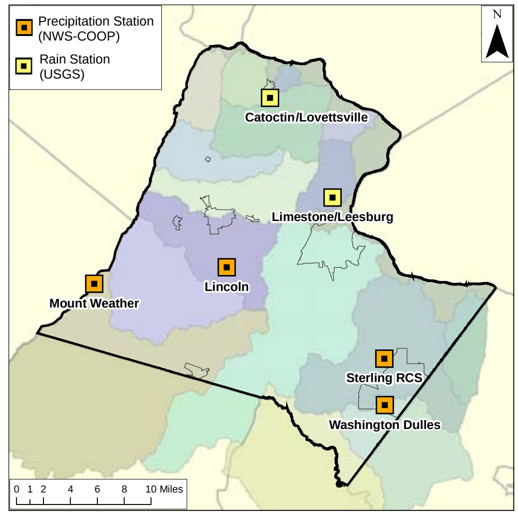

Figure 3. Precipitation monitoring sites.

Data from the long-term records indicate that annual precipitation has ranged from 20.4 inches (at the Lincoln station in 1930) to 67.7 inches (at the Sterling station in 2003). For the 30-year period of record, 1980 through 2009, the normal (median) annual precipitation at the Dulles monitoring station was 40.5 inches. During 2010, frozen and liquid precipitation recorded at the two stations with complete daily records was 39.1 (Dulles) and 49.7 (Mount Weather) inches (Table 1).

Table 1. Precipitation monitoring stations and data.

Precipitation Monitoring Station Name	Start of Record[1]	Station Operated by [2, 3]	Annual Statistics (Inches) for Period of Record[4]			2010 Total (Inches)[3]	Days missing in 2010
			Minimum	Median	Maximum		
Dulles	1964	NWS-COOP	27.0	39.0	65.7	39.1	0
Limestone Branch	2004	USGS	28.0	38.6	76.1	31.5	7
Lincoln	1930	NWS-COOP	20.4	41.3	63.5	37.6	30
Lovettsville	2005	USGS	27.6	37.8	61.3	27.6	6
Mt. Weather	1949	NWS-COOP	24.8	39.9	64.1	49.7	0
Sterling RCS	1978	NWS	30.3	41.8	67.7	42.7	1

[1] First full year that generally continuous data collection began.

[2] NWS-COOP = National Weather Service Cooperative weather station. USGS = U.S. Geological Survey.

[3] NWS-COOP stations record liquid and frozen precipitation; USGS stations record liquid precipitation only

[4] Annual precipitation statistics based on site's period of available record through 2010 (see footnote 1).

Figure 4 presents annual precipitation data from the Dulles Airport station from 1980 through 2010. Figure 5 shows 2010 monthly precipitation at the Dulles Airport station in relation to monthly data for the 30-year period from 1980 through 2009. The data indicate that this site had four dry months during 2010: January, April, June and December; and three months with above normal precipitation: February, May and September. Also noteworthy at Dulles Airport, the National Weather Service recorded 53.3 inches of snow and ice during 2010. In particular, one storm on February 5 and 6 produced 32.4 inches of snow. Normal annual snow and ice accumulation during the 1980 through 2009 period was approximately 20 inches.

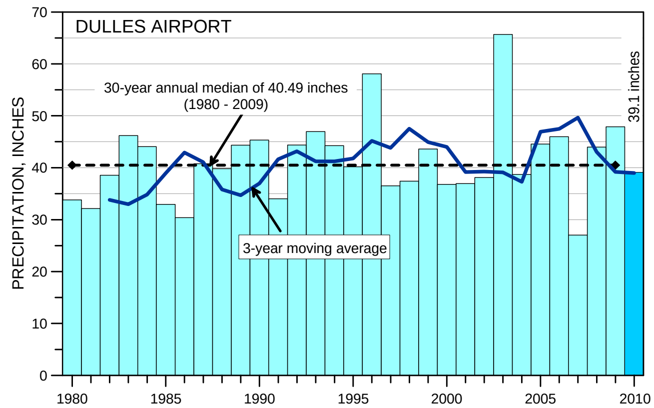

Figure 4. Annual precipitation at Dulles Airport from 1980 through 2010.

Measurable precipitation was reported on 101 days during 2010 at the Dulles Airport station. For those days with reported precipitation, the average accumulation was 0.39 inches and the median was 0.17 inches.

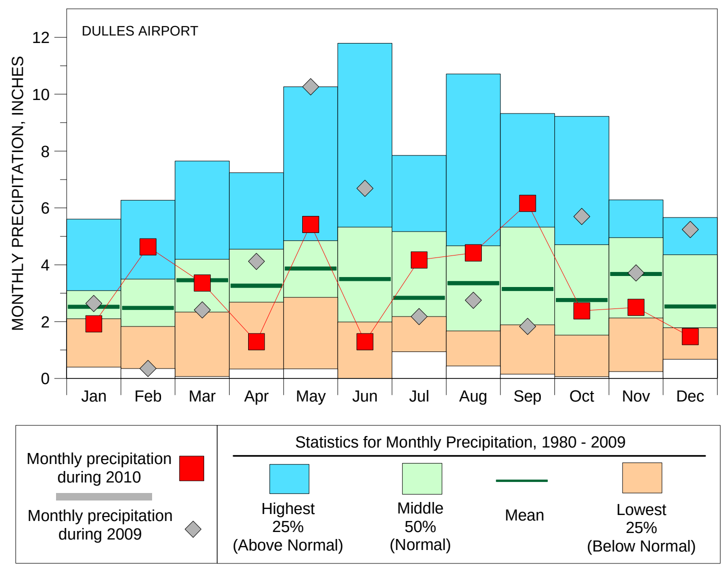

Figure 5. Monthly precipitation at Dulles Airport.

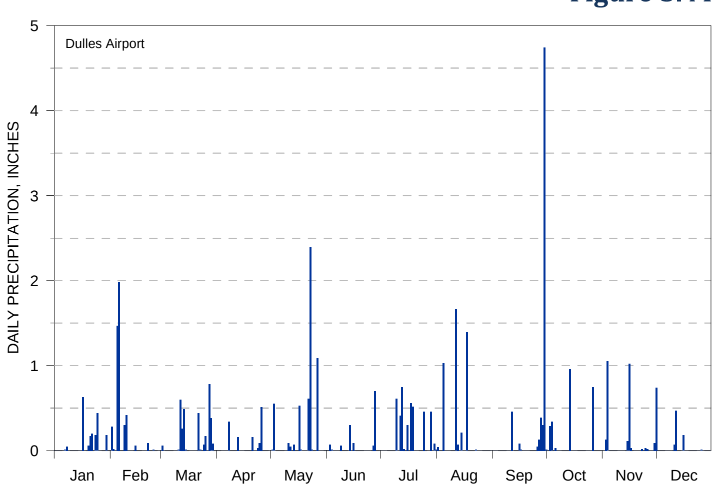

Figure 6. Daily precipitation at Dulles Airport in 2010.

Precipitation during 2010 was distributed fairly evenly throughout the year. The largest precipitation event at Dulles Airport occurred on September 30 where 4.74 inches of rainfall was recorded. During that same period, less than 3.5 inches of rainfall was recorded in western Loudoun. A graph of daily precipitation at Dulles Airport is shown in Figure 6.

Streamflow

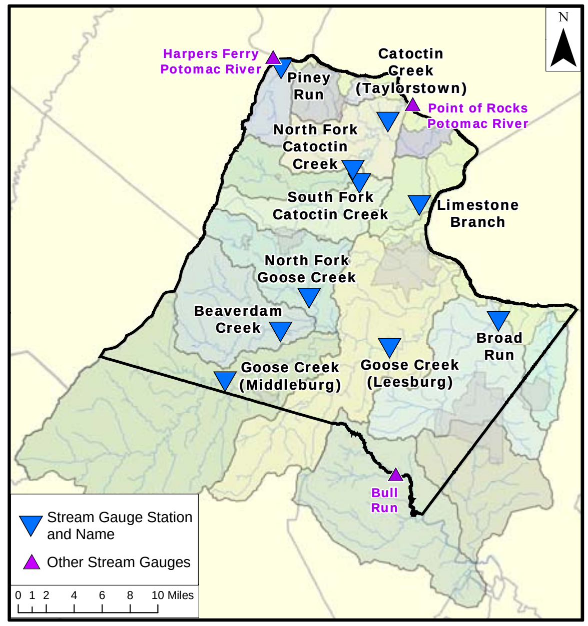

Figure 7. Locations of stream gauging stations.

Perennial streams flow all or most of the year. In the past, the USGS has estimated that Loudoun County has approximately 507 miles of perennial streams while more recent investigations using standardized methodologies have indicated that the county may have over 1,500 miles of perennial streams. Knowing how much water flows in the larger perennial streams and how it varies over both short and long time periods is useful in the assessment of flood control, stormwater structures, and environmental conditions. There are ten USGS stream gauges that measure and record water stage (level) in Loudoun County streams (Figure 7). Measured water levels at each gauging station are reported via telemetry to the USGS, correlated to historical site-specific stream discharges (flows), and the data made available in near real-time with updates every 15 minutes on the web site (http://va.water.usgs.gov/Loudoun/data.htm). At the County's perimeter, three additional gages are located at Harpers Ferry and Point of Rocks on the Potomac River and on Bull Run near Route 705.

The stream gauge stations are routinely checked and calibrated by the USGS to maintain accuracy, but the data are considered provisional until passing the USGS's quality control process. A review of the 2010 gauging data indicates that, while stream flows were within normal ranges throughout most of the year, flows during portions of the year were also below or above normal. Stream flows were above normal during January, February, and March and below normal in June, July, and September. Figure 8 illustrates the flow of Goose Creek near Route 621 during 2010. The peak flow at this station occurred on March 14 with a flow of 9,280 cfs at a gage height of 13.1 ft. Goose Creek is the County's largest stream and flows through the county from its headwaters in Fauquier County to the Potomac River. Table 2 lists the ten gauging stations in the county along with selected data statistics. Almost all of the maximum flow rates for 2010 occurred on March 13 and 14.

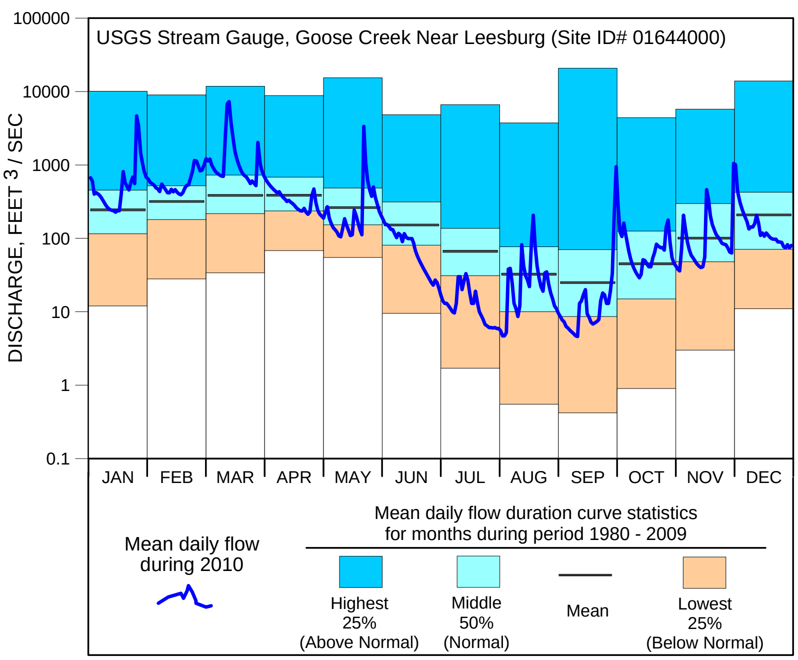

Figure 8. Stream discharge hydrograph for Goose Creek during 2010.

Table 2. Stream gauging stations and basic statistics.

Stream Gauge Site Name	Start of Record	Drainage Area[1] (sq. miles)	2010 Avg[2] (cfs)	02-'09 Avg[3] (cfs)	2010 Min[4] (cfs)	02-'09 Min[5] (cfs)	2010 Peak[6] (cfs)	02-'09 Peak[7] (cfs)	2010 0 Flow[8] (days)	02-'09 0 Flow[9] (days)
Beaverdam Creek	Jul 2001	47.2	49.9	51.4	0.0	0.0	1420	5000	37	118
Broad Run	Oct 2001	76.1	103.1	133.3	12.0	1.3	2230	10300	0	0
Catoctin Creek - Taylorstown	Oct 1970	89.5	86.9	101.1	0.5	0.1	1830	6770	1	22
Goose Creek - Leesburg	Jul 1909	332.0	340.9	364.7	4.6	1.1	7260	20800	0	0
Goose Creek - Middleburg	Oct 1965	122.0	150.4	135.0	0.7	0.0	3920	14000	0	55
Limestone Branch	Aug 2001	7.9	7.2	8.9	0.4	0.4	121	976	0	0
North Fork Catoctin Creek	Jul 2001	23.1	24.4	23.7	0.0	0.0	599	1190	29	51
North Fork Goose Creek	Jul 2001	38.1	38.2	51.9	0.4	0.2	757	3040	0	0
Piney Run	Oct 2001	13.5	15.4	13.9	0.1	0.0	260	488	14	17
South Fork Catoctin Creek	Jul 2001	31.6	31.7	35.7	0.1	0.0	940	1920	2	33

[1] Drainage area above the stream gauge (square miles)

[2] Average daily flow rate during 2010 (ft^3/sec)

[3] Average daily flow rate for the period of 2002–2009 (ft^3/sec)

[4] The lowest 7-day average flow rate during 2010 (ft^3/sec)

[5] The lowest 7-day average flow rate for the period of 2002–2009 (ft^3/sec)

[6] Peak daily flow rate during 2010 (ft^3/sec)

[7] Peak daily flow rate for the period of 2002–2009 (ft^3/sec)

[8] Maximum number of consecutive days with very low flow (below 0.2 ft^3/sec) during 2002-2009

[9] Maximum number of consecutive days with very low flow (below 0.2 ft^3/sec) during 2010

Groundwater Levels and Wells

Groundwater levels during 2010 were generally within the normal range of long-term recorded levels. There are approximately 14,000 active residential wells throughout Loudoun County and groundwater is the primary source of drinking water for the majority of residents in western Loudoun. In 2010, groundwater levels were recorded at 18 dedicated monitoring wells at the sites shown in Figure 9. Fifteen of these wells were monitored by County staff from the Department of Building and Development and three were monitored by the USGS. Groundwater level data have been collected from the three USGS wells since the late 1960s or early 1970s. Table 3 shows well and groundwater level data from the 11 wells with complete datasets for the year. Wells BRPK-01, THPK-01, ALPK-01, HRKN-01, VRGO-01, EVGN-01 and LWTP-01 were added to the monitoring network in 2010.

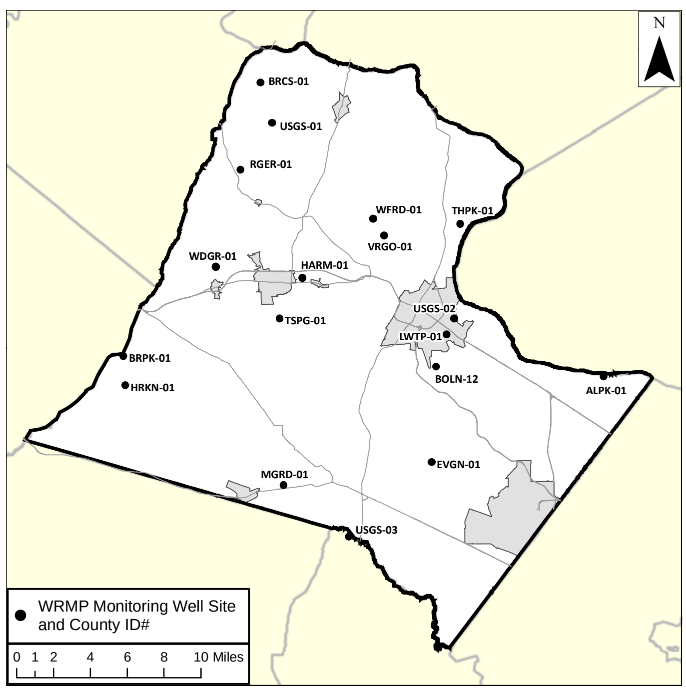

Figure 9. Locations of groundwater monitoring wells.

Table 3. Monitoring well and groundwater level data.

Well Site ID (see map for location)	Monitoring Organization	Well Depth (feet)	Rock Type	Period of Record	Groundwater Level (feet)[1]			
					Historic High	2010 High	Historic Low	2010 Low
USGS-01	USGS	516	Meta-conglomerate/ metasiltstone	8/1969 - Present	51.67	50.34	61.5	61.97
USGS-02	USGS	535	Fluvial, deltaic sandstone	10/1977 - Present	25.93	19.73	41.52	30.56
USGS-03	USGS	165	Siltstone/sandstone	11/1968 - Present	6.73	6.59	13.09	11.54
BOLN-12	Loudoun	515	Fluvial, deltaic sandstone	12/2006 - Present	7.33	7.33	13.8	12.55
BRCS-01	Loudoun	320	Igneous intrusive	12/2007 - Present	23.43	24.44	35.06	35.06
HARM-01	Loudoun	945	Plutonic igneous intrusive	2/2005 - Present	37.14	41.4	65.38	56.95
MGRD-01	Loudoun	400	Plutonic igneous intrusive	12/2007 - Present	-1.92	-1.92	12.34	12.34
RGER-01	Loudoun	700	Igneous intrusive	2/2005 - Present	31.91	32.57	43.42	43.42
TSPG-01	Loudoun	360	Plutonic igneous intrusive	2/2005 - Present	68.23	70.74	84.4	82.24
WDGR-01	Loudoun	940	Mafic igneous intrusive	3/2005 - Present	6.75	6.75	23.9	22.6
WFRD-01	Loudoun	400	Plutonic igneous intrusive	11/2002 - Present	9.74	9.74	31.78	30.15
BRPK-01	Loudoun	680	Igneous intrusive	7/2009 - Present	66.09	66.09	77.52	77.45
THPK-01	Loudoun	360	Limestone conglomerate	7/2009 - Present	42.48	42.48	64.73	64.19
ALPK-01	Loudoun	240	Alluvium/metasiltstone	7/2009 - Present	17.11	17.11	32.8	32.8
HRKN-01	Loudoun	600	Plutonic igneous intrusive	3/2009 - Present	26.02	26.02	37.35	37.35
VRGO-01	Loudoun	300	Igneous intrusive	3/2009 - Present	55.77	55.77	80.19	80.19
EVGN-01	Loudoun	320	Diabase	3/2009 - Present	15.53	15.53	24.03	24.03
LWTP-01	Loudoun	250	Metasiltstone	3/2009 - Present	22.2	22.2	25.71	25.71

[1] Feet below ground surface. Negative number indicates feet above ground surface (flowing artesian condition).

Figure 10 shows hydrographs for selected monitoring wells that are representative of groundwater levels for the years 2009 through 2010. Short-term natural increases in groundwater levels occur because of recharge from precipitation. In the absence of additional recharge from precipitation and outside influences such as nearby pumping, groundwater levels typically exhibit a steady, slow decline over time after rain events.

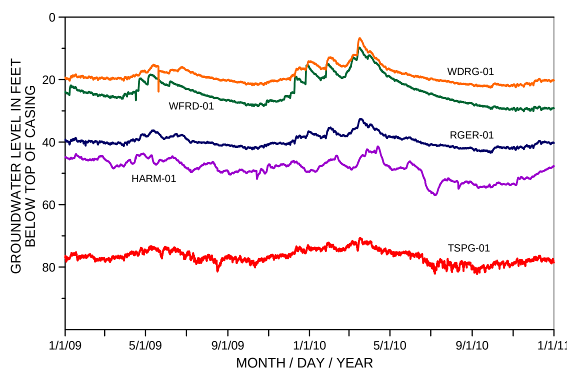

Figure 10. Groundwater levels from selected County WRMP monitoring wells.

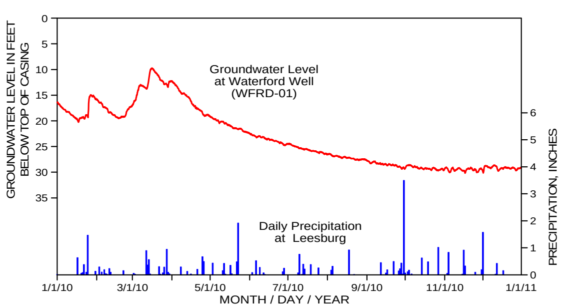

Figure 11. Daily precipitation and groundwater level changes during 2009.

Figure 11 is a hydrograph from a monitoring well during 2010 with daily precipitation also plotted to show the effects of precipitation on groundwater levels. Groundwater recharge occurs primarily in the winter months as melting snow slowly reaches the subsurface and because there is little water uptake from vegetation. In late 2009 and early 2010, large winter snow accumulations resulted in excellent groundwater recharge.

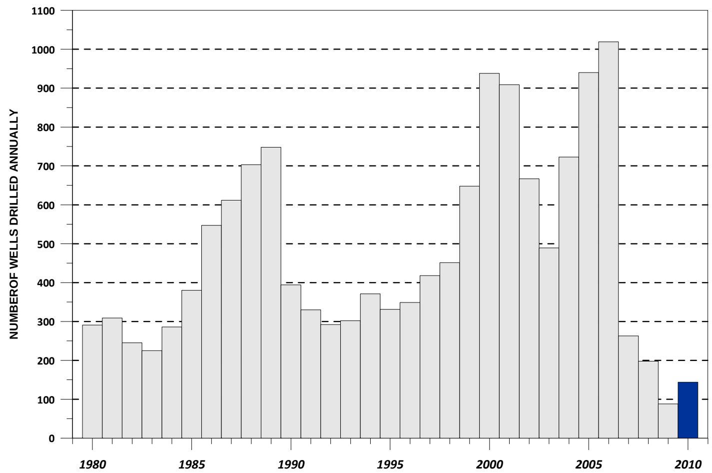

Figure 12. Number of wells constructed in Loudoun County between 1978 and 2009.

During 2010, 144 new water wells were constructed. Figure 12 presents the number of wells drilled each year since 1980. The installation of new wells is primarily driven by the pace of residential construction and zoning changes affecting residential development potential. In 2009, the weak economy resulted in the fewest number of wells installed since the early 1950's. A modest increase in new well construction occurred in 2010. The median total depth of wells installed in 2010 was 420 feet with the depths ranging from 100 to 1,080 feet. The median estimated yield (based on air-lift pumping) was 15 gallons per minute with yields ranging from 0.3 to 130 gallons per minute.

WATER QUALITY

The quality of surface water in Loudoun County was quantified in 2010 using several metrics including chemical, microbiological, and benthic macroinvertebrates. Groundwater quality was assessed through chemical and bacteria analyses conducted on well water samples. Monitoring results from each of these data types are discussed below.

Surface Water Chemistry

Chemical sampling and analysis of surface water in 2010 was primarily conducted by the Virginia Department of Environmental Quality (DEQ) as part of their state-wide surface water quality sampling program (see http://www.deq.state.va.us/watermonitoring/). In 2010, DEQ collected 167 samples from 32 sites from the watersheds of Loudoun County (some watershed boundaries extend beyond the County's boundaries).

Nutrient enrichment has been identified as a major cause of the reported stream impairments nationwide. Nutrient enrichment can lead to low dissolved oxygen, fish kills, shifts in flora and fauna and blooms of nuisance algae. Figure 13 illustrates the results of sampling by DEQ for nitrogen and phosphorus in the surface waters from the watershed of Loudoun County during 2010.

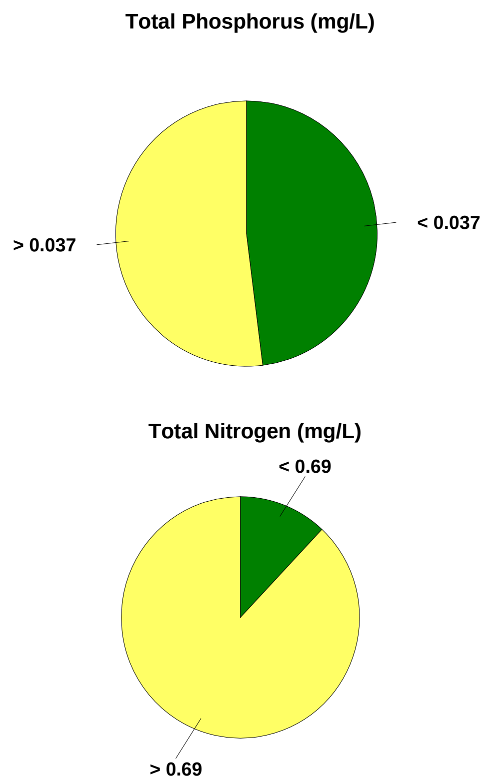

Figure 13. Nutrient concentrations as portions of samples collected from the watersheds of Loudoun County streams by DEQ during 2010.

In 2000, the U.S. Environmental Protection Agency developed ambient water quality criteria recommendations and information for 14 nutrient eco-regions in the continental United States. Individual states could adopt the criteria developed by EPA or elect to develop their own criteria and methodologies. Virginia has been working on a methodology to evaluate nutrient stress in wadeable streams since that time. In 2010, DEQ reported that it hopes to adopt amendments to the water quality standards regulation by 2015. As shown in Figure 13, approximately 88% of the samples collected by DEQ in 2010 contained nitrogen concentrations above the 0.69 mg/L EPA guidance criteria and approximately 52% contained phosphorus concentrations above the 0.037 mg/L EPA guidance criteria.

Surface Water Microbiology

The primary microbiological area of concern for surface water relates to pathogens that may adversely affect human health. An accepted practice to test for pathogens from human and warm-blooded animal waste is to test water for *Escherichia coli* (E. coli) bacteria as an indicator of waste contamination. EPA uses E. coli concentrations as an indicator of whether the water is considered safe for humans after casual contact. This criterion is identified by EPA as “recreational use” and includes activities such as swimming, fishing and boating.

In 2010, DEQ collected and analyzed approximately 159 samples from the watersheds of Loudoun County and found that approximately 26 percent were above the recreational limit of 235 E. coli colonies per 100 milliliters. Stream segments that are tested and exceed the recreational use criteria more than 10 percent of the time may be identified as “impaired” by DEQ. Using a similar approach, Table 4 summarizes the number of sites in which more than 10.5 percent of the samples exceeded the recreational limit over the last 5 years. Several programs are in place to reduce bacterial contamination in the impaired surface waters of Loudoun County including initiatives to repair or upgrade on-site wastewater treatment systems (e.g., septic systems and drain fields), reduce pet waste, and fence livestock out of streams.

Table 4. Summary of surface water microbiological testing by DEQ.

Year	Number of Samples	Number of Monitoring Sites	Number Sites Exceeding	Percent Sites Exceeding
2006	153	36	30	83%
2007	152	30	16	53%
2008	152	27	18	67%
2009	180	29	24	83%
2010	159	28	23	82%

Elevated levels of pathogens in surface water can be minimized by:

- *Repair and maintenance of on-site waste water treatment systems*
- *Cleaning up pet waste*
- *Fencing livestock away from streams*
- *Covering manure piles*
- *Vegetated riparian stream buffers*

Stream water sampling in the Catoctin watershed by citizen volunteers (Loudoun Watershed Watch) has resulted in almost 1,000 bacteriological samples collected from 2004 to 2009, of which almost 40 percent were above the recreational use limit for E. coli. These data indicate that microbiological contamination is highly variable, but generally increases with stormwater runoff.

Benthic Macroinvertebrates

Benthic macroinvertebrates are stream bottom-dwelling invertebrate organisms (mostly insect larvae) that can be seen without magnification. Their tolerance of poor water quality varies depending on the species and, as a result, these organisms are used as indicators of water quality.

Sampling a stream for benthic macroinvertebrates usually involves collecting all the organisms within a small area of the stream bottom, identifying the types of organisms collected to the order or family taxa level, and counting the number of each type. These results are then converted to a "macroinvertebrate score" which is used to qualitatively grade the water quality at one of several levels ranging from excellent to poor. In 2010, two techniques were used to evaluate the benthic macroinvertebrate populations: the Virginia Stream Condition Index (VA SCI) used by DEQ and the Virginia Save Our Streams (VA SOS) index used by several citizen volunteer organizations in and adjacent to the county. In 2010, DEQ sampled 16 locations in Loudoun and calculated VA SCI scores which ranged from severe stress to excellent. Figure 14 illustrates the average stream conditions from benthic samples collected by DEQ between 2005 and 2010.

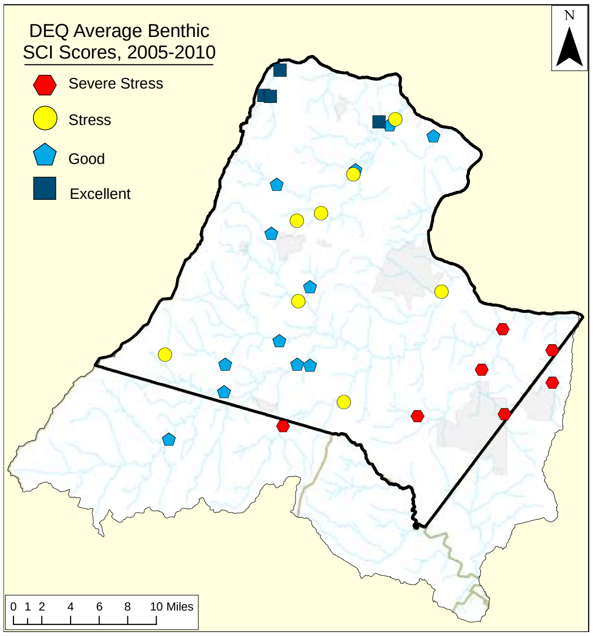

Figure 14. Summary of DEQ benthic monitoring results.

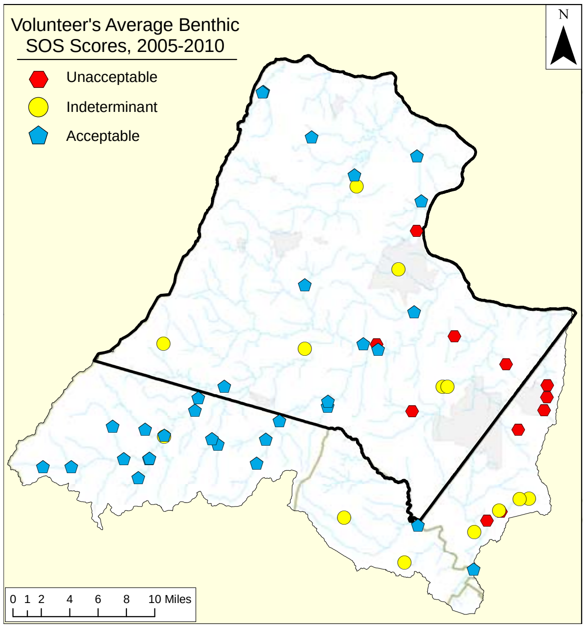

Figure 15. Summary of volunteer benthic monitoring results.

Several volunteer organizations work within the watersheds of the county to collect benthic macroinvertebrate data. From 2005 through 2010, the volunteer organizations: Loudoun Wildlife Conservancy, Goose Creek Association and other groups collected 482 samples from approximately 57 locations using the VA SOS methodology. Results ranged from acceptable to unacceptable. Figure 15 illustrates the average VA SOS scores from 2005 and 2010.

Benthic macroinvertebrate species vary in their tolerance of poor water quality. Monitoring benthic populations is an efficient way for professionals and volunteers to assess one aspect of stream water quality.

Stream Assessments

In 2009, Loudoun County conducted a comprehensive study of stream health. In the study, the stream benthic macroinvertebrate population was evaluated at 200 locations and the stream habitat was evaluated at 500 locations. This was the first ever comprehensive evaluation of Loudoun County's steam health. The study resulted in a large amount of data and photos and as a result, a "stream conditions" mapping web site was developed to communicate the information to the general public. The interactive map (Figure 16) includes data from the Loudoun County 2009 stream assessment project as well as 2010 VA DEQ stream impairments, stream gages, scenic river information and other data. The public can quickly access the site from www.loudoun.gov/streamconditions and enter their home address to identify nearby field studies and stream segments.

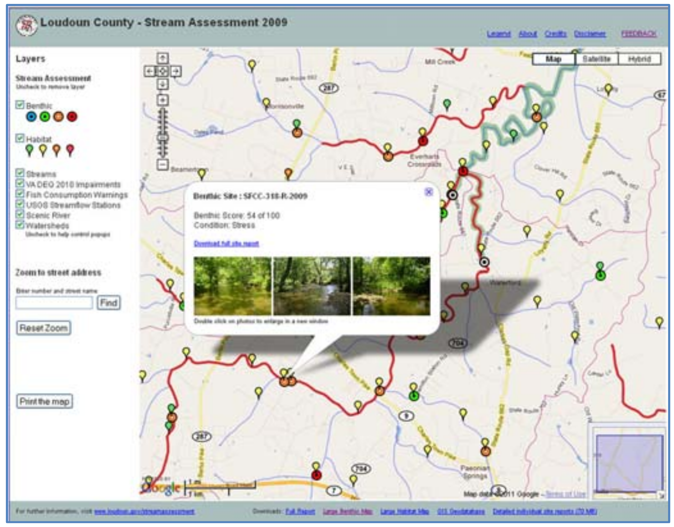

Figure 16. Online interactive stream conditions map.

Stream Impairments

Each year, DEQ tests a statistically significant fraction of Virginia's streams, rivers, lakes, and tidal waters as part of their water quality assessment. Over 130 different pollutants are monitored to determine whether the waters can be safely used for swimming, fishing and drinking. Waters that do not meet adopted standards are reported to EPA in the Clean Water Act 303(d) Impaired Waters Report. DEQ has developed lists of impaired waters every even calendar year since 1992. In Loudoun County, DEQ water quality impairments have included:

- aquatic life (benthic macroinvertebrates)
- recreational/swimming (bacteria)
- fishing/consumption (tissue analysis)

In the last report released in 2010, there were a total of 124 stream miles in Loudoun County identified as impaired for one or more criteria. Listing a stream as "impaired" begins a multi-year process of identifying pollution sources, determining appropriate pollution loadings, and designing and implementing corrective measures. Figure 17 through Figure 20 illustrate the impairments for aquatic life use, recreational/swimming use, fish consumption and public water supply, respectively.

Surface water quality impairments are reported to the Environmental Protection Agency every two years by the Virginia Department of Environmental Quality (DEQ). The Final 2010 305(b)/303(d) Water Quality Assessment Integrated Report (Integrated Report) was released on Feb. 9, 2011. The 2010 Integrated Report is a summary of the water quality conditions from Jan. 1, 2003, to Dec. 31, 2008 (http://www.deq.state.va.us/wqa/ir2010.html)

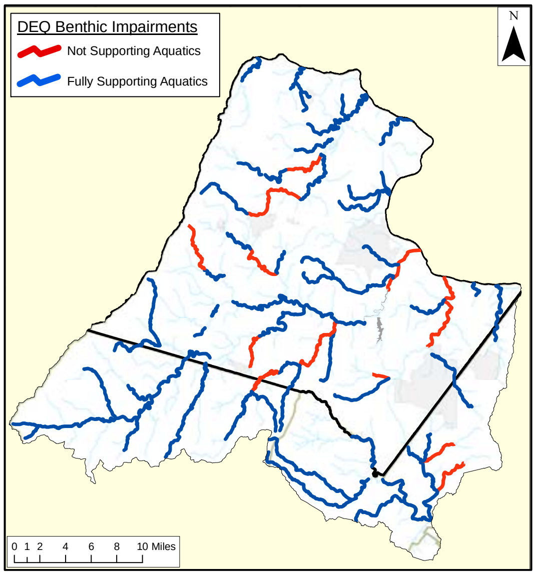

Figure 17. Aquatic life use (benthic macroinvertebrates) impaired stream segments.

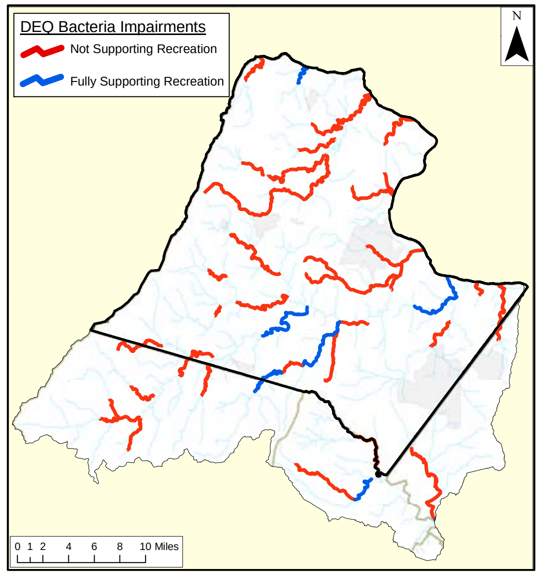

Figure 18. Recreational/swimming use (bacteria) impaired stream segments.

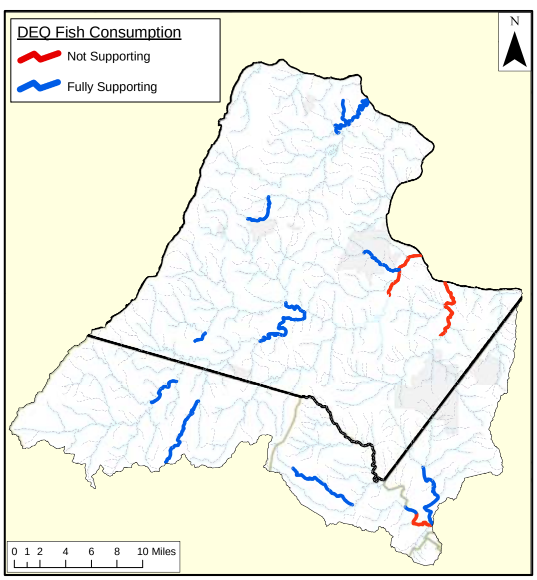

Figure 19. Fish consumption use (PCB and mercury in fish tissue) impaired stream segments.

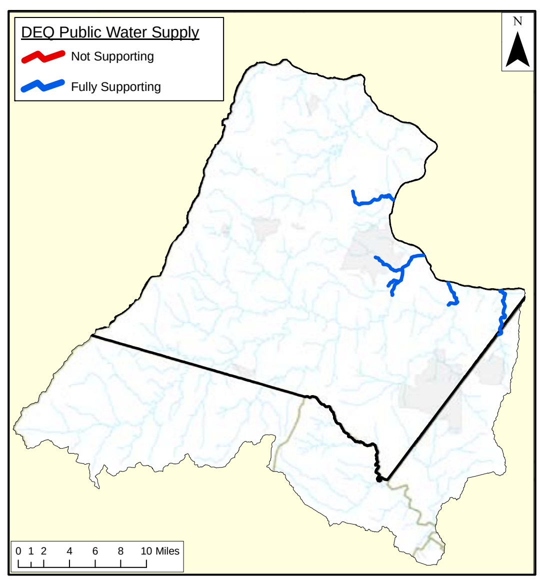

Figure 20. Public water supply use (chemicals) impaired stream segments.

Groundwater Quality

Groundwater is the source of drinking water for most of Loudoun County outside of Loudoun Water's central service area and the Town of Leesburg. Information on groundwater quality is obtained from several sources. Before new potable water wells can be used, they must be tested and pass drinking water quality standards for a wide range of chemical parameters listed by the County Health Department. In 2010, groundwater samples collected and analyzed from new wells were generally consistent with historical data (Table 5). There are some areas of the county that have elevated levels of iron and manganese which are aesthetic contaminants and do not adversely affect human health at the concentrations found in the county. In general, groundwater quality in the county is good.

Table 5. Statistics for selected groundwater chemistry parameters.

Analyte	MCL(mg/L)	Samples		# above MCL	% above MCL
Nitrate	10	*All*	2992	8	0.3
		2010	128	0	0.0
Sulfate	250	*All*	2992	10	0.3
		2010	128	2	1.6
Lead	0.015	*All*	2993	29	1.0
		2010	128	1	0.8
Fluoride	4	*All*	2992	4	0.1
		2010	128	0	0.0
Arsenic	0.01	*All*	2997	15	0.5
		2010	128	0	0.0
Manganese	0.05*	*All*	2992	1914	64.0
		2010	128	76	59.4
Iron	0.3*	*All*	2992	2101	70.2
		2010	128	80	62.5
TDS	500*	*All*	2992	17	0.6
		2010	128	4	3.1

* Secondary MCL for taste, color, and odor.

There are a few isolated spots in the county where serious groundwater contamination is known to exist, the most notable being Hidden Lane Landfill in northeast Loudoun, which was placed on EPA's National Priorities List (i.e., superfund site) in 2008. (For additional information on the Hidden Lane Landfill, see www.loudoun.gov/tce.) The Environmental Protection Agency is currently conducting an investigation of the landfill. Separately, DEQ is investigating groundwater contamination in four wells of the Richland Acres subdivision in Sterling. In 2007, low levels of the gasoline additive methyl t-butyl ether as well as perchloroethylene were detected in water samples from four wells.

The most prevalent sources of potential groundwater pollution are the on-site wastewater treatment systems (OWTS) serving homes and small businesses in the rural areas of the county. There are approximately 14,000 active OWTSs in the county and during 2010, 128 new OWTSs were installed. An OWTS that is properly installed and serviced should not pose a threat to groundwater quality. However, improper OWTS installation or maintenance can cause wastewater to be untreated or undertreated and lead to groundwater or surface water contamination. Because OWTSs are typically used in areas with private water wells, it is important to properly maintain the OWTS and regularly have the well water sampled and tested to assure that it is safe to drink. The Loudoun County Department of Environmental Health can provide information on maintenance and testing of private water wells and OWTSs at (703-777-0234 and http://www.loudoun.gov/onsite).

Groundwater in the county is generally of good quality. Some wells have elevated levels of iron and manganese which diminish the aesthetics of the water, but do not adversely affect human health. Owners of private wells used to supply drinking water should have their well water tested regularly to assure that the water is safe to consume.

OUTLOOK FOR 2011

With the completion in September 2009 of the EPA grant that had funded a significant portion of the development and activities of the Water Resources Monitoring Program (WRMP) since 2003, monitoring activities in 2011 will be dependent on more limited funding. Although no major new monitoring projects are planned, the monitoring objectives for 2011 will include:

- **Precipitation/rainfall – continue to monitor and/or obtain data from the stations operated by NOAA, USGS, or Loudoun County.**
- **Stream flow – continue the cooperative funding agreement with the USGS to monitor stream stage and discharge (flow) within 10 of the county's major watersheds.**
- **Groundwater levels – maintain continuous groundwater level recording instrumentation in the 15 dedicated monitoring wells operated by Loudoun County or the USGS. Additional wells may be brought into the monitoring network through the County's monitor well donation program in which either wells with easements are given to the County or the County is provided long-term monitoring use of an inactive well by the owner.**
- **Water quality sampling – groundwater and/or surface water quality sampling may be conducted depending on available funding.**

The Department of Building & Development will continue watershed management planning activities in 2011 with initiating a pilot project in the Broad Run watershed. The Upper Broad Run Watershed Management Plan Pilot Project will be the first detailed watershed management plan by Loudoun County Government and is expected to be completed in 2013. Water resources monitoring data will be used to help develop the plan and, if the plan is implemented, track progress in the efficacy of watershed improvement projects.

On December 30, 2010, the U. S. Environmental Protection Agency issued a Total Maximum Daily Load (TMDL) for the 64,000 square-mile Chesapeake Bay watershed, which includes all of Loudoun County. The Bay TMDL is focused on reducing the amounts of phosphorus, nitrogen, and sediment entering the Chesapeake Bay from the contributing watershed. The target amounts that will meet the Bay TMDL goal are sometimes called the "pollution diet". Virginia will be preparing watershed implementation plans during 2011 and 2012 that will be designed to meet Virginia's portion of the pollution diet. The deadline to put in place all of the measures designed to accomplish the pollution diet is 2025. Data from the WRMP will be available to help support efforts to meet the pollution diet that will be established for Loudoun County.

County staff will continue to explore grant opportunities to supplement Loudoun County funding for monitoring and watershed management programs.

More information about Loudoun County's water resources monitoring program can be obtained at:

http://www.loudoun.gov/watermonitoring