Loudoun County, Virginia

2013 Water Resources Monitoring Data Summary

December 2014

Photo: Carol Clay-Ward

2013 Water Resources Monitoring Data Summary



Loudoun County, Virginia Department of Building and Development Engineering Division Water Resources Team

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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)
NWS:	National Weather Service (Division of National Oceanographic and Atmospheric Administration)

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 12/31/2013
- USGS rainfall site Catoctin/Lovettsville, 1/1/2005 12/31/2013
- USGS stream gaging station, typically from 10/23/2013 through 12/31/2013

HYPERLINKS

The underlined text in this document 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. The report can be found at <u>www.loudoun.gov/watermonitoring</u> and follow the link to Data Analysis & Reporting.

ACKNOWLEDGMENTS

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INTRODUCTION AND SETTING

This document summarizes data collected during various water resources monitoring activities in and adjacent to Loudoun County, Virginia, by government, private and volunteer organizations during calendar year 2013. 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 estimated population of Loudoun in 2013 is nearly 339,000 and is forecast to reach 471,000 by 2030; an increase of 39 percent.

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, formerly known as the Loudoun County Sanitation Authority, owns and operates a centralized water and sewer system that serves the developed area of eastern Loudoun as shown in Figure 1. The Town of Leesburg provides treated Potomac River water to residents inside the Town limits, and to several residential areas adjacent to its eastern boundary. Outside of the Leesburg Loudoun Water central and service areas, county residents obtain water primarily from wells. In the rural towns and several of the subdivisions, water may come from communal water systems and sewage is treated in small wastewater treatment plants. The remaining single-family homes and businesses have on-site individual wastewater treatment systems.

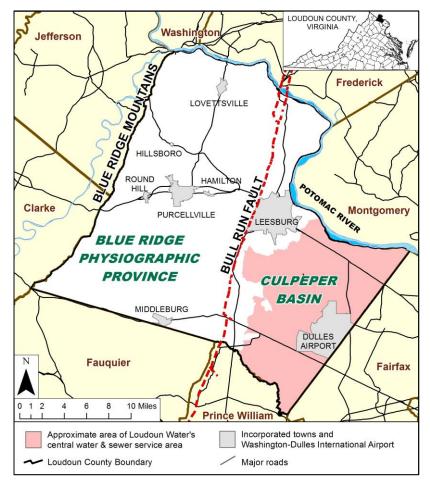


Figure 1. Major features of Loudoun County, VA.

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 to the west. The Culpeper Basin is comprised of sedimentary rocks and sedimentary-derived metamorphic rocks, both of 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 Virginia 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.

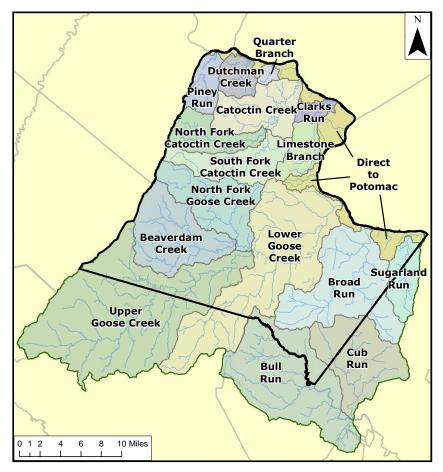


Figure 2. Watersheds and streams in and adjacent to Loudoun County, VA.

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 2013.

Precipitation

Total annual precipitation in 2013, 45.4 inches, was 4.1 inches above the normal (mean) annual precipitation of 41.2 inches for the full period of annual records of 1964 to 2013 at the Dulles Airport monitoring station. Precipitation data used in the WRMP are obtained from seven monitoring sites in the county (Figure 3). Four precipitation stations are part of the National Weather Service's (NWS) cooperative monitoring network and two rain gages are operated by the U.S. Geological 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 gages have mostly continuous data records beginning in 2004 and 2005 and provide data at 5-minute intervals.

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 purposes of identifying "normal" (mean) conditions and for comparison to current conditions, the

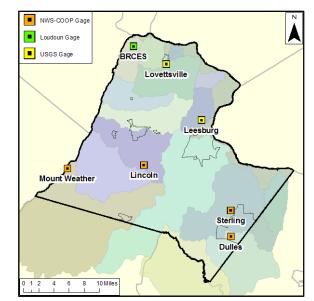


Figure 3. Precipitation monitoring sites.

standard practice is to group climatic data into periods of 30 consecutive years with the most recent year of the group ending in "0". For the 30-year period of 1981 through 2010, the normal annual precipitation at the Dulles station was 41.3 inches.

		0					
Precipitation Monitoring	Start of Record ¹	Station Operated		tatistics (In iod of Reco	2013 Total	Days missing	
Station Name	Record	by ^{2, 3}	Minimum	Median	Maximum	(Inches) ³	in 2013
Blue Ridge Center ⁵	2009	Loudoun	NA	NA	NA	31.7	23
Dulles	1964	NWS-COOP	27.0	39.1	65.7	45.4	0
Limestone Branch	2004	USGS	28.0	38.3	76.1	31.7	47
Lincoln	1930	NWS-COOP	20.4	41.4	63.5	25.0	25
Lovettsville	2005	USGS	27.6	37.5	61.3	37.5	13
Mt. Weather	1949	NWS-COOP	24.8	40.0	64.1	47.6	0
Sterling RCS	1978	NWS	30.3	41.8	67.7	47.3	0

Table 1. Precipitation monitoring stations and data.

¹ First full year that generally continuous data collection began.

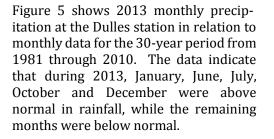
² National Weather Service Cooperative weather station; U.S. Geological Survey; Loudoun County Government

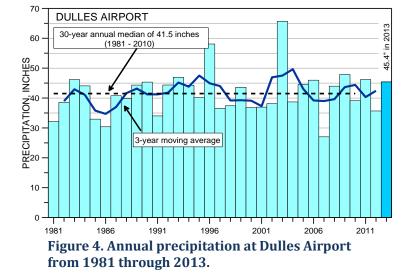
³ NWS-COOP stations record liquid & frozen precipitation; USGS & Loudoun stations record rainfall only.

⁴ Annual precipitation statistics based on site's period of available record through 2013 (see footnote 1).

⁵ Only one complete year of data (2011) exists for this monitoring station (50.5").

Figure 4 presents annual precipitation data from the Dulles station from 1981 through 2013. Annual precipitation has alternated above and below the 30-year median for the last several years so that there has not been a prolonged, multi-year deficit or surplus of precipitation.





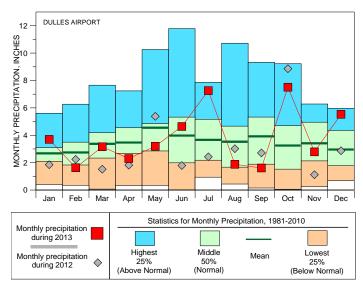
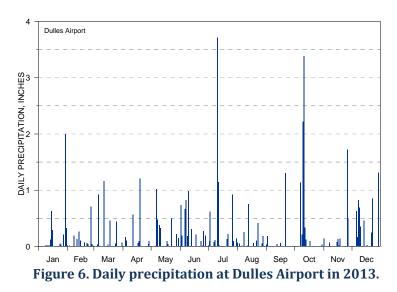


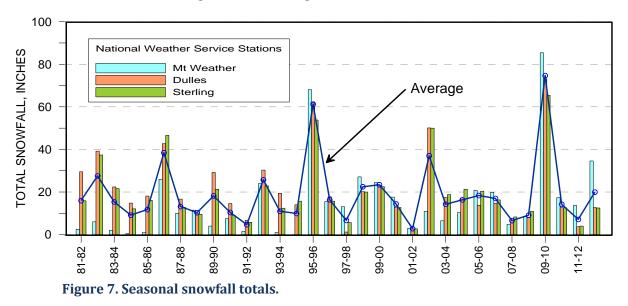
Figure 5. Monthly precipitation at Dulles Airport.



A graph of daily precipitation at the Dulles station is shown in Figure 6. Only three days during 2013 received rainfall totals greater than two inches. The greatest occurred on October 11 with 3.38 inches and a weekly total of 7.39 inches. Over the entire year, there were 249 days with no recorded precipitation at the Dulles station.

Snowfall

Of the total precipitation at the Dulles station during 2013, frozen precipitation totaled 15.2 inches, which was much less than the normal annual total of 21.9 inches of frozen precipitation and well below the 73.2 inches in winter season 2009-2010. Note that frozen precipitation contributes to the total (liquid) reported precipitation, however, at a reduced ratio based on the characteristics of the frozen precipitation. For example, heavy snow may be a 3 to 1 ratio (3 in of snow = 1 in of water) while dry, powdery snow may be 50 to 1 or more. Snowfall totals are reported by season during the winter and early spring months. The total snow depths are aggregated from daily values recorded at three weather stations operated by the National Weather Services as shown in Figure 7. The average total of the three stations for each season is also shown.



Streamflow

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 additional data and 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 floodplains, flood control, stormwater structures, and environ-mental conditions. There are 10 stream gages that measure and record water stage (level) in Loudoun County streams (Figure 8). Measured water levels at each gaging station are reported via telemetry to the USGS, correlated to historical sitespecific stream discharges (flows), and the data posted in near real-time with updates normally every 15 minutes. The data are available at the USGS web site for Loudoun County. Three additional stream gages are located along the county's perimeter: at Harpers Ferry and Point of Rocks on the Potomac River (both with real-time data on an internet web page) and on Bull Run near Route 705.

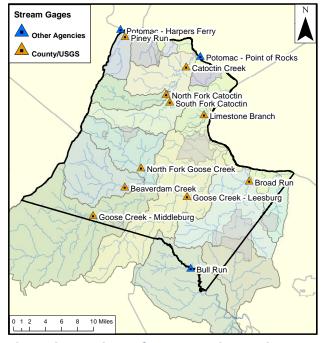


Figure 8. Locations of stream gaging stations.

The USGS regularly inspects the gaging stations to check the monitoring equipment and measure stream channel cross sections, water levels, and stream flow velocities in order to maintain calibration and data accuracy. However, data are considered provisional until passing the USGS's full quality control process.

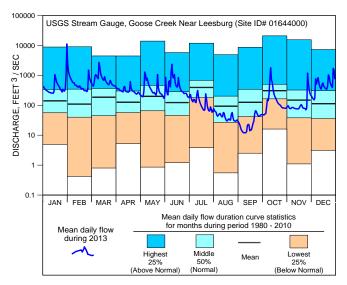


Figure 9. Stream discharge hydrograph for Goose Creek during 2013 compared to data from 1981-2010.

Figure 9 illustrates mean daily flow rates in Goose Creek near Leesburg during 2013 and compares it to monthly flow statistics at the same site for the period 1981 through 2010. These data indicate that streamflows were above normal from January through April, then dropping to below normal in August and September and above normal in December. Spikes in streamflow are generally correlated with rainfall at Dulles Airport (Figure 6). These two monitoring sites are approximately 5 miles apart, but the upper reaches of the watershed are over 30 miles from the Dulles precipitation station. If a storm event is localized in the upper area of the watershed, it can result in a relatively high stream discharge even though reported precipitation at the Dulles site is relatively low. The highest peak stream discharge recorded in 2013 at this station occurred on January 31. Goose Creek is the County's largest stream, with its headwaters in Fauquier County, flowing across Loudoun County, and discharging to the Potomac River.

Table 2 lists the 10 gaging stations in the county along with selected data statistics. The peak flow rates for 2013 occurred on October 30-31 at all of the stream gages.

Stream Gage Site Name	Start of Record	Drainage Area ¹ (sq. miles)	2013 Avg ² (cfs)	Previous Historic Avg ³ (cfs)	2013 Min ⁴ (cfs)	Previous Historic Min ⁵ (cfs)	2013 Peak ⁶ (cfs)	Previous Historic Peak ⁷ (cfs)	2013 Non- flowing ⁸ (days)	Average Annual Historic Non-flowing ⁹ (days)
Beaverdam Creek	Jul 2001	47.2	58.1	49.9	0.0	0.0	2,490	5,000	14	23.3
Broad Run	Oct 2001	76.1	146.2	130.1	12.0	1.3	5,910	10,300	0	0
Catoctin Creek - Taylorstown	Oct 1970	89.5	113.8	101.5	5.1	0.1	4,660	6,770	0	2.1
Goose Creek - Leesburg	Jul 1909	332.0	376.9	353.5	12.0	1.1	11,100	20,800	0	0
Goose Creek - Middleburg	Oct 1965	122.0	145.8	135.9	1.4	0.0	4,380	14,000	0	5.9
Limestone Branch	Aug 2001	7.9	9.0	8.6	0.7	0.4	468	976	0	0
North Fork Catoctin Creek	Jul 2001	23.1	27.1	24.0	0.5	0.0	780	1,190	0	10.5
North Fork Goose Creek	Jul 2001	38.1	45.5	48.6	0.9	0.2	1,250	3,040	0	0
Piney Run	Oct 2001	13.5	14.1	14.0	0.6	0.0	237	488	0	2.8
South Fork Catoctin Creek	Jul 2001	31.6	39.2	36.0	0.7	0.0	1,310	1,920	5	3.5

Table 2. Stream gaging stations and basic statistics.

¹ Drainage area above the stream gage (square miles)

² Average daily flow rate during 2013

³ Average daily flow rate for the period 2002–2012

⁴ Lowest 7-day average flow rate during 2013. Note: Broad Run flow augmented by wastewater discharge up to 11 MGD starting in 2008.

⁵ The lowest 7-day average flow rate for the period 2002–2012

⁶ Peak daily flow rate during 2013

⁷Peak daily flow rate for the period 2002–2012

⁸ Maximum number of consecutive days with very low flow (below 0.2 cfs) during 2013

^{'9} Maximum number of consecutive days per year with less than 0.2 cfs flow during the period 2002–2012

Groundwater Levels and Wells

There are approximately 14,500 active water supply wells throughout Loudoun County. Groundwater is the primary source of drinking water for the majority of residents in western Loudoun. Groundwater levels during 2013 were recorded at 20 dedicated monitoring wells at the sites shown in Figure 10 and the data were included in the County's Water Resources Monitoring Program. Seventeen of these wells are operated by staff from the Department of Building and Development and three are operated by the USGS. Groundwater level data have been collected from the three USGS wells since the late 1960s or early 1970s. Most of the Countymonitored wells were established as monitoring sites within the past decade, with one well dating back to 2002. Table 3 lists the monitoring wells, basic information about each well, and groundwater level data for both 2013 and the well's historic record.

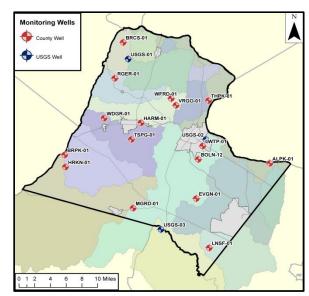


Figure 10. Locations of groundwater monitoring wells.

Well Site ID		Well			Grour	ndwater L	evel (feet)	1, 2
(see map for	Monitoring	Depth	Rock Type	Period of	Historic	2013	Historic	2013
location)	Organization	(feet)	Noek Type	Record	High	High	Low	Low
USGS-01	USGS	516	Meta-conglomerate/ metasiltstone	8/1969 - Present	1013.9	1011.0	1001.4	1001.6
USGS-02	USGS	535	Fluvial, deltaic sandstone	10/1977 - Present	380.3	380.3	361.2	366.0
USGS-03	USGS	165	Siltstone/sandstone	11/1968 - Present	421.1	421.1	407.5	416.3
BOLN-12	Loudoun	515	Fluvial, deltaic sandstone	12/2006 - Present	346.2	346.2	339.7	342.1
BRCS-01	Loudoun	320	Igneous intrusive	12/2007 - Present	532.8	528.5	521.1	522.0
HARM-01	Loudoun	945	Plutonic igneous intrusive	2/2005 - Present	502.7	502.7	475.8	496.5
MGRD-01	Loudoun	400	Plutonic igneous intrusive	12/2007 - Present	491.9	491.9	477.4	485.4
RGER-01	Loudoun	700	Igneous intrusive	2/2005 - Present	664.9	661.3	652.2	654.4
TSPG-01	Loudoun	360	Plutonic igneous intrusive	2/2005 - Present	435.3	431.3	419.1	422.5
WDGR-01	Loudoun	940	Mafic igneous intrusive	3/2005 - Present	646.8	641.0	629.6	632.3
WFRD-01	Loudoun	400	Plutonic igneous intrusive	11/2002 - Present	421.8	416.6	399.7	403.5
BRPK-01	Loudoun	680	Igneous intrusive	7/2009 - Present	1647.8	1647.8	1632.6	1634.0
THPK-01	Loudoun	360	Limestone conglomerate	7/2009 - Present	195.3	187.5	173.6	175.4
ALPK-01	Loudoun	240	Alluvium/metasiltstone	7/2009 - Present	214.4	211.5	193.6	193.7
HRKN-01	Loudoun	600	Plutonic igneous intrusive	3/2009 - Present	688.5	673.9	643.3	643.3
VRGO-01 ³	Loudoun	300	Igneous intrusive	3/2009 - Present	563.1	557.9	538.4	542.6
EVGN-01	Loudoun	320	Diabase	3/2009 - Present	309.0	309.0	300.2	300.4
LNSF-01 ⁴	Loudoun	322	Hornfels	8/2013 - Present	287.7	287.7	276.4	276.4
LWTP-01 ³	Loudoun	250	Metasiltstone	3/2009 - Present	276.9	276.8	373.3	273.3
¹ Elevation above	mean sea level.		² Historic data highs and lows a	e during the period of re	cord through	2013.		

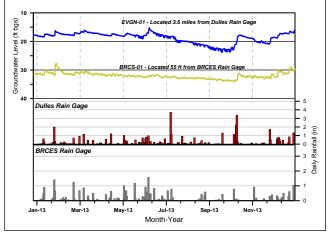
Table 3. Monitoring wells and groundwater level data for 2013.

³ Partial year data.

Boxes indicate new historic Highs/Lows set during 2013.

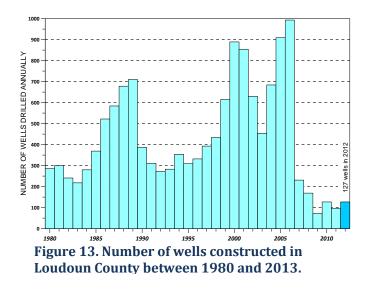
⁴ New Well put into service in 2013.

Figure 11 shows hydrographs for selected monitoring wells that are representative of groundwater levels in the county for calendar year 2013. Shortterm 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 normally exhibit a steady, slow decline over time after rain events. Groundwater levels are typically highest in late spring/early summer and lowest in late fall/early winter. Assuming normal precipitation patterns, this is due to greater recharge to the groundwater system during cooler winter/spring weather when evapotranspiration is low, thereby allowing more water to infiltrate downward to the water table.



Record period from Jan. 2013 through Dec. 2013 Source: Loudoun County Dept. of Bldg. & Dev.

Figure 12. Groundwater hydrograph and daily rainfall in 2013.



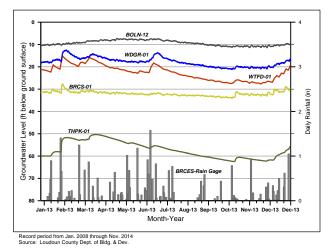


Figure 11. Groundwater levels from selected County WRMP monitoring wells.

Figure 12 shows a hydrograph from two sets of monitoring wells coupled with the nearest rain gauge with daily rainfall data. One couple shows the EVGN-01 monitoring well off Ryan Road near Brambleton plotted with daily rainfall from the NWS rain gage at Dulles Airport. The other couple shows monitoring well BRCS-01 and daily rainfall from the BRCES rain gage. Both data sets are during 2013 and show the response of groundwater levels to precipitation events, as well as regional differences in rainfall events between the western and eastern parts of the County.

During 2013, 117 new water supply wells were constructed. Figure 13 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, occasionally, zoning changes affecting residential development potential. As occurred during the previous three to four years, the number of new wells drilled in 2013 remained relatively low. The median total depth of wells installed in 2013 was 500 feet with the depths ranging from 140 to 1,400 feet. The median estimated yield (based on air-lift pumping) was 3.0 gallons per minute with yields ranging from 0 to 100 gallons per minute.

The median depth of wells drilled in Loudoun County has increased from 150 feet in the 1960's to the current median of 410 feet. The increase has been possible because of advances in drilling technology, allowing wells to be drilled cheaper, quicker and deeper to provide increased water storage.

WATER QUALITY

The quality of surface water in Loudoun County was quantified in 2013 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 2013 was primarily conducted by the Virginia Department of Environmental Quality (DEQ) as part of their state-wide <u>surface water</u> <u>quality sampling program</u>.

In 2013, DEQ collected samples from 19 sites and conducted 543 analyses of nitrogen and phosphorous 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 and can lead to low dissolved oxygen, fish kills, shifts in flora and fauna and blooms of nuisance algae. Figure 14 illustrates the results of sampling by DEQ for nitrogen and phosphorus in the surface waters from the watersheds of Loudoun County during 2013.

In 2000, the U.S. Environmental Protection Agency (EPA) developed ambient water quality criteria re- commendations and information for 14 nutrient eco-regions in the continental United

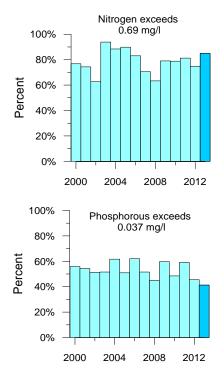


Figure 14. Nutrient concentrations as percent of samples exceeding EPA guidance thresholds from 2000 to 2013.

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. As shown in Figure 14, the percent of stream samples which exceed the threshold levels for nitrogen and phosphorous between 2000 and 2013 are shown. In 2013, approximately 85 percent and 41 percent of the samples collected by DEQ contained nitrogen and phosphorus concentrations above the 0.69 mg/L and 0.037 mg/L EPA guidance criteria, respectively.

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 2013, DEQ collected and analyzed approximately 99 samples from the watersheds of Loudoun County and found that approximately 88 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.

Year	Number of Samples	Number of Monitoring Sites	Number of Sites Exceeding ¹	Percent Sites Exceeding ¹
2008	121	20	13	65%
2009	115	18	16	89%
2010	132	21	19	90%
2011	127	27	22	81%
2012	119	21	18	86%
2013	99	16	14	88%

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

¹ Exceeds recreational use criteria for *Escherichia coli*.

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 macro-invertebrates usually involves collecting all the organisms within a small area of the stream bottom, identifying the types of organisms collected to the order, family or genus 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. In 2013, two techniques were used to evaluate the benthic macro-invertebrate populations: the Virginia Stream Condition Index (VA SCI) at both the family and genus level used by DEQ and the Virginia Save Our Streams (VA SOS) index used by several citizen volunteer organizations in and adjacent to the county.

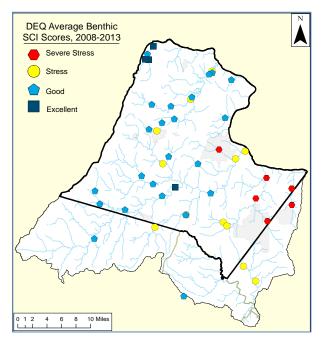


Figure 15. Summary of DEQ benthic monitoring results.

During the period 2008 through 2013, DEQ sampled a total of 157 times at 44 locations in Loudoun and calculated VA SCI scores which ranged from Severe Stress to Excellent. Figure 15 illustrates the average stream conditions from benthic samples collected by DEQ between 2008 and 2013. Several volunteer organizations in <u>Loudoun</u> <u>Watershed Watch</u> collect benthic macroinvertebrate data. From 2008 through 2013, Loudoun Wildlife Conservancy, Goose Creek Association, and other volunteer groups collected 200 samples from approximately 59 locations using the VA SOS methodology. Results ranged from Acceptable to Unacceptable as shown in Figure 16.

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.

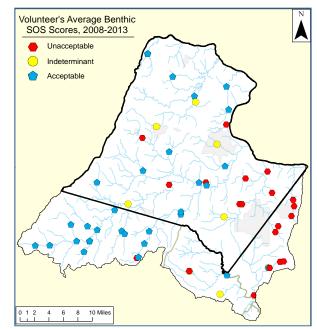


Figure 16. Summary of volunteer benthic monitoring results.

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 program. 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 the 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 latest report released in 2013, 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. On December 12, 2013 EPA approved the 2012 305(b)/303(d) Water Quality Assessment Integrated Report.

Surface water quality impairments are reported to the Environmental Protection Agency every two years by the Virginia Department of Environmental Quality (DEQ). The Final 2012 305(b)/303(d) <u>Water Quality Assessment Integrated Report</u> (Integrated Report) summarizes the water quality conditions from Jan. 1, 2005, to Dec. 31, 2010.

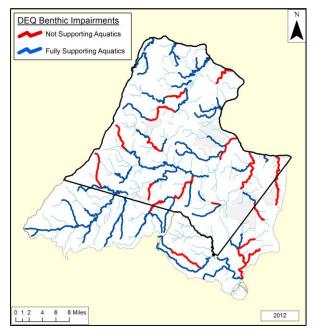


Figure 17. Aquatic life use (benthic macroinvertebrates) impaired stream segments.

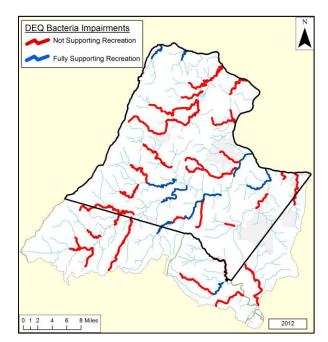


Figure 18. Recreational/swimming use (bacteria) impaired stream segments.

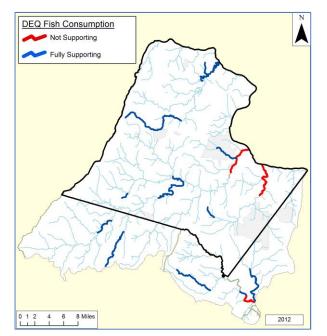


Figure 19. Fish consumption use (PCB and mercury in fish tissue) impaired stream segments.

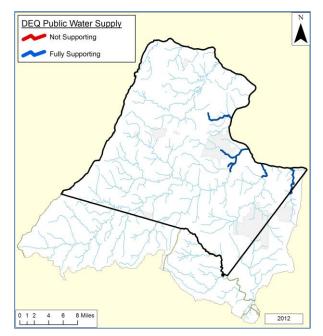


Figure 20. Public water supply use (chemicals) impaired stream segments.

Groundwater Quality

Groundwater is the source of drinking water for most of Loudoun County outside of Loudoun Water's central service area (see Figure 1) 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 2013, 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 2013	3544 203	15 0	0.4 0.0
Sulfate	250	All 2013	3544 203	14 1	0.4 0.5
Lead	0.015	All 2013	3547 203	37 4	1.0 1.9
Fluoride	4	All 2013	3544 203	7 0	0.2 0.0
Arsenic	0.01	All 2013	3551 203	16 0	0.5 0.0
Manganese	0.05*	All 2013	3551 203	2310 147	65.1 72.4
Iron	0.3*	All 2013	3567 203	2429 143	68.1 70.4
TDS	500*	All 2013	3546 202	26 3	0.7 1.5

Table 5. Results of Water Quality Analyses. All records vs. 2013.

* Secondary MCL for taste, color, and odor.

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 15,000 active OWTSs in the county and during 2013, 86 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 (703-777-0234 and <u>www.loudoun.gov/onsite</u>). There are a few isolated locations in the County where significant groundwater contamination is known to exist. The most notable location is the Hidden Lane Landfill in northeast Loudoun, which was placed on the EPA's National Priorities List (Superfund). The EPA has developed fact sheets to update citizens on clean-up and investigation activities at the site. The latest Hidden Lane fact sheet and more information can be found by visiting the EPA web site.

Of the 203 groundwater samples collected in 2013, only five samples had individual analyte concentrations higher than the EPA Maximum Contaminant Level (MCL); one for sulfate, and four for lead. Although groundwater quality is generally good, this shows why owners of private drinking water wells should have their well water tested regularly to assure that the water is safe to consume.

FUTURE WATER RESOURCES OUTLOOK

The EPA grant that supported the WRMP ended in 2009; however, continuation of most monitoring activities is positioned to continue with limited local funding. Although no major new monitoring projects are planned, the monitoring objectives for 2014 and beyond will include:

- Precipitation/rainfall continue to monitor and/or obtain data from the stations operated by NWS, 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 20 dedicated monitoring wells operated by Loudoun County or the USGS. The most recently added monitoring well, located at Lunsford Middle School in South Riding, was brought on line in 2013.
- Water quality sampling groundwater and/or surface water quality sampling may be conducted depending on available funding.

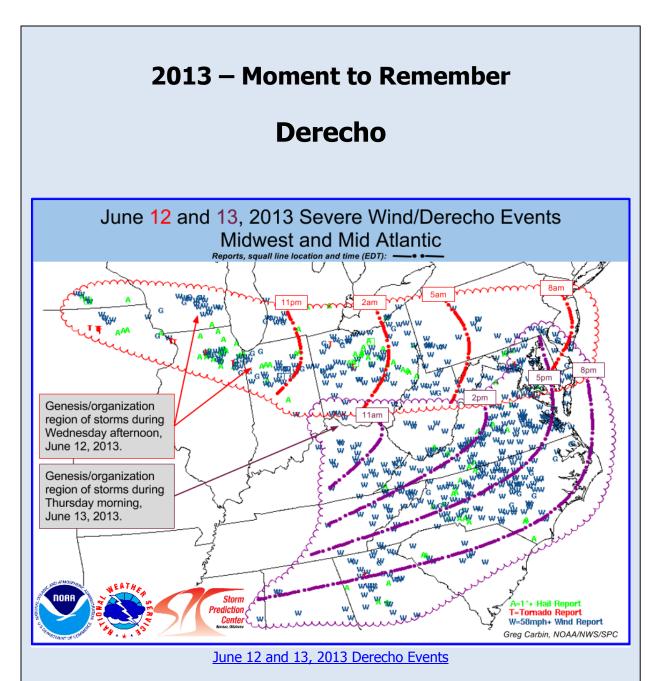
The Department of Building & Development has begun watershed management planning activities through initiation of a pilot project. The Upper Broad Run Watershed Management Plan Pilot Project began in August of 2013, with Versar, Inc. selected as the consultants for the project. Two Public Information meetings were held that fall, while Versar was engaged in watershed assessment activities. A Watershed Partnership Workgroup was created to help guide the process, and began meeting in October, 2013. The Upper Broad Run Project is slated for completion in the summer of 2014.

On December 30, 2010, the U. S. Environmental Protection Agency issued a Total Maximum Daily Load (TMDL) for 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 submitted the state <u>Phase II Watershed Implementation Plan (WIP)</u> to the EPA in March of 2012. The Phase II WIP is designed to show how the Commonwealth and local Bay jurisdictions, including Loudoun, will meet Virginia's portion of the pollution diet. During 2013, at the request of the Board of Supervisors, County staff completed a public process to determine the most cost effective and reasonable strategies to meet Virginia's Phase II WIP goals for Loudoun County. The County is now developing a work plan to continue efforts to achieve the County's WIP II reduction goals. Data from the WRMP will be available to help support those goals.

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:

www.loudoun.gov/watermonitoring



From June 12 to June 13, 2013, two derechos occurred across different areas of the Eastern United States. The initial derecho formed on the afternoon of June 12 and tracked across a large section of the Midwestern United States, the central Appalachians, and the Mid-Atlantic states before moving into the Atlantic Ocean during the morning of June 13. A second, more widespread and intense derecho occurred on June 13 across the Southeastern United States, resulting in major wind damage across North Carolina, Virginia, and Maryland, among other states. Locally in Loudoun County over a dozen trees were downed and winds of 59 mph were recorded.