

Maryland Department of the Environment

Baltimore, Maryland

**Source Water Assessments for
Transient, Non-Community Public
Water Systems, Montgomery
County, Maryland**

July 16, 2005

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Project No.: 56004790

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1 Executive Summary

Maryland Department of the Environment (MDE) contracted with VIEW Engineering to complete a Source Water Assessment (SWA) for the transient, non-community public water systems in Montgomery County, Maryland. VIEW Engineering visited 33 locations that comprise 39 public water system wells regulated by MDE. After conducting well inspections and surveying each well with Global Positioning Satellite equipment, maps were created that included the well location, delineated wellhead protection area, and potential contaminant sources for each water supply site. The susceptibility of each well to contamination was assessed and recommendations were provided where appropriate.

While the majority of well sites are not in immediate danger of contamination, 16 systems, or 41.0% of those surveyed, are highly susceptible to future degradation of water quality. In most cases, risks to these sites come from human influences such as nearby septic systems, underground storage tanks for petrochemicals, or non-point agricultural influences. To ensure that existing high quality water sources remain viable and minimize their susceptibility to future degradation, current water quality sampling practices should be maintained, and where noted, augmented. Maryland Department of the Environment data collection has been an effective means to identify contaminants of concern and ensure that the transient public water system suppliers comply with regulations.

2 Introduction

The U.S. Environmental Protection Agency (EPA) is authorized by the Safe Drinking Water Act (SDWA) to regulate contaminants that may present health risks to public drinking water supplies and to ensure safe drinking water for all users of public water systems. MDE is the primary agency responsible for implementation of the SDWA in the State of Maryland. The 1996 Amendments to the SDWA reaffirmed the importance of source water protection as the first step in ensuring drinking water quality. A formalized Source Water Assessment (SWA) is mandated by the SDWA and consists of 1) delineating the boundaries of areas providing source water for public systems; 2) inventorying significant potential sources of contamination; and 3) determining the susceptibility of the public water system to such contaminants. The source water assessment report makes recommendations for management of risk and is intended to

assist in implementing a Source Water Protection Program (SWPP). Maryland's SWA Plan was approved by the EPA in Nov. 1999, and is currently being implemented. In early 2004, MDE selected VIEW Engineering to conduct a SWA study for the transient, non-community public water supplies located in Montgomery County. The methods, results, and recommendations of this SWA study are contained in the subsequent sections of this report.

A generalized reproduction of the Montgomery County portion of the *Maryland Geologic Map* (Maryland Geologic Survey, 1968) is included as Figure 1 of this report and includes the well locations surveyed for this study. Figure 1 also allows for an initial interpretation of well locations with respect to geology. Montgomery County lies wholly within the Piedmont Plateau physiographic province of the Appalachian Mountains. The majority of the county is contained within the Upland Section and the most northwestern portion of the county within the Lowland Section. The Piedmont Plateau Province is composed mainly of crystalline igneous and metamorphic rocks extending from the inner edge of the Coastal Plain westward to Catoctin Mountain, the eastern boundary of the Blue Ridge Province. Bedrock in the eastern part of the Piedmont consists of schist, gneiss, gabbro, and other highly metamorphosed sedimentary and igneous rocks of volcanic origin with some granitic pluton and pegmatite intrusions.

The rocks of the western part of the Piedmont are diverse and include phyllite, slate, marble, and moderately to slightly metamorphosed volcanic rocks. Gently undulating plains underlain by sedimentary bedrock (New Oxford Formation) of Triassic-age red to maroon shale, siltstone, and sandstone occur in western Montgomery County in the Culpeper Basin, which is a north-northeast trending half-graben fault (down-faulted) basin. The Culpeper Basin was subsequently filled with sedimentary rocks of the New Oxford formation that lie unconformably on top of the Precambrian and Paleozoic crystalline bedrock that comprises the rest of Montgomery County.

Groundwater flow within both the sedimentary and crystalline bedrock occurs primarily through the fractures, faults, joints, and bedding plane partings that exist within the bedrock, which also contribute largely to the aquifer storage and transmissive capacity. This type of fractured-dominated groundwater flow regime can be quite complex and contaminants can migrate rapidly through these fractures and impact public water

supplies. The need to understand and evaluate the susceptibility of groundwater to potential contamination through this SWA evaluation is critical to protect public health.

3 Methods

The Source Water Assessment was initiated by a meeting between VIEW Engineering and the Maryland Department of the Environment in March 2004. At that meeting, the MDE explained their expectations and provided the necessary data to begin the project. After an initial review of the electronic and hard copy records at the MDE office, VIEW Engineering contacted each of the transient water system owners or operators to arrange for a site survey.

During the week of June 7, 2004 VIEW Engineering visited each of the 39 transient, non-community public water systems at 33 separate locations identified by the MDE. The names and Public Water Supply Identification numbers of all the visited sites are shown in Table 1. VIEW employed a Trimble Pro XRS Global Positioning Satellite (GPS) receiver to obtain an accurate horizontal position at each well. If any nearby potential contaminant sources were accessible, those sources were also located with the GPS equipment. Efforts were made to obtain well information from each well owner. In some cases, the well owners met with VIEW personnel to provide assistance or provided information over the telephone. Often, detailed information regarding well construction could not be obtained. Where available, sanitary survey reports and well completion records from the MDE were used to augment existing well information.

The GPS data, well owner information, and MDE geographic data were combined to create data layers for use in ESRI's ArcView 9 Geographic Information System (GIS) software. Using the GIS, 1000-foot radius, circular, wellhead protection areas were delineated around each well having an average daily water appropriation permit of less than 10,000 gallons per day. Potential contaminant sources identified by MDE or VIEW Engineering located within those wellhead protection areas were evaluated for contamination susceptibility. Land use data provided by the MDE was used to further characterize each location and the nearby potential risks to water quality.

Water quality analytical data supplied by the MDE were assembled and combined into a relational database for use in assessing each system's susceptibility. These data primarily include nitrate and bacteriological sample results, however some additional

inorganic data were also available for some locations. Detections in the electronic data were noted and checked against hard copy data results from MDE’s files where possible. The date ranges for the analytical results for each transient water supply are shown in Table 1. Where applicable, results were compared against the Code of Maryland Regulations, Title 26, Subtitle 4, Chapter 1 Regulation 6, *Maximum Contaminant Level for Inorganic Chemicals in Drinking Water*.

The Stadler Nursery site in Laytonsville, MD is the only transient, non-community public water supply identified by the MDE in Montgomery County to use more than 10,000 gallons per day. To delineate the Nursery’s wellhead protection area fracture trace analysis and hydrogeologic mapping were employed. A more detailed description of the methodology used for this location can be found in Section 5.27 Stadler Nursery.

After reviewing the available data and maps, a qualitative rating for the susceptibility of each system to contamination was made along with recommendations to minimize the susceptibility of each water supply to potential contaminant sources. The results and recommendations for the study area and for each public water supply well follow in the subsequent sections of this report.

Table 1 Listing of Investigated Transient, Non-Community Water Supplies and the Date Ranges for Which Analytical Data Are Available

PWSID	Water Supply Name	Sample Date Range	
		Earliest	Most Recent
1151038	Boyds Presbyterian Church	3/6/1996	10/27/2004
1151003	Camp Bennett Lodge	5/29/1996	10/20/2004
1151081	Camp Bennett Office/Rec Center	7/24/2002	5/27/2004
1151004	Camp Brighton Woods	5/8/1996	10/20/2004
1151066	Camp Friendship	3/20/1996	5/28/2003
1151005	Camp Waredaca	5/1/1996	11/15/2004
1151008	Comus Inn	7/31/1996	11/9/2004
1151009	Darnestown Swim and Racquet Club	6/4/1996	4/28/2004
1151082	Dayspring Church – Jacob’s Well	6/11/2002	10/26/2004
1151010	Dayspring Church – Wellspring Well	8/1/1996	12/8/2004
1151011	Dickerson Market	4/16/1996	12/14/2004
1151036	Etchison Country Store	12/2/1999	10/22/2004
1151041	Hyattstown Deli	4/9/1996	12/1/2004
1151046	Laytonsville Golf Club	4/17/1996	10/21/2004
1151065	Little Bennett Golf Course – Clubhouse	8/14/1996	12/1/2004
1151083	Little Bennett Golf Course – Driving Range	7/29/2002	10/8/2004
1151019	Montgomery Country Club	6/20/1996	10/25/2004

PWSID	Water Supply Name	Sample Date Range	
		Earliest	Most Recent
1151020	National Capital Skeet and Trap Club	10/1/1996	10/6/2004
1151075	New Hope Presbyterian Church	11/18/2000	2/7/2005
1151022	Old Anglers Inn	11/21/1996	11/17/2004
1151057	Owens Park	5/2/1996	1/8/2004
1151024	Poole's General Store	4/30/1996	10/17/2004
1151023	Poolesville Public Golf Course	10/10/1996	6/8/2004
1151042	Potomac Oak Center I [12944 A-E]	1/3/1996	10/27/2004
1151064	Potomac Oak Center II [12948 A-F]	2/9/1996	10/27/2004
1151013	Potomac Oak Center III [12960- 12964]	3/27/1996	10/27/2004
1151025	Potomac Swim and Recreation Assoc	6/4/1996	5/29/2003
1151026	Red Door Store	2/28/1996	11/8/2004
1151048	Ross Body Community Center	4/17/1996	3/23/2004
1151084	Smokey Glen Farm Grove Area	9/24/2002	9/1/2004
1151028	Smokey Glen Farm Pavilion Area	10/1/1996	11/1/2004
1151030	St. Mary's Church	4/25/1996	10/27/2004
1150048	Stadler Nursery	1/24/2000	8/31/2004
1151050	Sunshine General Store	6/5/1996	11/8/2004
1151033	Tex's Place	6/24/1996	1/6/2005
1151078	Tri-County Baptist Church	11/19/2001	10/20/2004
1151070	Trotters Glen Golf Course	1/27/2000	11/18/2004
1151079	Waters Landing Golf Park	1/31/2002	10/26/2004
1151035	Whites Ferry Store	3/6/1996	11/9/2004

4 Results and Discussion

4.1 General Assessment of Risks Faced by Transient, Non-Community Water Supply Systems

Montgomery County comprises a mixture of land uses, each of which may have its own potential adverse impact on groundwater quality. The predominantly fractured bedrock aquifers throughout the county coupled with thin soil profiles can result in rapid transport of contaminants from the surface into the fractures that ultimately transmit groundwater toward public or private supply wells.

Many of the wells from this study are located in relatively rural areas where agricultural land uses are predominant and may result in nitrate loading to the aquifer. Nitrate in drinking water is primarily a risk to infants and is implicated in causing methemoglobinemia, or blue-baby syndrome, a condition in which the blood is unable to carry sufficient amounts of oxygen. Unfortunately, few inexpensive, simple methods for

removing nitrogen from drinking water exist at present. In some cases the most straightforward and cost effective solution is to locate another water supply. This can mean drilling a well in another location, or re-drilling an existing well and extending the casing within the well to tap a deeper portion of the aquifer. Substituting bottled water for well water is an option, however the cost-effectiveness of this solution is dependent upon how much water must be purchased. Bottled water usage also requires a waiver from the state. The land available to many transient water supply operators often limits the effectiveness of relocating the primary well. In such cases, treatment technologies such as distillation, reverse osmosis, or ion exchange are available. These methods, while effective, involve significant long-term maintenance and operation costs.

Bacterial (i.e. coliform bacteria) or other water-borne pathogen contamination of the aquifer can originate from multiple sources including: agricultural land use, improperly constructed on-lot septic systems, and infiltrations of surface runoff to a fractured rock aquifer. Certain coliform strains can cause gastro-intestinal irritation (i.e. diarrhea) and, in certain extreme cases death. Young children, the elderly, and people with compromised immune systems are especially vulnerable. Channeling surface runoff away from wells and having an adequately grouted casing of sufficient length can greatly reduce bacterial contamination potential. If bacterial contamination persists, chlorination or UV disinfection systems can often remove bacterial contamination, however it will not eliminate water borne cysts, such as *Cryptosporidium*.

Commercial or industrial land uses may include chemical or petroleum storage underground storage tanks that can become a source of volatile organic compounds (which are often carcinogenic) or heavy metals in groundwater. Those wells located near gas stations, industrial facilities, or other commercial operations can be rapidly impacted from an unknown chemical release and therefore well owners should be aware of the types of chemicals used or stored at these types of facilities.

4.2 General Recommendations

The most significant potential threat to water quality in Montgomery County is from agricultural land use, which can result in elevated nitrate levels in groundwater. A combination of proper well construction (including a properly grouted well casing), proper nutrient management, surface runoff (storm water) management, public education, and

use of agricultural best management practices can greatly reduce the threat of degraded water quality from potential contaminant sources. Periodic water quality testing of wells is recommended for nitrates and coliform bacteria in those areas with significant agricultural land use or on-lot septic systems, while water quality analysis for volatile organic compounds is recommended for areas near underground storage tanks.

4.3 Summary of Susceptibility Analyses for Transient Non-Community Water Supplies in Montgomery County

Each of the transient non-community water supply systems, their susceptibility to contamination, and brief description of the reasoning behind the susceptibility rating are shown in Table 2. As shown in Table 3, 41.0%, or 16 systems, are highly susceptible to contamination. One system (2.6%) is moderately to highly susceptible. Eleven systems (28.2%) are considered to be at a moderate susceptibility while the remaining 11 systems (28.2%) are considered to be at low to moderate or low susceptibility.

Table 2 Summary of Susceptibility Analyses for Transient Non-Community Water Supplies in Montgomery County

PWSID	Location Name	Susceptibility	Reason
1151038	Boyds Presbyterian Church	Moderate	Land use, coliform
1151003	Camp Bennett Lodge	High	Nitrate and coliform
1151081	Camp Bennett Office/Rec Center	Low	
1151004	Camp Brighton Woods	Low	
1151066	Camp Friendship	Low	
1151005	Camp Waredaca	High	Nitrate
1151008	Comus Inn	Moderate	Coliform, nearby septic
1151009	Darnestown Swim and Racquet Club	High	Coliform, nitrate
1151082	Dayspring Church Jacob's Well	Moderate	Nearby septic
1151010	Dayspring Church Wellspring	Moderate	Nearby septic
1151011	Dickerson Market	High	Septic, UST, nitrate, coliform
1151036	Etchison Country Store	Mod - High	No well info, nearby septic
1151041	Hyattstown Deli	Moderate	Coliform
1151046	Laytonsville Golf Club	High	Coliform, nitrate
1151065	Little Bennett Golf Course Clubhouse	Low	
1151083	Little Bennett Golf Course Driving Range	Low - Mod	One coliform detection
1151019	Montgomery Country Club Primary	Low	
1151020	National Capital Skeet and Trap Club	Low	
1151075	New Hope Presbyterian Church	Low - Mod	Nitrate near 50% MCL
1151022	Old Anglers Inn	Low	

PWSID	Location Name	Susceptibility	Reason
1151057	Owens Park	High	Coliform, nearby septic
1151024	Poole's General Store	High	Nearby septic
1151023	Poolesville Public Golf Course	Moderate	Coliform
1151042	Potomac Oak Center I [12944 A-E]	High	Nitrate, coliform
1151064	Potomac Oak Center II [12948 A-F]	High	Nitrate
1151013	Potomac Oak Center III [12960- 12964]	High	Nitrate
1151025	Potomac Swim and Tennis Club	High	UST, no grout seal, lack of info
1151026	Red Door Store	High	Coliform, shallow well
1151048	Ross Body Community Center	Moderate	Nearby UST
1151084	Smokey Glen Farm Grove Area	Low	
1151028	Smokey Glen Farm Pavilion Area	Moderate	Nitrate
1151030	St. Mary's Church	Moderate	Land use
1150048	Stadler Nursery	High	Coliform, land use
1151050	Sunshine General Store	High	Nitrate, nearby USTs
1151033	Tex's Place	High	Industrial land use
1151078	Tri-County Baptist Church	Moderate	Nitrate, nearby pesticide dealer
1151070	Trotters Glen Golf Course	Low	
1151079	Waters Landing Golf Park	Moderate	Nitrate, nearby interstate
1151035	Whites Ferry Store	High	Shallow well, nearby river

Table 3 Transient, Non-Community Water Supply Systems Summarized by Susceptibility Rating

Susceptibility Rating	Count	Percentage
High	16	41.0%
Mod - High	1	2.6%
Moderate	11	28.2%
Low - Mod	2	5.1%
Low	9	23.1%
Total	39	100%

Maps showing the transient system locations, wellhead protection areas, and potential contaminant sources are shown in Figure 2 through Figure 34. Wellhead photographs taken during the June 2004 survey are shown in Figure 35 through Figure 75. All figures are located in the rear of the report starting at page 70.

5 Individual Transient, Non-Community Public Water System Source Water Assessments

5.1 Boyds Presbyterian Church

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	Unknown	1151038

5.1.1 Location and Well Description

Address: 19821 White Grounds Road, Boyds, MD 20841

The Boyds Presbyterian Church well, shown in Figure 2, sits behind the church rectory in a grassy area and is surrounded by cropland and deciduous forest to the south and east. To the north, a section of low and medium density residential land extends to the perimeter of the 1000-foot wellhead protection area. A section of cropland fills in the rest of the area to the northwest. No well construction details are available for this well, although an ultraviolet light treatment system is in use. The geology of the area is mapped as the Ijamsville Formation-Marburg Schist (blue, green, or purple phyllite and phyllitic slate, with interbedded metasiltstone and metagraywacke; and bluish-gray to silvery-green, fine-grained, muscovite-chlorite-albite-quartz schist with interbedded quartzites).

5.1.2 Potential Sources of Contamination

The most immediate potential for contamination comes from the cropland located to the south and east of the well. While cropland itself poses no danger, the possible over-application of manure, fertilizers, pesticides, or herbicides could impact water quality. The church's fuel oil underground storage tank is located approximately 375 feet to the northwest and is listed in good condition according to MDE records. The septic tank for the church is located approximately 150 feet northwest of the well. Both the fuel oil and septic tanks are downgradient from the well. The well is also located within 300 of the church's cemetery, which can pose the risk of elevated arsenic levels in the groundwater.

5.1.3 Discussion and Recommendations

Water quality analytical data for Boyd’s Presbyterian Church are available from March 1996 through October 2004. During September 1997 and September and October 1998, total coliform bacteria were detected in the well samples. Aside from these four detections, however, no other detections of bacterial contamination were detected during the period for which data are available. Average nitrate concentrations over time for the church are 3.7 mg/L and vary between below detectable limits and 6.3 mg/L, both of which are below Maryland standard of 10 mg/L. The 6.3 mg/L detection occurred in August 2004 and represents the highest historic concentration.

The two greatest causes for concern at this well site are the nearby underground storage tank and septic or agricultural influence. Unless a leak is detected in the fuel oil tank, there is little reason to sample the groundwater for fuel oil components since it is downgradient from the well. The tank is listed in good condition and is separated from the well by nearly 400 feet. The coliform detections in the well were isolated incidents and do not appear in the more recent data. However, agricultural land usage, the septic tank for the church, and nearby residential septic systems pose potential threats to the water quality. Continued monitoring of state-mandated parameters is advised. The contamination risk to this well is moderate given its surrounding land use, unknown well construction, nearby underground storage tank, and historic coliform bacteria detections. The treatment system should be properly maintained to reduce the possibility of future coliform detections along with annual sampling for volatile organic compounds to verify the integrity of the nearby underground storage tank.

5.2 Camp Bennett

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Office and Recreation Center	MO-94-1107	1151081
Lodge	Unknown	1151003

5.2.1 Locations and Well Descriptions

Address: 20501 Georgia Avenue, Brookeville, MD 20833

Located in eastern Montgomery County, Camp Bennett has two wells serving their facility as shown in Figure 3. One well supplies the Office and Recreation Center, while

the other well supplies the Lodge. These wells are located in the Wissahickon Boulder Gneiss (thickly bedded to massive, pebble- and boulder-bearing, arenaceous to pelitic metamorphic rock, typically a medium-grained, garnet-oligoclase-mica-quartz gneiss). According to the MDE sanitary survey report the Office and Recreation Center well is installed to a depth of 400 feet with 44 feet of 6-inch diameter casing and a grout depth of 41 feet. This well's yield is reported to be 10 gpm with an average daily use of 500 gallons with no treatment system in use. The Lodge well is installed to an unknown depth with 6-inch diameter steel casing and a chlorination system is used for treatment.

The well wellhead protection area is almost entirely covered by deciduous forest, with the exception of a swath of grassland extending from the wellhead to the southern extent of the wellhead protection area. This grassland is characterized as pasture by the Maryland Department of the Environment's land use data.

5.2.2 Potential Sources of Contamination

The lack of industrial and residential development near both wells affords these water supplies considerable protection from contamination with the exception of two septic holding tanks located near the wells. The first tank is approximately 150 feet northeast of the Office and Recreation Center well and the second is approximately 60 feet to the south of the Lodge well.

5.2.3 Discussion and Recommendations

Water quality analytical data for the Camp Bennett Lodge are available from May 1996 to October 2004. The Lodge well has tested positive for e Coli bacteria once in June 2003 and had several detections of total coliform bacteria during the past 5 years as shown in Table 4 below.

Table 4 Camp Bennett Lodge Total Coliform Results in Colonies per 100 mL

Sample Date	Total Coliform Result	Result Unit
5/12/1998	16	col/100 ml
6/25/1998	20.7	col/100 ml
7/24/2002	8.7	col/100 ml
7/26/2002	9.9	col/100 ml
7/26/2002	15	col/100 ml
7/26/2002	6.4	col/100 ml
7/26/2002	3.1	col/100 ml
6/5/2003	30.6	col/100 ml

Sample Date	Total Coliform Result	Result Unit
11/20/2003	21	col/100 ml

The multiple total coliform results during July of 2002 represent several confirmatory samples taken from different locations on site. Nitrate levels in the Lodge well were consistently below the state standard of 10 mg/L, although, as shown in Table 5, they show display some variability through time. After a period of low nitrate detections from November 1999 through early July 2003, levels increased in late July 2003 to between 4.6 and 4.9 mg/L. While the 2004 detections are still below the 10 mg/L state standard, they are approaching 50% of the maximum contaminant level. Nitrate levels should be closely monitored to ensure that they do not continue to increase. Nitrite was detected at both 0.005 and 0.007 mg/L in May of 1997.

Table 5 Camp Bennett Lodge Nitrate Results Over Time in mg/L

Sample Date	Result Value	Sample Date	Result Value
5/15/1997	4.5	6/26/2002	2.4
5/15/1997	1.6	7/24/2002	1.3
5/12/1998	1	11/25/2002	1.3
7/22/1998	4.4	1/24/2003	1.3
4/13/1999	1.2	7/1/2003	1.6
4/13/1999	6.1	7/23/2003	4.8
11/18/1999	1.5	11/20/2003	4.6
5/2/2000	1.4	1/21/2004	4.9
7/31/2001	2.2		

Water quality analytical data for the Office and Recreation Center well is available from July 2002 to May 2004. The well has not tested positive for bacterial contamination, nor are nitrate levels in the well problematic. In July of 2002, nitrate was detected at 4.7 mg/L. From July 2003 to May 2004, nitrate levels varied between 1.1 and 1.6 mg/L.

The Office and Recreation Center well is at a low susceptibility to future contamination due to a lack of nearby potential contaminant sources, adequate well construction, and good water quality, therefore no further action is necessary for this well. The Lodge well appears to have increased nitrate levels along with several bacterial detections, which may originate from either pasture or a failing septic system. If nitrate levels continue to rise, the source of the nitrates should be verified. The Lodge well is presently at high

susceptibility due to the increased nitrate levels and coliform bacteria detections, and the lack of well construction information. Continued water quality monitoring is recommended for the Lodge well along with a thorough sanitary inspection and the institution of a regular maintenance program for the existing disinfection system.

5.3 Camp Brighton Woods

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-81-0016	1151004

5.3.1 Location and Well Description

Address: 120 Brighton Dam Road, Brookeville, MD 20833

The well for Camp Brighton Woods is located amidst a forested region near the eastern border of Montgomery County. As shown in Figure 4, trees largely cover the region within the wellhead protection area. Land use is characterized as deciduous forest, with an area of low density residential housing to the west and south of the well. Very little of the area of interest contains impervious surfaces. According to the sanitary survey report the well is drilled to a depth of approximately 240 feet below grade with 91 feet of 6-inch diameter steel casing, with a grout depth of 30 feet. The well’s yield is reported to be 10 gpm with an average daily use is approximately 1000 gallons. No treatment system is used for this well. The well is mapped as drilled into the Wissahickon Lower Pelitic Schist (medium- to coarse-grained biotite-oligoclase-muscovite-quartz schist).

5.3.2 Potential Sources of Contamination

The primary potential sources of contamination are found on the property itself. As shown in Figure 4, a septic tank is located 200 feet to the northeast and an above ground storage tank for fuel oil resides approximately 150 feet to the north-northeast. No public sewerage is locally available and the several single-family residences to the west almost certainly use on-site septic systems.

5.3.3 Discussion and Recommendations

Water quality data for this well are available from May 1996 to October 2004. No bacterial contamination has been detected during this time. Nitrate levels have been consistently low or undetectable. The fuel oil AST did not show any signs of decay and

therefore poses little risk of impacting water quality. Provided the AST and septic system on site are maintained, there is little reason to suspect these may impact the well's water quality. Barring changes in land use, no additional sampling or protective measure except those currently mandated by the state are recommended. The well is at a low susceptibility to contamination due to surrounding land use, adequate well construction, and good water quality.

5.4 Camp Friendship

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	Unknown	1151066

5.4.1 Location and Well Description

Address: 4019 Damascus Road, Gaithersburg, MD 20760

Camp Friendship is located in a largely agricultural area as shown in Figure 5. A large patch of deciduous forest occupies the northern and western portions of the wellhead protection area. With the exception of a small pond in the south, the balance of the land is used for crops. Little of the land within the wellhead protection area is paved. There is no well construction data available for the well except that the well has a 6-inch diameter steel casing and is treated with a chlorination system. The well is located very near to mapped contact of the Wissahickon Upper Pelitic Schist (albite-chlorite- muscovite-quartz schist) and Wissahickon Boulder Gneiss (garnet-oligoclase-mica-quartz gneiss).

5.4.2 Potential Sources of Contamination

The agricultural areas surrounding the wellhead have the potential to influence water quality of the well through the misuse or over-application of fertilizers, herbicides, and pesticides. A septic tank is located approximately 400 feet to the northeast of the well while a small pond is located approximately 650 feet to the south of the well.

5.4.3 Discussion and Recommendation

No bacterial contamination was detected during the period for which data are available, March 1996 through May 2003. Nitrate levels have been consistent during this time as well with average values of 3.4 mg/L. Nitrite was detected at 0.002 mg/L in 1996 and at

0.005 mg/L in 1997, but no data on nitrite was collected since that time. The Maryland State standard for nitrate is 10 mg/L and nitrite is 1 mg/L.

Based on the results of the water quality analysis, the potential sources of contamination listed above do not appear to have an effect on the water quality at the well and its susceptibility is considered to be low. The Camp owns some of the agricultural land within the wellhead protection area. Provided that responsible use of agricultural chemicals continues here, there would appear to be little cause for concern. However, a baseline analysis for herbicides and pesticides would be needed to quantitatively prove that assertion. The septic system is located almost 400 feet downgradient from the wellhead and therefore does not appear to be of great concern. Aside from the current sampling schedule, no other sampling is recommended.

5.5 Camp Waredaca

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-93-0545	1151005

5.5.1 Location and Description

Address: 4015 Damascus Road, Gaithersburg, MD 20882

The Camp Waredaca well is located among a predominantly agricultural area of Montgomery County (Figure 6). The land surrounding the well within a 1000-foot radius is almost entirely classified as cropland, with a section of pasture to the west and a small pond to the north. The pond to the north is separate from the small pond that occupies the wellhead protection area surrounding the nearby Camp Friendship Well. Well construction details and a sanitary survey report are not available for this well. The well is located very near the mapped contact of the Wissahickon Upper Pelitic Schist (albite-chlorite- muscovite-quartz schist) and Wissahickon Boulder Gneiss (garnet-oligoclase-mica-quartz gneiss).

5.5.2 Potential Sources of Contamination

Two septic tanks are located within 175 feet to the north-northwest of the wellhead. The agricultural activities occurring near the well also have the potential to influence shallow

groundwater quality. Approximately 90 horses are stabled on the property and are part of the camp’s daily activities.

5.5.3 Discussion and Recommendations

Water quality data for Camp Waredaca are available from May 1996 through November 2004. Three detections of total coliform were noted in the Camp’s well, once in March 2002 and twice in July 2002. No magnitudes were associated with those detections. Nitrate levels in the water are problematic. Since 1996, the average nitrate level for the period of record is 9.5 mg/L and detections have exceeded the 10 mg/L maximum contaminant level six times. For a more detailed explanation of nitrate risks and treatment options, please see Section 4.1 General Assessment of Risks Faced by Transient, Non-Community Water Supply Systems.

The nearby Camp Friendship’s low levels of nitrate in the water suggest that the nitrate concentrations in the Camp Waredaca well are localized and are not indicative of regional groundwater quality. The presence of approximately 90 horses, the nearby septic system, and the agricultural land use patterns that dominate the area within the wellhead protection area are all probable sources. A review of the manure/nutrient management practices at the farm would be valuable to determine if significant volumes of manure are stored near the well. If so, the material should be transferred to an appropriate manure storage facility away from the well. The septic system should also be checked to see that it is operating properly. Fertilizer usage patterns and persistent areas of standing water near the well should also be investigated.

The Camp Waredaca well has a high susceptibility to contamination as indicated by high nitrate levels, and the lack of well information. Assuming that the source of the nitrate can be identified and remedied, any expected decrease in nitrate concentrations would be gradual. If the source of nitrate cannot be identified, some other measure such as drilling a new well or installing a treatment should be considered.

5.6 Comus Inn

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
South Well	MO-92-0482	1151008
North Well	MO-88-1199	none

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
East Well	MO-88-2039	none
Central Well	MO-73-3592	none
Abandoned Well	unknown	none

5.6.1 Location and Description

Address: 23900 Old Hundred Road, Comus, MD 20842

The Comus Inn has four wells that can now supply water to the facility. The Inn was closed for a time, sold, and recently reopened. When VIEW Engineering personnel spoke with the new owner in June of 2004, he indicated that several of the wells on the property were refurbished and new piping was installed to convey water to the Inn. The wells can be seen in Figure 7. As of March 2004, only one of the wells was assigned a Public Water System Identification Number by the MDE. Based on discussions with the owner, the South Well was the only one that was used for supplying water to the Inn in the past. It should also be noted that the well designations in the table above are not official MDE titles, but were assigned by VIEW Engineering for the sake of clarity. Well construction information is shown in Table 6 below and the well water is treated using hypochlorination. The geology of the area is mapped as the Ijamsville Formation-Marburg Schist (blue, green, or purple phyllite and phyllitic slate, with interbedded metasiltstone and metagraywacke; and bluish-gray to silvery-green, fine-grained, muscovite-chlorite-albite-quartz schist with interbedded quartzites).

Table 6 Comus Inn Well Construction Specifications

Well Description	South Well	North Well	East Well	Central Well
County Well ID	MO-92-0482	MO-88-1199	MO-88-2039	MO-73-3592
Completion Date	3/25/1993	7/25/1985	8/14/1991	1/13/1983
Well Diameter (in)	6	6	6	6
Depth of Well (ft)	525	325	200	230
Grout Depth (ft)	43	47	32	50
Casing Depth (ft)	45	48	40	65
Casing Diameter (in)	6	6	6	6
Casing Material	Steel	Steel	Steel	Steel

The Comus Inn is primarily surrounded by agricultural and forested land. However, a strip of low-density residential area extends for approximately 1600 feet from the northeast to just south of the Inn. An additional patch of low-density residential land occupies approximately 2 acres of the southwestern edge of the wellhead protection area zones around the wells. With the exception of a strip of mixed forest adjoining the residential zone to the northeast the balance of the land use surrounding the Inn is either cropland or pasture.

5.6.2 Potential Sources of Contamination

A septic tank sits approximately 100 feet to the west of the South Well. A nearby resident indicated that, in the past, this septic system did not function properly, however this claim cannot be verified. The ground around the septic holding tank was recently disturbed and the openings to the tank appeared to be newly constructed. Several other renovations were also in progress at the time of VIEW Engineering's site visit. A neighboring residence has an above ground fuel oil storage tank located approximately 130 feet to the southeast of the South well. The agricultural land use surrounding the Inn also has the potential to serve as a non-point source of contamination.

5.6.3 Discussion and Recommendations

Water quality data for the Inn are available from July 1996 through November 2004. During that period, total coliform was detected in four samples. The first total coliform detection was noted in July 1996, but no magnitude is associated with that detection. This was followed by a detection of 144 colonies/100 mL on November 2, 2000 and on October 14, 2004, total coliform was detected at 1 colony/100 mL. Three samples were collected on October 28, 2004. Two samples tested positive for total coliform at 2 colonies/100 mL and 201 colonies/100 mL while one sample was free of bacterial contamination. Neither fecal coliform nor E. Coli was detected during the period for which data are available. Four nitrate results are available for this period. Nitrate levels varied between 3.6 and 2.5 mg/L. Only one nitrite sample for the Comus Inn was analyzed on April 29, 1997 at a level of 0.005 mg/L. Both nitrate and nitrite results are well below the Maryland standards for these compounds.

The Comus Inn wells have a moderate susceptibility to contamination. Nitrate levels in the well are steady and the lack of densely populated areas nearby serve to preserve

source water quality. The coliform detections, nearby septic tanks, and agricultural land represent potential concerns. The multiple pumping wells also have the potential to create an expanded cone of depression that could draw in additional contaminants from within the wellhead protection area. At present, no further action is recommended beyond the current sampling program.

5.7 Darnestown Swim and Racquet Club

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-73-1022	1151009

5.7.1 Location and Well Description

Address: 15004 Spring Meadows Drive, Germantown, MD 20874

The Darnestown Swim and Racquet Club well is located in the southwestern portion of Montgomery County as shown in Figure 8. The predominant land use pattern surrounding the well is low-density residential, which occupies almost the entire western half of the wellhead protection area. To the east is a sinuous strip of deciduous forest that becomes wider as you go southward. To the northwest, a small area of cropland is present. According to the sanitary survey the well is drilled to a depth of 325 feet with 62 feet of 6-inch diameter steel casing fully grouted. The reported average daily demand is 10,000 gallons per day on a seasonal basis and no treatment system is in use. The well is mapped as being located in the Wissahickon Metagreywacke (interbedded chlorite-muscovite metagraywacke and fine-grained chlorite-muscovite schist).

5.7.2 Potential Sources of Contamination

A septic system is in use on site, however the location of the holding tank is not precisely known. Since no sewer service is available, the other residences within the wellhead protection areas almost certainly use on-lot septic systems. The locations and definite existences of those tanks are not known either. The small patch of cropland within the wellhead protection area also holds the potential for agricultural impact on the shallow groundwater. However, at its closest approach to the well, the cropland is over 800 feet to the northwest.

5.7.3 Discussion and Recommendations

Water quality data for the Darnestown Swim and Racquet Club are available from June 1996 to April 2004. The club’s well water has tested positive for total coliform 9 times during 6 separate sampling events (July 1998, May 1999, July 2002, August 2002, May 2003 and June 2003) during this period, with some detections at 200 colonies/100 mL or greater. Nitrate levels varied between 1.8 and 6.9 mg/L from mid-1996 to mid-2003. Detections of nitrate showed a marked increase in 2002 and 2003, although only two nitrate samples are available for this time period. While the detections of nitrate are still below the state standard of 10 mg/L, they now exceed 50% of the MCL.

The susceptibility of this well to contamination is high due to frequent total coliform detections and nitrate water quality results and unknown location of the septic tank. Locating the septic system and ensuring that it is operating properly is highly recommended. An inspection of the piping, pressure tank, and well should also be conducted to determine if there are any routes by which the water may become contaminated.

If the septic system is functioning as designed, it might still be impacting the well water quality. If that is the case, drilling a new well in another location or installing a treatment system should be considered.

5.8 Dayspring Church

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Wellspring Well	MO-73-0526	1151010
Jacob’s Well	MO-88-0318	1151082

5.8.1 Location and Well Description

Address: 11411 Neelsville Church Road, Germantown, MD 20876

As shown in Figure 9, the Dayspring Church has two wells, designated by the MDE as the Wellspring Well and Jacob’s well. The Church property is located among a deciduous forest and is flanked on the west and south by medium-density residential developments. Also to the south is a section of land described as pasture. The Wellspring Well is drilled to a depth of 85 feet with 22 feet of 6-inch diameter steel casing

fully grouted with a reported yield of 6 gpm and treated with pH neutralization. The average daily demand for the well is 1000 gallons.

Jacob's Well is drilled to a depth of 400 feet with 21 feet of 6-inch diameter steel casing grouted to a depth of 18 feet. The reported well yield is 4 gpm with an average daily demand of 500 gallons. Jacob's Well is also treated with a pH neutralization system. The geology of the area is mapped as the Ijamsville Formation - Marburg Schist (blue, green, or purple phyllite and phyllitic slate, with interbedded metasiltstone and metagraywacke; and bluish-gray to silvery-green, fine-grained, muscovite-chlorite-albite-quartz schist with interbedded quartzites).

5.8.2 Potential Sources of Contamination

Both the Wellspring and Jacob's wells are located near septic tanks. The septic tank near the Wellspring Well is approximately 180 feet to the east of the wellhead. The septic tank near Jacob's Well is approximately 75 feet to the southeast of that well. The development to the west of the Church is served by a municipal sewer system. However, as with any developed area, the possibility of groundwater degradation due to human influence increases with increasing population densities. The pastureland near the Wellspring Well also presents the possibility of agricultural influence on the shallow groundwater.

5.8.3 Discussion and Recommendations

Water quality data for Jacob's Well are available from June 2002 through October 2004 and for the Wellspring Well from August 1996 to December 2004. Water quality in both wells is generally good. As shown in Table 7 nitrate and nitrite levels vary between low detections to below detectable limits. Total coliform was detected in October 1999 at 42 colonies per 100 mL and December of 1999 at 5 colonies per 100 mL in the Wellspring well. Neither well has tested positive for any bacterial contamination since then.

Table 7 Nitrate Results in mg/L for the Dayspring Church Wells

Sample Date	Jacob's Well	Wellspring Well
8/1/1996	no data	2.5
6/19/1997	no data	3.3
11/17/1998	no data	2.2
12/8/1998	no data	<0.2
8/24/1999	no data	1.6

Sample Date	Jacob's Well	Wellspring Well
11/1/2000	no data	2.5
11/27/2000	no data	0.2
1/10/2002	no data	2.1
6/11/2002	<0.5	<0.5
12/19/2002	<0.2	<0.2
12/24/2002	<0.2	0.2
3/5/2003	<0.5	<0.5
12/8/2004	no data	0.2

The susceptibility for both of these wells is moderate given the proximity of the nearby septic tanks and the residential development to the west. However, the well is not under immediate development pressure and deciduous forest provides a significant buffer for the wellhead protection area around both wells. If water quality remains good for these wells then no additional action or sampling outside of the currently mandated program is recommended for these wells.

5.9 Dickerson Market

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	Unknown	1151011

5.9.1 Location and Well Description

Address: 22145 Dickerson Road, Dickerson, MD 20842

The Dickerson Market and its associated wellhead protection area are shown in Figure 10. The well for the Market is hidden from view behind a wooden fence on the adjacent southern property. Land use surrounding the well is largely low-density residential. To the north of the well, a swath of industrial and commercial land stretches from east to west within the wellhead protection area zone. The well is reported to have a chlorinator and carbon filter however no well construction information exists except that the well is constructed with a 6-inch diameter steel casing. The store uses ultraviolet treatment, but the residence supplied by the same well does not. The well is mapped as being located in the New Oxford Formation (red, maroon, and gray sandstone, siltstone and shale).

5.9.2 Potential Sources of Contamination

The Dickerson Market dispenses gasoline and diesel fuel for automobiles. The three underground storage tanks that store the fuel are located approximately 100 feet to the north of the well. According to the property owner, a residence across the street had a leaky fuel oil underground tank. However, this assertion is not supported by data supplied by the MDE. The septic tank for the store and the adjacent residence are both within 100 feet of the well. No municipal sewerage is locally available and the market is surrounded by single-family homes that utilize on-lot septic systems.

5.9.3 Discussion and Recommendations

Water quality data for the Dickerson Market are available from April 1996 through December 2004. During this time, two instances of bacterial contamination were noted. In January of 2000, total coliform was detected at 1 colony per 100 mL. On November 9, 2004, total coliform was detected at 2 colonies/100 mL. Coliform was not detected from samples collected 7 days later on November 16, 2004. A likely hypothesis for the November 9th bacterial detections was external contamination that was not indicative of source water quality.

Nitrate detections in the water have been consistently between 4.6 and 6.4 mg/L indicating nitrate levels at greater than 50% of Maryland's maximum contaminant level of 10 mg/L. The nutrient enrichment of the water may indicate septic influences around the well. While nitrogen levels are high, they do not presently pose a danger to human health. However, both septic systems should be checked for proper functioning. If there are any problems with tank integrity they will need to be repaired. However, a properly functioning septic system can still degrade groundwater quality. If nitrogen levels begin to rise further, additional treatment will be required, or a new well may need to be drilled.

Another concern regarding this well is its proximity to the underground fuel tanks and the adjacent gas stations. Leaks from the tanks or fuel spills at the surface pose a risk for shallow groundwater contamination. No VOC analytical data were available at the time of this assessment. In addition to the current state sampling program, sampling the water for volatile organic compounds is recommended to determine if routine VOC sampling is warranted. The Dickerson Market Well is highly susceptible to contamination

due to increasing nitrate levels, nearby septic system, and nearby underground storage tanks.

5.10 Etchison Country Store

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	Unknown	1151036

5.10.1 Location and Well Description

Address: 7000 Damascus Road., Gaithersburg, MD 20882

The Etchison Country Store and its corresponding wellhead protection area are shown in Figure 11. The store is bordered on the northwest and south by individual residences and light commercial facilities. The dominant land use pattern within a 1000-foot radius of the wellhead is cropland that surrounds the well on the east, north, and west. To the south is an area of low-density residential housing. The roads running by the store, the store's parking lot, and the facility to the east compose the majority of the impervious surface area within the wellhead protection area. The Etchison County Store Well construction details are not known except that the well consists of a 6-inch diameter steel casing. The average daily demand of this well is not known and is treated with a carbon and sediment filter, ion exchange, and pH neutralizer. The well is mapped as drilled into the Upper Pelitic Schist of the Wissahickon formation (albite-chlorite-muscovite-quartz schist with sporadic thin beds of laminated micaceous quartzite).

5.10.2 Potential Sources of Contamination

According to MDE sanitary survey reports, two septic holding tanks are located approximately 60 and 90 feet south-southwest of the well. The lack of municipal sewer service also ensures that nearby residences also contain septic tanks. Data provided by MDE indicate that an underground storage tank for gasoline was present at the store, however, it is now permanently out of service. The well is surrounded on three sides by cropland that has the potential to act as a non-point source of agricultural runoff.

5.10.3 Discussion and Recommendations

Water quality results for this well are available from December 1999 to October 2004. Except for total coliform detections in July 2002 and October 2003, the Etchison Country Store well has been free of bacterial contamination.

Nitrate levels in the water varied from 8.7 to 10.4 mg/L from December 1999 to December 2000. These levels were near or above the Maryland Maximum Contaminant Level of 10 mg/L. The next available nitrate detection was measured in December of 2001 at a level of at 0.9 mg/L. Since December 2001 nitrate levels varied between 0.9 and 1.4 mg/L. The explanation for this change is provided by the sanitary survey report for the store that indicates the use of a nitrogen treatment system.

This well is judged to be moderately to highly susceptible due to the nearby septic holding tanks, high pre-filtration nitrate levels, and a lack of information on the well’s construction. The nitrate results indicate a possible septic influence. These systems should be inspected to ensure their integrity. Even if the septic systems are working properly, they may still influence the well water quality. No additional sampling outside of the current program is recommended. The nitrate filtration system should be carefully maintained.

5.11 Hyattstown Deli

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-88-1428	1151041

5.11.1 Location and Well Description

Address: 25901 Frederick Road, Clarksburg, MD 20871

The Hyattstown Deli, shown in Figure 12, is located in the northern section of Montgomery County. Land use patterns surrounding the well are largely low-density residential and commercial tracts. Deciduous forest wraps around the perimeter of the 1000-foot wellhead protection area, except for the north, which is classified as low-density residential. The Deli is located on a section of commercial land near the center of the wellhead protection area. The Hyattstown Deli Well is drilled to a depth of 380 feet with 82 feet of 6-inch diameter steel casing grouted to a depth of 81 feet. The average daily demand of this well is reported to be 800 gallons per day. The well is hidden in a

patch of trees on a hill approximately 100 feet to the north of the deli. A chlorinator exists, however was reported not to be working at the time of the sanitary survey inspection in June of 2003. The geology of the area is mapped near the contact between the Ijamsville Formation-Marburg Schist (blue, green, or purple phyllite and phyllitic slate, with interbedded metasiltstone and metagraywacke; and bluish-gray to silvery-green, fine-grained, muscovite-chlorite-albite-quartz schist with interbedded quartzites) and Urbana Formation (dark gray to green sericite-chlorite phyllite, metasiltstone, and quartzite).

5.11.2 Potential Sources of Contamination

No precisely located, discrete, point sources of pollution exist within the area of interest. MDE sanitary survey reports indicate that the Deli does not have a septic system, although none of the provided data indicate that sewerage is available either. Given the lack of a septic tank, a municipal sewer hookup is probable. However, some of the surrounding residences may use septic systems on their properties. Additionally, heavy automobile and truck traffic along the road near the well, pose the potential threat of spills or runoff of hazardous materials.

5.11.3 Discussion and Recommendations

Water quality analysis results are available from April 1996 through December 2004. Nitrate detections at the Hyattstown Deli have been consistently below state standards and varied between 3.1 and 3.8 mg/L during this time. Total coliform bacteria were detected in the well water starting in May 1998. In total, the Deli has tested positive for total coliform on 9 separate sampling events. Detections were noted through July 2003 culminating in a total coliform count of 130 colonies per 100mL in July 2003. From July 2003 to December 2004, no bacterial contamination has been encountered.

The bacterial contamination observed in the water has not persisted. Either the source of the contamination no longer exists, or a remedy was implemented to correct the problem (chlorinator may have been fixed). The source of the bacterial contamination is not clear. The contamination susceptibility for this well is moderate given the past detection of coliform and lack of well construction information. No additional sampling is recommended beyond the currently implemented program. However bacteriological

results should be closely watched in the future and the chlorination system should be properly maintained.

5.12 Laytonsville Golf Club

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-92-0554	1151046
Secondary Well	MO-73-0180	none

5.12.1 Location and Well Description

Address: 7130 Dorsey Road, Laytonsville, MD 20882

As shown in Figure 13, the Laytonsville Golf Course has two wells on its property, only one of which is currently used to supply water to the facility. The land use patterns surrounding the well are dominated by the golf course to the south and low-density residential land to the north. A wedge of cropland extends from the middle of the wellhead protection area out to the west. The Laytonsville Golf Club Well is drilled to a depth of 400 feet with 120 feet of 6-inch diameter steel casing grouted to a depth of 60 feet. The average daily demand for this well is reported to be 500 to 2000 gallons per day and no treatment system is in use. The well is mapped as drilled into the Upper Pelitic Schist of the Wissahickon formation (albite-chlorite- muscovite-quartz schist with sporadic thin beds of laminated micaceous quartzite).

5.12.2 Potential Sources of Contamination

A septic system is used on-site, however VIEW Engineering personnel were unable to locate it during the site visit. According to MDE sanitary survey reports, the holding tank is located approximately 600 to 700 feet to the east of the primary well. Additional septic systems are probably in use at several residences to the north. The golf course's use of chemicals on its turf grass also poses a potential hazard to water quality. The cropland near the primary well also has the potential to introduce agricultural contaminants into the water.

5.12.3 Discussion and Recommendations

Water quality data are available from April 1996 through October 2004. A review of water quality records at the golf course reveals several detections of total coliform

bacteria. Total coliform was detected on 12 separate occasions as shown in Table 8. Although not every sample was contaminated, and no detections have been noted from October 2003 through October 2004, the bacteriological results should be monitored closely. The sanitary survey report indicates that coliform detections may be the result of insect activity inside the well casing.

Table 8 Laytonsville Golf Club Water Quality Results Summary

Sample Date	Nitrate mg/l	Total Coliform colonies/100 ml
4/17/1996	no data	<1
12/18/1996	4.2	DET
1/22/1997	no data	DET
2/27/1997	11.1	no data
3/6/1997	no data	<1
3/11/1997	no data	<1
4/3/1997	5.3	<1
10/8/1997	no data	<1
4/21/1998	4.4	DET
5/12/1998	no data	29
6/25/1998	no data	109.1
7/14/1998	no data	3
9/17/1998	no data	1
10/1/1998	no data	<1
5/19/1999	4.5	<1
1/24/2000	5.1	<1
6/12/2001	5.8	2
7/12/2001	5.9	<1
1/3/2002	5.3	2
1/18/2002	7.6	no data
1/28/2002	no data	3
2/13/2002	no data	2
4/4/2002	no data	<1
11/21/2002	4.8	no data
2/4/2003	4.4	<1
6/10/2003	no data	<1
9/16/2003	no data	<1
10/30/2003	5.3	10
12/1/2003	no data	<1
2/19/2004	5	<1
5/20/2004	no data	<1
10/21/2004	7.2	no data

The golf course nitrate results have been consistently detected at elevated levels. With one exception in February 1997, nitrate levels have been beneath state standards. However, From February 1997 through October 2004, the average nitrate concentration in the water was 5.4 mg/L, which is greater than 50% of the nitrate MCL and suggests that land use is affecting water quality.

The contamination susceptibility for this well is high given the past detection of coliform and continued above-average nitrate concentrations. A review of the nutrient management practices at the course should be undertaken, and a water sample should be analyzed for pesticides and herbicides to determine if other chemicals used at the course are influencing water. The site’s septic system and water conveyance infrastructure should be thoroughly inspected to determine if any potential contamination pathways exist. If nutrient management practices are found to be sufficient, the septic system and water delivery system are in good working order, and no other golf-course related chemicals are detected, then treatment for nitrogen and bacteria should be installed, or the well should be relocated. The additional well on-site could also serve as a potential alternate water supply.

5.13 Little Bennett Golf Course

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Clubhouse	Unknown	1151065
Driving Range	MO-93-310	1151083
Hillside	MO-92-017	none

5.13.1 Location and Well Description

Address: 26001 Prescott Road, Clarksburg, MD 20871

VIEW Engineering personnel located three wells while visiting the Little Bennett Golf course. Their positions are shown in Figure 14. At present, only two of the wells are part of the MDE’s transient, non-community water supply program. The third, designated by VIEW Engineering as the Hillside Well, may supply the maintenance shed facility in the southern portion of the golf course, however it was not possible to verify this. The intersecting 1000-foot wellhead protection areas around each well fall almost entirely within the extent of the golf course. Patches of deciduous forest are present in the south

and one of the ponds at the golf course occupies approximately 6 acres in the northern portion of the wellhead protection area. The Little Bennett Golf Club Well is drilled to a depth of 400 feet with 120 feet of 6-inch diameter steel casing grouted to a depth of 60 feet. The average daily demand is reported to be 4000 gallons per day per well for the Clubhouse and Driving Range. The Clubhouse well uses an ion-exchange treatment system and the Driving Range well is untreated. The well is mapped as drilled into the Upper Pelitic Schist of the Wissahickon formation (albite-chlorite- muscovite-quartz schist with sporadic thin beds of laminated micaceous quartzite).

5.13.2 Potential Sources of Contamination

The major potential contamination concern for these wells is the application of chemicals to the golf course’s turf grass. A septic system also exists for both the Clubhouse and the Driving Range building, but the locations of the holding tanks are not precisely known. The large golf course pond also presents the possibility of surface water influence on the wells. The course has two fueling areas for vehicles that contain above ground storage tanks for gasoline.

5.13.3 Discussion and Recommendations

Water quality data for the Clubhouse are available from August 1996 to December 2004. Total coliform were detected on four occasions from April 1997 through July 2002. Nitrate levels at the Clubhouse varied from below detectable limits to 1.5 mg/L. Since 2000, nitrate has been detected above detectable limits three times. Nitrite was detected at 0.2 mg/L in June of 1999 and has been below detectable limits since that time.

Water quality data for the Driving Range are available from July 2002 to October 2004. Total coliform was detected three times during this period, once in July 2002 and twice in July 2003. Nitrate for the Driving Range well has been measured twice, in 2002 at 1.7 mg/L and in 2003 at 1.8 mg/L. These levels are also well below the state standard of 10 mg/L.

The Clubhouse well is judged to be at a low risk of susceptibility and the Driving Range well is judged to be at low to moderate susceptibility of contamination. The low nitrate levels in the groundwater point to appropriate use of fertilizers on the golf course. The coliform detections at the Driving Range in 2003 have not been repeated and do not seem to indicate a persistent problem at present, however bacterial results should be

scrutinized closely in the future. Care should be taken when fueling vehicles on the course to avoid spillage. The above ground tanks are well maintained, and barring a major spill or accident, it is unlikely that the ASTs pose a serious threat to the water quality. No additional sampling or action is recommended outside of presently implemented measures.

5.14 Montgomery Country Club

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	Unknown	1151019
Secondary Well (unused)	Unknown	none

5.14.1 Location and Well Description

Address: Laytonsville Road, Gaithersburg, MD 20882

Shown in Figure 15, the Country Club has two wells, one of which is not currently in use. Land use patterns around the primary well include the golf course itself in the eastern half of the wellhead protection area, low-density residential housing, and cropland. While it is not shown in the 1998 aerial photo, the area to the west of the well was undergoing development for single-family homes at the time of the GPS survey in June 2004. Cropland occupies a large section of the southern wellhead protection area. Details about the primary well’s construction are not known, however average daily demand is reported to be 5000 gallons per day. A chlorination system is used for disinfection at the primary well. No details are available for the secondary well, nor is it currently used by the golf course. Both wells are mapped as drilled into the Upper Pelitic Schist of the Wissahickon formation (albite-chlorite- muscovite-quartz schist with sporadic thin beds of laminated micaceous quartzite).

5.14.2 Potential Sources of Contamination

Septic systems for the golf course and in the surrounding residences represent a potential threat to the shallow groundwater quality. The country club’s septic holding tank is approximately 450 feet to the northeast of the primary well. The closest residential septic tank is approximately 250 to the west of the primary well. Agricultural chemicals and fertilizers used on the golf course or surrounding cropland, if applied in excess, may also pose a risk to water quality.

5.14.3 Discussion and Recommendations

Water quality data are available from June 1996 to October 2004. The water quality at the Country Club has been consistently good. Nitrate levels have consistently been measured between 2.5 to 2.8 mg/L. No exceedances of the 10 mg/L nitrate standard have been recorded since June of 1996, nor has bacterial contamination been observed through October 2004. It should be noted that the absence of bacterial in the water samples may be a result of the treatment system and may not be indicative of source water quality. The nitrate levels in the water suggest that the golf course’s nutrient management practices are appropriate and effective. The recent construction activities and changing land use patterns provide the potential for future degraded water quality. However, neither nitrogen levels nor bacteriological results have changed in the recent well water analyses. This well is considered to be at a low susceptibility to contamination. No further sampling outside of the state mandated program is recommended at this time.

5.15 National Capital Skeet and Trap Club

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	Unknown	1151020

5.15.1 Location and Well Description

Address: 16700 Riffle Ford Road, Gaithersburg, MD 20878

The well for the National Capital Skeet and Trap Club is shown in Figure 16. Characterized as open urban land, the Skeet Club property takes up approximately 25 acres within the center of the 1000-foot radius wellhead protection area. The Skeet Club is almost entirely surrounded by deciduous forest. To the west, a 1.75 acre sliver of land characterized as pasture fills in the remaining portion of the wellhead protection area. The well for the facility is located within a concrete vault below the ground surface and the entrance to the vault is covered with a lightweight metal door. VIEW Engineering was not able to obtain information regarding construction details of the well, nor is a sanitary survey report available. The well for the site is mapped as drilled into the Upper Pelitic Schist of the Wissahickon formation (albite-chlorite-muscovite-quartz schist with sporadic thin beds of laminated micaceous quartzite).

5.15.2 Potential Sources of Contamination

Land use patterns surrounding the facility are free of extensive human influence. The pasture to the west is, at its closest point, approximately 900 feet from the well. The club’s land usage may be the primary potential source of contamination. Lead from discharged ammunition may accumulate on the ground nearby the well and, with the help of precipitation, dissolve into the groundwater over time.

5.15.3 Discussion and Recommendations

Water quality data are available starting in October 1996 and continuing through October 2004. During that time, no bacterial contamination has been detected in the well water. Nitrate levels have been consistently detected between 2.1 and 3.9 mg/L, with an average detection of 3.1 mg/L. These values are below the standard of 10 mg/L. Nitrite was below detectable limits when an analysis was performed in 2002.

The high water quality at the Club, coupled with the lack of intensive land use patterns pose a low risk to this transient non-community public water supply system. The discharge of firearms near the well and the associated metals associated with this activity has the potential to increase metals and metal salts levels in the shallow groundwater. To ensure that this is not occurring, analyzing one water sample for metals is recommended. However, no regular additional sampling beyond the currently implemented schedule is recommended.

5.16 New Hope Presbyterian Church

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-94-0542	1151075

5.16.1 Location and Well Description

Address: 17930 Bowie Mill Road, Rockville, MD 20855

The position of the well at the New Hope Presbyterian Church is shown in Figure 17. The aerial photograph used as the basemap for the figure was taken in 1998 and predates the construction of the church. However, the positions of the well and septic tanks are accurate. Land use around the well is classified as low-density residential to the south and west, with deciduous forest to the north and east. Rock Creek winds its

way along the eastern portion of the wellhead protection area. The well is approximately 500 feet deep, with a 6-inch diameter steel casing, cased to 98 feet below the ground surface, and has a grout seal that extends to 70 feet. The well's average daily demand is listed at 500 gallons per day, and no treatment system is currently in place. The well for this site is drilled in the Wissahickon Boulder Gneiss (thickly-bedded to massive, pebble- and boulder-bearing, arenaceous to pelitic metamorphic rock, typically a medium-grained, garnet-oligoclase-mica-quartz gneiss).

5.16.2 Potential Sources of Contamination

Two or more septic tanks are located approximately 275 feet away from the wellhead. Municipal sewerage is available nearby, but the area around the church is not shown to be connected. The nearby residences can be assumed use septic systems, but their positions are not precisely known. The proximity of Rock Creek provides low potential for surface water influences on the well since the creek's closest approach to the well is at almost 700 feet to the northeast.

5.16.3 Discussion and Recommendations

Water quality data are available from November 2000 to February 2005. No bacterial contamination has been detected as of June 2004. Nitrate levels have consistently been between 4.0 and 4.9 mg/L. These values are close to half of the state standard of 10 mg/L. The lack of intensive land use and the absence of bacterial contamination do not seem to indicate that the nitrate detections are problematic. The septic tanks are downgradient, if only slightly, from the well. The consistency seen in the nitrate data suggests while there may be some nutrient enrichment to groundwater from the septic system, the levels are in equilibrium. At present, no additional sampling outside of the currently implemented schedule is recommended. This well is considered to be at a low to moderate susceptibility to contamination due to the nitrate levels approaching 50% of the maximum contaminant level.

5.17 Old Angler’s Inn

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-73-0502	1151057

5.17.1 Location and Well Description

Address: 10801 Macarthur Blvd, Potomac, MD 20854

The Old Angler’s Inn is located at the southwestern edge of Montgomery County, near the banks of the Potomac River and is shown in Figure 18. The northeastern third of the wellhead protection area is characterized as medium density residential housing. The rest of the wellhead protection area is deciduous forest. The Potomac River occupies approximately one acre of the southwestern edge of the wellhead protection area. Well construction details are not available, however the well was drilled prior to 1970 and has a 6-inch diameter steel casing. The well is located in a concrete vault covered with a wooden door. A chlorination system is in use for disinfection purposes. The well for the site is mapped as drilled into the Upper Pelitic Schist of the Wissahickon formation (albite-chlorite- muscovite-quartz schist with sporadic thin beds of laminated micaceous quartzite).

5.17.2 Potential Sources of Contamination

Both the Inn and the surrounding residences all have municipal sewer service. The medium density housing upgradient from the Inn is not a point source of pollution. However, the more intensive land use in that area does pose a difficult-to-define risk to the groundwater quality. The Potomac River is over 875 feet away from the well and groundwater is likely flowing south/southwest toward the river.

5.17.3 Discussion and Recommendations

No bacteriological contamination was detected in the well water from November 1996 to November 2004, the period for which data are available. Nitrate levels are below the Maryland standard of 10 mg/L and have been consistently detected at between 1.2 and 2.4 mg/L. Nitrite has not been detected in the water.

The land use patterns around the well (approximately 60% forest and 40% residential) coupled with the historically high water quality suggest that this transient water supply is

at a low susceptibility to contamination. Unless a spill occurs along the road or in the residences near the well, no additional sampling is recommended outside of the currently implemented program.

5.18 Owens Park

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-73-0502	1151057

5.18.1 Location and Well Description

Address: 19900 Beallsville Road, Beallsville, MD 20839

The Owens Park Recreation Center well shown in Figure 19 is located near the edge of the paved driveway leading up to the center. The well has approximately two feet of 6 inch diameter protective casing sticking up above the ground surface and is surrounded by a manicured grass lawn. There is no county tag on the well.

Land use immediately surrounding the well and stretching to the southwest along the road is defined as low density residential. The northern half of the 1000-foot wellhead protection area around the wellhead is composed of deciduous forest and open urban land. However, as shown in Figure 19, there is no clear delineation between the forest and the open urban land. Two small sections of animal pasture are found in the southwest corner and a strip of cropland fills out the eastern border of the wellhead protection area. A pond covering about $\frac{3}{4}$ of an acre is located approximately 500 feet east of the well. The well, drilled in 1974, is 160 feet deep, cased to 21 feet, and grouted to 20 feet below the ground surface. Average daily demand is approximately 800 gallons and a sediment filter is used for treatment. The geology of the area is mapped as the Ijamsville Formation - Marburg Schist (blue, green, or purple phyllite and phyllitic slate, with interbedded metasiltstone and metagraywacke; and bluish-gray to silvery-green, fine-grained, muscovite-chlorite-albite-quartz schist with interbedded quartzites).

5.18.2 Potential Sources of Contamination

The septic tank for the site is located approximately 125 feet west and slightly upgradient from the well. The pasture and cropland near the well are located at the outskirts of the 1000-foot wellhead protection area and make up a small percentage of the land within

the wellhead protection area. The well is in a highly visible location that is accessible to the public. There is a risk that the well could be damaged or tampered with due to the absence of a locking cap. The nearby pond also raises the possibility of introducing surface water influences to the aquifer.

5.18.3 Discussion and Recommendations

Water quality data are available from May 1996 to January 2004. The water chemistry data show levels of nitrate and nitrite that are well below (non-detect to 0.5 mg/L) the Maryland standard of 10 mg/L, with one exception in February of 2000 of 12.2 mg/L. The one exceedance of nitrate in February 2000 appears to be an outlier and was not consistent with data collected before or after. The Owens Park well has a history of eight total coliform detections from June 1999 to December 2003. In addition, E. Coli was detected in June of 2003, although no colony count was available.

The Owens Park well is highly susceptible to contamination. The well’s easily accessible and unprotected location coupled with its proximity to the site’s septic tank pose challenges to the maintenance of sanitary conditions. The E. Coli detection, while not repeated since June 2003, should be verified with future sampling to make certain no future detection occur. A thorough sanitary inspection should be conducted and additional treatment or relocation of the well should be considered if future detections occur.. No additional sampling is recommended, but future bacterial results should be monitored closely.

5.19 Poole’s General Store

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-94-3193	1151024

5.19.1 Location and Well Description

Address: 16315 Old River Road, Poolesville, MD 20837

A map showing Poole’s General Store and its associated wellhead protection area is shown in Figure 20. The well for the store is located in a manicured lawn within a small fenced area. The dominant land use pattern around the well is deciduous forest with a stream passing through the southern and eastern section of the wellhead protection

area. At its closest point, the eastern bank of the stream is within 350 feet of the wellhead. Two sections of cropland are present along the northwest and southwest. The Poole's General Store and accompanying structures are the only buildings found within the wellhead protection area. The well was completed on October 7, 2003, is 6" in diameter, 180 feet deep, grouted to a depth of 36 feet, and its 6 inch steel casing extends to a depth of 40 feet below the ground surface. A chlorination system is used for water treatment, but daily average demand is not known. The store and its well are located near the contact of the New Oxford Formation (red, maroon, and gray sandstone, siltstone and shale) and the Ijamsville Formation-Marburg Schist (blue, green, or purple phyllite and phyllitic slate, with interbedded metasiltstone and metagraywacke; and bluish-gray to silvery-green, fine-grained, muscovite-chlorite-albite-quartz schist with interbedded quartzites).

5.19.2 Potential Sources of Contamination

The septic tank for the property resides approximately 175 feet to the east and slightly north of the well, and was recently reconstructed by the property owner. Two above ground gasoline storage tanks are situated 230 feet to the east on a gravel driveway. According to data from the MDE, three underground gasoline storage tanks and one kerosene underground storage tank were located on the property. These tanks are no longer in use. The store is also listed as a pesticide dealer by MDE. The nearby stream has the potential to introduce surface water influences into portions of the shallow aquifer.

5.19.3 Discussion and Recommendations

Water quality data are available from April 1996 through October 2004. Numerous detections of coliform contamination have been recorded during this period, as shown in Table 9. Total coliform was detected on 7 separate occasions, most recently in July 2004. E. Coli was detected in May of 2003 and fecal coliform was detected in April 1998.

Table 9 Water Quality Results Summary for Poole's General Store

	Total Coliform	E. Coli	Fecal Coliform	Nitrate	Nitrite
Sample Date	colonies/100 mL			mg/L	
4/30/1996	<1	no data	<1	4	<0.002
12/10/1996	<1	no data	<1	no data	no data
8/7/1997	<1	no data	<1	no data	no data

	Total Coliform	E. Coli	Fecal Coliform	Nitrate	Nitrite
Sample Date	colonies/100 mL			mg/L	
8/12/1997	<1	no data	<1	6.6	no data
4/30/1998	4	no data	1	no data	no data
5/18/1998	1	no data	<1	no data	no data
9/29/1998	<1	no data	<1	6.1	no data
5/18/1999	<1	no data	<1	no data	no data
12/29/1999	<1	<1	<1	3.9	no data
12/4/2001	no data	no data	no data	6.4	no data
9/25/2002	<1	<1	<1	5.5	<0.2
1/2/2003	<1	<1	<1	no data	no data
1/8/2003	<1	<1	no data	no data	no data
1/15/2003	no data	no data	no data	4.6	no data
5/28/2003	DET	DET	<1	no data	no data
9/3/2003	DET	<1	<1	no data	no data
9/12/2003	DET	<1	<1	no data	no data
9/25/2003	DET	<1	<1	no data	no data
10/29/2003	<1	<1	<1	no data	no data
11/7/2003	<1	<1	<1	3.58	0.014
12/1/2003	no data	no data	no data	2.8	no data
3/31/2004	<1	<1	no data	3.66	no data
6/24/2004	<1	<1	no data	no data	no data
7/7/2004	DET	no data	no data	no data	no data
9/7/2004	no data	no data	no data	4	no data
10/17/2004	<1	<1	no data	no data	no data

Nitrate detections for the Poole's General Store have been below the Maryland maximum contaminant level (MCL) of 10 mg/L. However, prior to 2003, four detections exceeded 50% of the MCL. From 2003 forward, all detections have been between 2.8 and 4.6 mg/L, or less than 50% of the MCL. Nitrite was detected once in three samples at 0.014 mg/L and was well below the standard of 1 mg/L.

The chlorination system should be checked and regularly maintained. The repeated bacterial detections could be the result of the chlorination system breaking down or running out of sodium hypochlorite. Additionally the septic system and water conveyance system should be checked for proper functioning.

Pesticides are kept within protective structures and are unlikely to make their way into the subsurface. The underground storage tanks are no longer in use and do not pose a threat. The above ground storage tanks are clearly visible and well maintained. A leak from one of these tanks would be more easily detected than a leaky UST. The possibility

exists that small amounts of fuel could be spilled during refueling operations. The lack of impermeable surfaces near the tanks raises the possibility of infiltration of gasoline into the soil.

This system is considered to be highly susceptible to contamination. The nitrate levels, while currently acceptable, should be closely watched. The continuing bacterial detections should also be resolved. Implementation of a regular maintenance program for the disinfection system is highly recommended. If nitrate levels return to their previous levels, additional treatment or a drilling a new well are recommended. Sampling the well once for VOCs, pesticides, and herbicides in addition to the currently implemented program is also recommended.

5.20 Poolesville Public Golf Course

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-88-1947	1151023

5.20.1 Location and Well Description

Address: 16601 West Willard Road, Poolesville, MD 20837

Shown in Figure 21, the well for the Poolesville Public Golf Course is located in a grassy area hidden behind some evergreen shrubs. Land use within the 1000-foot wellhead protection area is dominated by the golf course to the south. The majority of the wellhead protection area is composed of cropland extending from the well to the northwest, although some of the area characterized as cropland is actually the golf course’s driving range. Two strips of deciduous forest are present along both the eastern and western boundaries of the wellhead protection area. The well is 425 feet deep, cased and grouted to 50 feet with a 6-inch diameter steel protective casing. The well, drilled in 1991, taps the New Oxford formation (red, maroon, and gray sandstone, siltstone and shale) and has a reported daily demand of between 200 and 2500 gallons per day.

5.20.2 Potential Sources of Contamination

There are no point sources of pollution within the wellhead protection area. However, the well is within a large area of cropland and is near the golf course. Over-application of

fertilizers or other agricultural chemicals is a possibility. A wastewater treatment plant handles wastewater on-site.

5.20.3 Discussion and Recommendations

Water quality data are available from October 1996 to June 2004. Bacterial contamination in the form of total coliform was detected during seven sampling events during this period: October 1996, November 2000 at 70 colonies/100 mL, twice during December 2002, and twice during June 2003. Only the November 2000 detection has a magnitude associated with it. Nitrate levels during this time varied from 2.2 to 3.8 mg/L.

The MDE has visited the golf course to discuss disinfection methods. However, a more permanent solution is recommended, such as water treatment. This well is considered to be moderately susceptible to contamination due to persistent coliform detections. No additional sampling is recommended beyond current practices, however bacterial results should be carefully scrutinized.

5.21 Potomac Oak Center

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Well I [12944 A-E]	MO-73-3181	1151042
Well II [12948 A-F]	MO-73-2911	1151064
Well III [12960- 12964]	MO-73-2910	1151013

5.21.1 Location and Well Description

Address: 12944 A-E Travilah Road, Potomac, MD 20854

Formerly called the Glenvilah Center, The Potomac Oak Center’s three wells are shown in Figure 22. These wells provide water to businesses that occupy the center’s three main buildings. The Center is defined as commercial land and sits amidst a low density residential area. A half-acre pond is present near the southwestern corner of the wellhead protection area and patch of deciduous forest fills in the remaining area to the east. Well construction details are shown in Table 10. The wells are drilled into the Upper Pelitic Schist of the Wissahickon formation (albite-chlorite- muscovite-quartz schist with sporadic thin beds of laminated micaceous quartzite).

Table 10 Potomac Oak Center Well Construction Details

Construction Details	Well Name		
	I [12944 A-E]	II [12948 A-F]	III [12960- 12964]
Average Reported Demand (gpd)	unknown	1200 - 3300	1000
Total Depth (ft bgs)	130	130	70
Casing Depth (ft bgs)	110	95	65
Grout Depth (ft bgs)	>50	50	>40
Installation Date	6/5/1981	7/15/1980	7/17/1980
Treatment	Ion Exchange, UV, Filter, pH	Reverse Osmosis, pH, Chlorination	UV, pH, Ion Exchange, Filter

5.21.2 Potential Sources of Contamination

The septic systems at the rear of the buildings and the surrounding residential septic systems pose the most probable threat to water quality in the wells. The wells are located near or within a parking area for the center and the caps are bolted closed, but unlocked. Damage from a vehicle, tampering with the well itself, and leaking automotive fluids are other potential risks for these wells.

5.21.3 Discussion and Recommendations

Well I tested positive for total coliform in June 1996, July 1997, and July 2003. Well II had a detection of total coliform of 3 colonies/100 mL in March of 1998 and Well III tested positive for total coliform in twice in February 1998 and once in March 2000. The coliform detections, with the exception of the July 2003 result at Well I, are all over 5 years old as of the writing of this report.

Table 11 Potomac Oak Center Nitrate Result Statistics in mg/L from January 1996 Through June 2002

Detection Summary	I	II	III
Average	7.2	3.2	2.9
Maximum	13.2	10.8	7.9
Minimum	1.1	<0.5	<0.3

As shown in Table 11, nitrate levels in all the wells were high, and Wells I and II exceeded the standard of 10 mg/L several times until June 2002. According to sanitary survey reports from the MDE, reverse osmosis treatment systems were subsequently installed. From June 2002 to March of 2004 nitrate levels varied between below detectable levels to 1.4 mg/L in all of the wells. This promising trend seems to be

dependant upon proper treatment system maintenance, however. In March of 2004, nitrate was detected at 6.8 mg/L in Well III, and in Well II nitrate was detected at 10 mg/L.

The elevated nitrate levels in the immediate vicinity of these wells indicate a possible septic influence. The site’s septic system should be inspected to ensure that it is functioning as designed. If the septic system is in working order, the treatment systems for the wells need to be maintained on a regular basis. A periodic, documented maintenance schedule should be implemented to ensure that water quality at the Potomac Oak Center remains high.

All of the wells at the Potomac Oak Center are judged to be highly susceptible to contamination due to the persistently elevated nitrate levels in the groundwater, the occasional total coliform detections, and the lack of physical security at each well. No additional sampling beyond that mandated by the state is recommended, however regular maintenance is needed for the site’s well water treatment systems. To prevent unauthorized access to the wells, the installation of locking caps and locks on each well is recommended.

5.22 Potomac Swim and Tennis Club

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Well I	Unknown	1151025

5.22.1 Location and Well Description

Address: 10531 Oaklyn Drive, Potomac, MD 20854

The Potomac Oak Swim and Tennis Club, shown in Figure 23, is surrounded almost entirely by residential land. Medium density residential tracts are located to the northeast and northwest. In the south of the 1000-foot wellhead protection area is a wedge of land characterized as institutional. The balance of the land use is defined as low-density residential. The well’s total depth is 133 feet below the ground surface and it is cased to 58 feet with a 6-inch steel casing does that not have a grout seal. The average daily demand is listed between 2000 and 5000 gallons and no treatment system is currently in use for the well water. The well for the Club is mapped as drilled into the Upper Pelitic

Schist of the Wissahickon formation (albite-chlorite- muscovite-quartz schist with sporadic thin beds of laminated micaceous quartzite).

5.22.2 Potential Sources of Contamination

Approximately 45 feet to the north of the well is an underground storage tank for fuel oil. A septic tank is on the property, but its location is not precisely known. Based on sketches from the MDE sanitary survey reports, it appears that the tank is also within approximately 150 feet of the well. Municipal sewer service is available nearby, but not within the wellhead protection area. It is also probable that numerous residential septic tanks are present within the wellhead protection area.

5.22.3 Discussion and Recommendations

Water quality data are available from June 1996 through May 2003 and no bacterial contamination was detected for this period. During this time, nitrate detections at the facility ranged between below detectable limits to 5.1 mg/L. However, in the data supplied by the MDE, only one sample in the last six years, taken in May of 2003, was analyzed for nitrate. The May 2003 sample had nitrate levels of 2.3 mg/L. Current nitrate levels and trends cannot be ascertained from available data.

The close proximity of the fuel oil tank is of some concern. At the time of this writing, VIEW Engineering is not aware of any organic analyses that were performed for this well. If these data do not exist, sampling the well for fuel oil parameters is recommended to ensure that no fuel oil has made its way into the shallow groundwater. The land around the center is almost fully developed at this time, barring any zoning or land use changes, the current sampling program should be sufficient to ensure water quality, however nitrate results should be reported regularly. The susceptibility of this well is judged to be high due to the nearby UST, lack of a grout seal for the well, and lack of information regarding recent water quality analyses.

5.23 Red Door Store

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-03-1210	1151026

5.23.1 Location and Well Description

Address: 16400 Layhill Road /16410 Norwood Road, Sandy Spring, MD 20860

The Red Door Store is located at the intersection of Layhill Road and Norwood Road. The Red Door Store is shown in Figure 24. The land surrounding the well is largely free of structures. The western half of the 1000-foot wellhead protection area is almost entirely pasture, with a few patches of deciduous forest mixed in. The aerial photo in Figure 24, shows additional agricultural activity and storage of earth materials due west of the store and to the north is an open field. The southeastern corner of wellhead protection area is classified as low-density residential and deciduous forest. The well is drilled to a depth of 56 feet in 1958, and enclosed with PVC protective casing and is found behind a concrete jersey barrier at the rear of the store. Casing extends to 48 feet and no treatment is currently in use for the well water. The well is mapped as drilled into the Wissahickon Lower Pelitic Schist (medium- to coarse-grained biotite-oligoclase-muscovite-quartz schist), although the contacts for the Kensington Quartz Diorite and the Norbeck Quartz Diorite are nearby.

5.23.2 Potential Sources of Contamination

A septic tank for the site is located approximately 70 feet to the south of the well and is slightly upgradient. Non-point agricultural contamination, such as fertilizers, animal wastes, or other agricultural chemicals also has the potential of to influence shallow groundwater quality based on surrounding land use patterns.

5.23.3 Recommendations

Water quality data are available from February 1996 through November 2004. Total coliform has been a consistent problem for the store. Total coliform was detected during 10 sampling for the period on record, with four detections in 2002 and most recently in October 2003. Only the October 1999 detections (1 to 4 colonies/100 mL) have magnitudes associated with them. Nitrate levels and nitrite have been consistently below state standards in the water samples taken from the store. Nitrate levels varied between

below detectable limits and 1.43 mg/L. Nitrite was sampled three times, with the only detection occurring in March of 1997 at 0.4 mg/L. The most recent sample for nitrite in September of 2002 was below detectable limits.

This well is considered to be highly susceptible to contamination. The well is shallowly drilled and may be subject to surface water influence. The grout seal around the well should be inspected and surface runoff should be directed away from the well. Another option is to relocate the well and drill to a greater depth. If a new well is not drilled, treatment for bacteria is highly recommended and sampling for pesticides and herbicides in addition to the current schedule is also advised. The well’s protective casing is constructed of PVC, however it is protected from impact by a concrete barrier and is not easily visible. No additional protective measures are suggested.

5.24 Ross Body Community Center

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-00-7598	1151048

5.24.1 Location and Well Description

Address: 18529 Brooke Road, Sandy Spring, MD 20860

The well for the Ross Body Community Center is unique among the transient water supply systems in Montgomery County because it is located inside the Community Center Building. Shown in Figure 25, land use patterns around the well are defined as low-density residential to the north and west, deciduous forest to the east and cropland to the south. Little is known about the well’s construction, however it may be as deep as 140 feet and yield up to 25 gallons per minute. The well has an 8-inch protective steel casing and no treatment is currently used for the well. As mapped, the well is drilled near the contact of the Lower Pelitic Schist (medium- to coarse-grained biotite-oligoclase-muscovite-quartz schist) and the Wissahickon Boulder Gneiss (thickly bedded to massive, pebble- and boulder-bearing, arenaceous to pelitic metamorphic rock, typically a medium-grained, garnet-oligoclase-mica-quartz gneiss).

5.24.2 Potential Sources of Contamination

The most immediate threat to the well is the nearby 6000-gallon fuel oil underground storage tank. The tank is located approximately 27 feet to the west of the well. A septic tank is also located on site, however according the MDE records, this tank is pumped to the municipal sewer. The status of other residential septic tanks surrounding the center is not known. The cropland to the south has the potential to influence local water quality in the event of fertilizers, pesticides, or herbicides were over-applied.

5.24.3 Discussion and Recommendations

Water quality data are available from April 1994 through March 2004. No bacterial contamination has been detected in the well during this period. Nitrate levels have been consistently below the 10 mg/L Maryland State standard and varied between 3.1 and 3.7 mg/L. The well is unusually well protected from unauthorized physical access, however its close proximity to the fuel oil tank poses some concerns. If it has not been done already, analyzing the water for fuel oil constituents at least once is recommended. In the event of any spills or leakage from the tank, additional sampling might be required. The high water quality combined with the proximity to the large underground storage tank indicates a moderate susceptibility to contamination.

5.25 Smokey Glen Farm

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Pavilion Area	Unknown	1151028
Grove Area	Unknown	1151084

5.25.1 Location and Well Description

Address: 16407 Riffleford Road, Gaithersburg, MD 20878

The two wells that provide water to the Smokey Glen Farm are shown in Figure 26. The Farm is an expansive area of rolling hills, grassland, and trees. When the 1000-foot radius wellhead protection areas are shown around each well, the majority of the land contained within the wellhead protection area zone belongs to the farm and is a mixture of grassland and deciduous forest. To the west, 2.5 acres are classified as low density residential. To the east land use is described as deciduous forest with a wedge of pastureland near the southeastern extent of the wellhead protection area. No well

construction details are available for the Farm, however the Grove Well is treated with chlorine and the Pavilion well is treated with nitrate removal, chlorine, and a cartridge filter. The wells for the site are mapped as drilled into the Upper Pelitic Schist of the Wissahickon formation (albite-chlorite- muscovite-quartz schist with sporadic thin beds of laminated micaceous quartzite).

5.25.2 Potential Sources of Contamination

No septic system was identified on site, and sewerage is available for the nearby residences. The large amount of land under the control of the Farm coupled with the low population density and lack of industrial activity in the area of interest combine to pose few land use risks to the water quality.

5.25.3 Discussion and Recommendations

Water quality data for the Pavilion are available from October 1996 through November 2004 and for the Grove Area from September 2002 through September 2004. The pH of the water at the farm is slightly acidic at 5.5 to 5.6 on the pH scale. However, aquifers composed of predominantly metamorphic rock, such as the Upper Pelitic Schist of the Wissahickon formation, often have similar pH ranges. Total coliform bacteria in the Pavilion were detected in April 1998 and in April 2002 (2 colonies per 100 mL). No other microbial detections were noted from April 2003 through November 2004.

The Grove well has a shorter history of water quality analysis than does the Pavilion well. With two samples taken, the Grove well's nitrate levels varied from between 2.06 and 2.45 mg/L – well below the standard of 10 mg/L. The Pavilion well has a more erratic history of nitrate detections. The average nitrate level measured from 1996 through 2004 for the Pavilion well is 6 mg/L. However, that includes a non-detection (November 2000) and a value of 31 mg/L (June 2001). State standards for nitrate have not been exceeded at the Pavilion well since the 31 mg/L detection. At present no additional sampling is recommended outside of the current schedule, however nitrate levels should be closely monitored going forward and the treatment systems should be regularly maintained to ensure water quality. The Grove well is considered to be at a low susceptibility to contamination. The Pavilion Well is considered moderately susceptible due to high nitrate levels in the water.

5.26 St. Mary's Church

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-69-0187	1151030

5.26.1 Location and Well Description

Address: 18230 Barnesville Road, Barnesville, MD 20838

The St. Mary's Church well is shown in Figure 27. The predominant land use pattern surrounding the Church is low-density residential housing. To the west is an area of approximately 7 acres of deciduous forest, and due east of the well are two acres of medium density residential housing. The southern quarter of the wellhead protection area is characterized as pasture and contains two man-made ponds. The well is approximately 145 feet deep and cased to 24 feet below the ground surface. Average daily demand for the well is approximately 750 gallons. Ultraviolet light and microfiltration are used for treatment. The geology of the area is mapped as the Ijamsville Formation-Marburg Schist (blue, green, or purple phyllite and phyllitic slate, with interbedded metasilstone and metagraywacke; and bluish-gray to silvery-green, fine-grained, muscovite-chlorite-albite-quartz schist with interbedded quartzites).

5.26.2 Potential Sources of Contamination

A septic tank for the Church is located approximately 150 to the north and downgradient from the well. Surrounding properties may also have septic systems, but their precise locations are not known. The well was drilled adjacent to the church cemetery. The well sits near the crest of a gently rolling hill rendering many potential sources of contamination downgradient from the wellhead. The large area of pastureland to the south also has the potential to influence shallow groundwater quality.

5.26.3 Discussion and Recommendations

Water quality data are available from April 1996 to October 2004. Four instances of positive total coliform detections were measured during this time. These occurred in April 1997, October 1998 (5 colonies/100 mL), January 2001 (3 colonies/100 mL) and June 2002 (6 colonies/100 mL). Since that time no bacterial contamination has been detected at the well. Nitrate results were consistently measured between 1.7 and 3.7 mg/L. In October 2002, nitrate levels appear to have spiked to over 20 mg/L, twice the 10 mg/L

nitrate concentration permitted by the state. However, as noted in the MDE sanitary survey report, this was due to a lab error and was not indicative of water quality. Arsenic was below detectable levels in 2002 and 2003. The well water was last analyzed for nitrite in 1997 and was detected at 0.004 mg/L, which is well below the Maryland standard of 1 mg/L.

There is little paved area within the wellhead protection area, the well's proximity to the cemetery, residential areas, and pastureland combined with the occasional total coliform detections contribute to the assessment that this well is moderately susceptible to future contamination. As noted in the sanitary survey report, the well water is treated with a micro-filter and ultraviolet radiation. At present, no additional sampling beyond the current schedule is recommended

5.27 Stadler Nursery

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	Unknown	1150048

5.27.1 Location and Well Description

Address: 6815 Olney-Laytonsville Road, Laytonsville, MD 20879

Located in north central Montgomery County, the Stadler Nursery and surrounding area are shown in Figure 28. The Nursery's well is 120 feet deep and cased to a depth of 102 feet. An ultraviolet light is used for water treatment. The well is drilled into the Upper Pelitic Schist of the Wissahickon formation (albite-chlorite- muscovite-quartz schist with sporadic thin beds of laminated micaceous quartzite).

This transient non-community public water supply is the only supply to exceed 10,000 gallons per day average usage with reported usage of 51,000 gallons per day. As such, a wellhead protection area was defined through a combination of fracture trace analysis and hydrogeologic mapping. VIEW Engineering conducted a fracture trace analysis using the earliest available stereo pairs of aerial photographs at a reasonable scale, in this case from 1968. The earliest available photos are used in an attempt to minimize the effect of human activities on the fracture trace analysis. The fracture traces were transferred to a GIS and compared to geologic and aquifer information to determine an approximate groundwater recharge area that contributes to the Stadler Nursery well

using a recharge rate of 400 gpd/ac. The recharge area was used in place of the 1000-foot radius circular wellhead protection area when examining potential contamination sources. An elliptical wellhead protection area is shown that takes into account the presumed southerly direction of groundwater flow and an assumed north-south preferred anisotropy at a ratio of 2:1.

Land use surrounding the well is primarily a mixture of residential and agricultural land. To the west, the majority of the land is used for growing crops, low-density residential housing spreads in a widening wedge from the nursery down toward south. The wells for the Montgomery Country club can be seen in Figure 15 approximately 2400 feet to the southeast of the Stadler Nursery well. To the north of the nursery is the town of Laytonsville that is composed of a mixture of residential and commercial properties. Cropland and pasture spread eastward from the well, with some low-density residential land present to the southeast. The well for the site sits in a mulch bed by the entrance to the nursery. It is securely bolted closed, but not locked.

5.27.2 Potential Sources of Contamination

Data provided by the MDE indicated several generators of controlled hazardous substances near to the Stadler Nursery, however these businesses were incorrectly located in the provided GIS data and are not a concern for the wellhead protection area associated with Stadler Nursery. The location of the site's septic holding tank is not precisely known, however it drains downgradient of the well to the south of the Nursery property. The nursery deals with high nitrogen fertilizers and may also use some herbicides and pesticides during the course of business. Nearby cropland and pasture have the possibility to communicate contaminants to the groundwater if fertilizers or other agricultural chemicals are improperly applied.

5.27.3 Discussion and Recommendations

Water quality data for the Stadler Nursery are available from January 2000 through October 2004. During 2002, total coliform bacteria were detected in August (5.3 colonies/100 mL) and September. From November 2002 to August 2004, no additional total coliform detections have been noted. Fecal coliform was also detected in September of 2002. Nitrate detections in the water from 2000 through 2004 were

consistently measured between 3.1 and 3.6 mg/L. Only one sample was analyzed for nitrite in 2002 and was reported to be below detectable limits.

The well is within approximately 3 feet of the edge of the parking lot for the nursery. This position makes it vulnerable to a collision from a vehicle or from surface runoff. If practical, the installation of bollards around the well is recommended to help prevent damage to the protective steel casing.

Agricultural runoff and infiltration coupled with fecal coliform detection and increasing development of the surrounding land qualify the Stadler Nursery for high susceptibility. The greater than 10,000 gallon per day water consumption extends the wellhead protection area to outside of the standard 1000-radius, further increasing susceptibility. Coliform has not been detected recently, although this is probably due to treatment of the water. The consistently low nitrate levels in the water indicate proper fertilizer application in the surrounding areas. No additional sampling besides the current program is recommended, however coliform results warrant future scrutiny. If a treatment system is in use, a regular maintenance schedule is highly recommended.

5.28 Sunshine General Store

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	Unknown	1151050

5.28.1 Location and Well Description

Address: 22300 Georgia Avenue, Brookeville, MD 20833

The Sunshine General Store is shown in Figure 29. The land surrounding the store is largely used for agriculture, as the property is flanked on both the east and west by cropland. A small shopping center sits close by to the southwest. To the immediate north of the store, an area of low-density residential land spreads northward in an expanding wedge. The well for the property exists within a concrete vault adjacent to the store. A heavy steel door prevents access to the wellhead. The ground surface immediately around the well is entirely paved. No details about the well's construction or average daily usage are available as of this writing. The treatment system used by the site employs a cartridge filter, however additional specifics about the treatment system are unknown. The geology of the surrounding area is mapped as the Wissahickon Boulder

Gneiss (Thickly bedded to massive, pebble- and boulder-bearing, arenaceous to pelitic metamorphic rock, typically a medium-grained, garnet-oligoclase-mica-quartz gneiss).

5.28.2 Potential Sources of Contamination

The well is within 30 feet of three underground storage tanks for petrochemicals dispensed at the fuel island. The MDE lists these tanks as being in proper working order. However, several monitoring wells and an unused soil vapor extraction system exist on the property, suggesting that some remedial measures were in place associated with the site's current or previous USTs. The paved ground surrounding the well and the fuel island help to limit infiltration of small volumes of spilled fuel from cars and minimizes infiltration of those contaminants during rain events. If fertilizers, pesticides, and herbicides from nearby cropland are improperly applied, the potential to influence groundwater quality exists. To the north of the station, the presence of one or more residential septic systems is probable due to the lack of municipal sewer service in the area.

5.28.3 Recommendations

Water quality data for the Sunshine General Store are available from June 1996 to November 2004. During that period, no coliform detections have been noted. Nitrate detections for the Sunshine general store for all available dates are less than the 10 mg/L standard and vary between 3.2 and 7.5 mg/L. During November 2002 (6.2 mg/L) and January 2003 (7.5 mg/L), nitrate levels exceeded 50% of the maximum contaminant level. Since January of 2003, average nitrate concentrations were calculated to be 3.6 mg/L.

This well is highly susceptible to contamination due to the lack of information about the well's construction and treatment and its close proximity to underground storage tanks for gasoline. VIEW Engineering is not aware of any volatile organic compound sampling performed for the Sunshine General Store. A baseline sample analyzed for gasoline components is recommended if such a sample has not yet been taken. Additionally, if the treatment system for the site uses nitrate removal, the system should be regularly checked and maintained, and nitrate levels should be examined in the future.

5.29 Tex's Place

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	Unknown	1151033

5.29.1 Location and Well Description

Address: 14630 Southlawn Lane, Rockville, MD 20850

The Tex's Place well is shown in Figure 30. The protective casing for the well resides within a concrete slab in the front parking area of the restaurant, is clearly visible, and is protected by concrete-filled steel bollards. The well cap is bolted to the casing, but is not locked. The 1000-foot wellhead protection area surrounding the well is almost entirely industrial and urban. Machine shops, painting operations, and other industrial facilities are all nearby. A small area of forested land is present in the northwest corner, however the majority of the land surface within the wellhead protection area is impervious to water. No well construction details were available except that the completion date was prior to 1970 and chlorination and filtration systems are used. The well is mapped as drilled into the Upper Pelitic Schist of the Wissahickon formation (albite-chlorite-muscovite-quartz schist with sporadic thin beds of laminated micaceous quartzite).

5.29.2 Potential Sources of Contamination

Two Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or Superfund sites are located within the wellhead protection area for Tex's Place. They are the Microdyne Corporation (EPA ID: MDD098668551) and Proto Circuits (EPA ID: MDD064846959). Neither of these Superfund sites are part of the EPA's National Priorities Listing. Proto Circuits is located approximately 450 to the north of the wellhead and Microdyne is approximately 800 feet to the south. Data supplied by MDE indicate several underground storage tanks within the 1000-foot wellhead protection area, however all of these are noted as permanently out of service. The well does not have a locking cap.

5.29.3 Recommendations

Water quality analysis results are available from June 1996 to January 2005. Two positive results for total coliform were noted in January and February of 2002. According to MDE sanitary survey reports, these data are false positives. Nitrate levels detected in

the water have been consistently below the state standard of 10 mg/L and vary between 5.5 and 7.2 mg/L. Average nitrate levels for the Tex's Place are 5.7 mg/L, or above 50% of the acceptable level. The last available sample taken in December of 2003, where nitrate was detected at 0.4 mg/L, represents an order of magnitude decrease from previous detections. Whether this data point is an insignificant outlier or the indication of an improvement in water quality cannot be ascertained at present.

The Tex's Place well is highly susceptible to contamination due to its proximity to two Superfund sites, lack of well construction information, and elevated nitrate levels. The physical location of the well presents problems that have no easy remedy. The concrete bollards surrounding the well are commendable and have already proved their worth by protecting the well from an impact (see Figure 71). However, a locking cap of some sort to prevent against unauthorized access is recommended. The parking area in front of the store is not large enough to accommodate a greater area of exclusion around the wellhead. Since no volatile organic or metals water quality data were available at the time of this writing, obtaining a sample for these compounds would be wise. Thereafter, should any tampering or spills be observed or reported, additional sampling would be recommended. If nitrogen treatment is not currently in place, it should be considered in the future.

5.30 Tri-County Baptist Church

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-94-1630	1151078

5.30.1 Location and Well Description

Address: 7821 Damascus Road, Laytonsville, MD 20882

The Tri-County Baptist Church's water supply well is shown in Figure 31. The aerial photo shown in Figure 31 was taken in March of 1998, prior to the construction of the church building. The well sits in front between the church parking lot and the nearby road. The dominant land use pattern surrounding the well is agricultural, mostly cropland. The only impervious surfaces within the 1000-foot wellhead protection area radius are the church parking lot and the paved road. The 6-inch diameter steel-cased well is drilled to a depth of 400 feet, cased to 80 feet and grouted to a depth of 71 feet.

Average daily demand is reported to be 50 gallons and a sediment filter is used for treatment. The geology of the area is mapped as the Ijamsville Formation-Marburg Schist (blue, green, or purple phyllite and phyllitic slate, with interbedded metasiltstone and metagraywacke; and bluish-gray to silvery-green, fine-grained, muscovite-chlorite-albite-quartz schist with interbedded quartzites).

5.30.2 Potential Sources of Contamination

The church is adjacent to a pesticide dealer approximately 500 feet west from the wellhead, as indicated by MDE data. A septic tank for the church is located approximately 300 feet to the northeast of the well. Agricultural activity near the store poses the potential threat of the over-application of fertilizers, pesticides, and herbicides.

5.30.3 Recommendations

Water quality data are available from November 2001 through October 2004. Nitrate levels in the well show a constant, but steadily decreasing trend from late 2002 to early 2004, varying from 8.7 to 7.0 mg/L. All nitrate detections are below the state maximum contaminant level of 10 mg/L, but are greater than 50% of the state standard. Neither nitrite nor any coliform bacteria were detected during the period for which data are available.

Nitrate levels in the well may be indicative of agricultural or septic influence. The decreasing trend in the nitrate data is promising, but levels are elevated and deserve closer scrutiny. The well at this site is considered to be moderately susceptible to contamination. If nitrate levels remain high, or increase, nitrate treatment may be necessary. VIEW Engineering is not aware of any pesticide analyses performed for the Tri-County Baptist Church. A baseline sample analyzed for pesticides and herbicides is recommended if such a sample has not yet been taken. No additional periodic sampling except as mandated by the current state program is recommended.

5.31 Trotters Glen Golf Course

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-73-0538	1151070

5.31.1 Location and Well Description

Address: 16410 Batchellors Forest Road, Olney, MD 20832

The Trotters Glen Golf Course and its associated wellhead protection area are shown in Figure 32. The golf course occupies the majority of the land area within the wellhead protection area. To the north, a 6-acre piece of land is characterized as pasture. However, upon closer inspection of Figure 32, it appears more likely that this is low-density residential land use, similar to the eastern edge of the protection area. The well is located directly in front of the main clubhouse and sticks up out of the concrete sidewalk. The cap for the well is bolted to the 6-inch diameter steel casing, but is of questionable integrity. The well is 205 feet deep, cased to 50 feet, grouted to 40 feet, and has a reported average demand of 550 gallons per day. No treatment system is currently in use. The well for the Trotters Glen Golf Course is approximately 205 feet deep and is drilled near the contact of the Norbeck Quartz Diorite and the Kensigton Quartz Diorite formations (moderately to strongly metamorphosed and deformed quartz diorite to granodiorite rock).

5.31.2 Potential Sources of Contamination

The precise location of the septic tank for the facility is not known. The golf course uses a variety of fertilizers and chemicals on its turf that, if improperly applied, could enter the groundwater. The surrounding residences almost certainly use on lot septic systems due to the lack of municipal sewer service in the area, however the nearest house is over 600 feet from the well. Within the wellhead protection area, the well is installed at a higher elevation than the surrounding residences.

5.31.3 Discussion and Recommendations

Water quality analytical data are available from January 2000 to November 2004. No bacterial contamination was detected in the well water during this time. Nitrate was consistently detected at levels between 2.6 and 3.8 mg/L. Nitrite was detected at 0.003 mg/L in 2002 and 0.001 mg/L in 2003. The state maximum contaminant levels are 10

mg/L for nitrate and 1 mg/L for nitrite. The water quality results for the golf course are safely below those standards.

The installation of a lockable well cap is recommended. The protective casing for this well is exposed and should be secured to prevent tampering. Nitrate levels in the well are consistent and indicative that appropriate nutrient management practices are being followed at the golf course. The water quality for the well is good and no additional sampling is recommended outside the schedule that is currently in place. The low population density within the wellhead protection area and favorable water quality analytical data place this well at low susceptibility to future contamination.

5.32 Waters Landing Golf Park

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	Unknown	1151070

5.32.1 Location and Well Description

Address: 20701 Crystal Rock Drive, Germantown, MD 20874-3918

The well for the Waters Landing Golf Park is installed in the Ijamsville Formation and Marburg Schist complex (blue, green, or purple phyllite and phyllitic slate, with interbedded metasiltstone and metagraywacke; and bluish-gray to silvery-green, fine-grained, muscovite-chlorite-albite-quartz schist with interbedded quartzites). No well construction information or average daily usage figures were available at the time of this writing. No treatment system is in place. As shown in Figure 33, the facility is bordered on the west by the deciduous forest of the Black Hill Regional Park while Interstate 270 passes through the northeastern section of the wellhead protection area. The southern quarter of the wellhead protection area consists of the facility’s driving range and industrial development fills in the northeastern section above I-270.

5.32.2 Potential Sources of Contamination

Perhaps the most significant potential contamination source comes from I-270. The shoulder of the road is approximately 150 feet from the well at its closest point. The constant stream of vehicles represents a potential influence on water quality. The road surface is at a lower elevation, and presumably downgradient from the well. Municipal

sewer service is available, thus removing an on-lot septic system as a potential contamination source. Chemicals used on the turf grass at the golf park also have the possibility of entering the groundwater if not properly applied.

5.32.3 Discussion and Recommendations

Water quality data are available from January 2002 through October 2004. During that time, one detection of total coliform at 1 colony/100 mL was noted in January 2002. Since that time, no additional bacteriological contamination was detected. Nitrate levels vary between 3.3 mg/L and below detectable limits. The reason for this variability is unclear and a longer sample history would be beneficial to determine if the seasonal variation seen in the data (spring detections range from 2.4 to 3.3 mg/L, whereas samples from other times are below detection limits.) are indicative of a pattern or simply random fluctuations. The maximum contaminant level for nitrate is 10 mg/L and the golf park is in no danger of exceeding that standard at present. However, the periodicity of the nitrate detections may represent a nutrient management issue at the park or could be as a result of runoff from spring rains on the interstate affecting groundwater quality.

The nearby land use patterns, periodic nitrate spikes in water analyses, and presence of Interstate 270 make this well moderately susceptible to future contamination. If the nitrate detections in water can be tied to nutrient management at the park, then smaller amounts of nitrogen containing fertilizers should be used. If fertilizers are spread in conjunction with herbicides or pesticides during the spring, an analysis for these constituents is recommended. The bacterial contamination detected in 2002 does not appear to be a recurring problem and current sampling practices should be sufficient to detect coliform.

5.33 Whites Ferry Store

Well Description	Montgomery County Well ID Number	MDE Public Water System Identification Number
Primary Well	MO-88-0252	1151035

5.33.1 Location and Well Description

Address: 24801 White's Ferry Road, Dickerson, MD 20842

The Whites Ferry Store is located along the banks of the Potomac River in Western Montgomery County, with the well and wellhead protection area shown in Figure 34. Land use patterns within the wellhead protection area are composed of three areas of approximate equal length running north to south. The area to the east is predominantly cropland, the central area containing the store is mostly deciduous forest, and the Potomac River fills the rest of the wellhead protection area to the west. According to information provided by MDE, the well for the White's Ferry Store is approximately 75 feet deep and cased to a depth of 60 feet. Average daily demand is not known, although ultraviolet radiation is used for water treatment. The well is mapped as tapping the shallow portion of the aquifer in the New Oxford formation (red, maroon, and gray sandstone, siltstone and shale), however its close proximity to the Potomac River suggests that it likely also receives recharge from alluvial deposits along the river.

5.33.2 Potential Sources of Contamination

The highest risk to the water quality in the White's Ferry Store Well is the nearby Potomac River. The possibility of surface water influence upon the well is high. This could occur through the alluvial deposits or directly at the ground surface as a result of flooding. In addition, two septic tanks are located approximately 130 feet to the north-northwest of the well. Local groundwater flow is assumed to be westward toward the river, however, during times of high water this gradient may be locally reversed. The road immediately in front of the well receives a steady stream of traffic when the ferry is in operation. Idling cars are briefly parked on the blacktop near the well while waiting for the ferry, which may act as a source of oils and grease.

5.33.3 Recommendations

Water quality data are available for the Whites Ferry Store from March 1996 through November 2004. During that time total coliform (6 occurrences) and fecal coliform (2 occurrences) were detected in the well water. Bacteriological results are shown below:

Table 12 Whites Ferry Bacteriological Detection History (colonies per 100 mL)

Sample Date	Total Coliform	Fecal Coliform	E. Coli
3/6/1996	6	<1	no data
4/4/1996	DET	DET	no data
4/24/1996	<1	<1	no data
5/7/1996	<1	<1	no data
5/16/1996	<1	<1	no data
9/26/1996	10	4	no data
10/30/1996	<1	<1	no data
12/10/1996	DET	<1	no data
3/18/1997	<1	<1	no data
4/9/1997	<1	<1	no data
3/4/1998	<1	<1	no data
9/29/1998	<1	<1	no data
5/18/1999	<1	<1	no data
1/6/2000	9	<1	no data
4/13/2000	5	<1	no data
1/17/2002	<1	<1	<1
2/4/2003	<1	<1	<1
6/25/2003	<1	<1	<1
7/30/2003	<1	<1	<1
12/9/2003	<1	<1	<1
4/30/2004	<1	no data	<1
10/27/2004	<1	no data	<1
11/9/2004	<1	no data	<1

Some results do not have magnitudes associated with them and are only indicated as positive detections. No detections of bacteria have been noted since April 2000. The sanitary survey report conducted by the MDE in May 2003 indicates that a new septic system was recently installed.

Nitrate detections in the well were consistently between 2.0 and 3.5 mg/L until mid 2003. In June of 2003, nitrate levels were measured at 7.6 mg/L and were followed in December 2003 with a detection of 5.0 mg/L. Since that time, nitrate levels in the well returned to between 3.0 and 3.6 mg/L. These levels are below the maximum

contaminant level of 10 mg/L, however, the 2003 detections meet or exceed 50% of the MCL and may require more careful scrutiny in the future.

The variable water quality analytical results for this well and its proximity to the Potomac River indicate that it is highly susceptible to future contamination. The bacterial results are less worrisome due to the lack of detections in the last three and a half years for which data are available. However, the high nitrate detections noted in 2003 show that water quality concerns continue to exist. It should also be noted that the current water analyses meet applicable Maryland State requirements for water. If not already in place, a nitrate treatment system or deeper replacement well may be required if nitrate levels continue to climb in the future. At present, no additional sampling besides the current schedule is recommended.

6 Conclusion

6.1 Water Quality Data Summary

Data supplied by MDE to View Engineering were incorporated into a relational database and formed the basis of the susceptibility determinations. Where available, hard copies of lab reports were compared against the database results for detected compounds for accuracy.

As shown in Table 13, 22 of the county's systems use some form of water treatment thus complicating the evaluation of the chemistry data at these locations. Of those 22 that use treatment, 18 systems use a disinfection technology, primarily chlorination or ultraviolet radiation. Bacterial results from these systems may not be indicative of source water quality.

Table 13 Summary of Treatment Systems In Use for Transient, Non-Community, Public Water Supplies in Montgomery County

PWSID	Location Name	Treatment Description
1150048	Stadler Nursery	Ultraviolet Radiation
1151003	Camp Bennett Lodge	Hypochlorination, Post
1151004	Camp Brighton Woods	No Treatment
1151005	Camp Waredaca	No Treatment
1151008	Comus Inn South	Hypochlorination, Post
1151009	Darnestown Swim and Racquet Club	No Treatment
1151010	Dayspring Church Center	No Treatment
1151011	Dickerson Market	Hypochlorination, Post

PWSID	Location Name	Treatment Description
1151013	Potomac Oak Center III	Filtration, Cartridge; Ion Exchange; pH Adjustment; Ultraviolet Radiation
1151019	Montgomery Country Club Primary	Hypochlorination, Post
1151020	National Capital Skeet and Trap Club	No Information
1151022	Old Anglers Inn	Hypochlorination, Post
1151023	Poolesville Public Golf Course	No Treatment
1151024	Poole's General Store	Hypochlorination, Post
1151025	Potomac Swim and Recreation Association	No Treatment
1151026	Red Door Store	No Treatment
1151028	Smokey Glen Farm Pavilion Area	Filtration, Cartridge; Hypochlorination, Post; Ion Exchange
1151030	St. Mary's Church	Filtration, Cartridge; Ultraviolet Radiation
1151033	Tex's Place	Activated Carbon, Granular; Hypochlorination, Pre
1151035	White's Ferry Store	Ultraviolet Radiation
1151036	Etchison Country Store	Filtration, Cartridge; Ion Exchange; pH Adjustment
1151038	Boyds Presbyterian Church	Ultraviolet Radiation
1151041	Hyattstown Deli	Hypochlorination, Post
1151042	Potomac Oak Center I	Filtration, Cartridge; Ion Exchange; pH Adjustment; Ultraviolet Radiation
1151046	Laytonsville Golf Club	No Treatment
1151048	Ross Body Community Center	No Treatment
1151050	Sunshine General Store	No Treatment
1151057	Owens Park	Filtration, Cartridge; Filtration, Ultrafiltration
1151064	Potomac Oak Center II	Hypochlorination, Pre; pH Adjustment; Reverse Osmosis
1151065	Little Bennett Golf Course Clubhouse	Ion Exchange
1151066	Camp Friendship	Hypochlorination, Post
1151070	Trotters Glen Golf Course	No Treatment
1151075	New Hope Presbyterian Church	No Treatment
1151078	Tri County Baptist Church	Filtration, Cartridge
1151079	Waters Landing Golf Park	No Treatment
1151081	Camp Bennett Office and Rec Center	No Treatment
1151082	Dayspring Church Jacob's Well	No Treatment
1151083	Little Bennett Golf Course Driving Range	No Treatment
1151084	Smokey Glen Farm Grove Area	Hypochlorination, Post

Table 14 summarizes the maximum and average nitrate concentrations for the water supplies considered in this report. A column listing the number of nitrate samples upon

which the maximum and average are based is also shown. In Table 14, a value is shown in boldface if it exceeds 50% of the Maryland Maximum Contaminant Level of 10 mg/L. If a value exceeds the MCL, it is shown in boldface and shaded. Seven of the 39 systems investigated have at least one nitrate detection that exceeds the MCL. An additional 11 systems have at least one nitrate detection exceeds 50% or the MCL or 5 mg/L.

Examining the average values in Table 14 shows that none of the systems have an average nitrate result that exceeds the State standards, however seven systems do have average detections that exceed 50% of the MCL.

Table 14 Summary of Nitrate Results for Transient, Non-Community, Public Water Supplies in Montgomery County

PWSID	Location Name	Maximum Result (mg/L)	Average Result (mg/L)	Number of Samples
1151038	Boyd's Presbyterian Church	6.3	3.72	18
1151003	Camp Bennett Lodge	6.1	2.71	17
1151081	Camp Bennett Office and Rec Center	4.7	2.13	4
1151004	Camp Brighton Woods	0.6	0.16	10
1151066	Camp Friendship	5	3.37	10
1151005	Camp Waredaca	11.8	9.47	21
1151008	Comus Inn South	3.6	2.75	4
1151009	Darnestown Swim and Racquet Club	6.9	3.66	5
1151010	Dayspring Church Center	3.3	0.94	19
1151082	Dayspring Church Jacob's Well	<0.2	non det	4
1151011	Dickerson Market	6.5	5.82	10
1151036	Etchison Country Store	10.4	4.10	9
1151041	Hyattstown Deli	3.8	3.46	8
1151046	Laytonsville Golf Club	11.1	5.39	17
1151065	Little Bennett Golf Course Clubhouse	1.5	0.32	17
1151083	Little Bennett Golf Course Driving Range	1.8	1.75	2
1151019	Montgomery Country Club Primary	2.8	2.42	13
1151020	National Capital Skeet and Trap Club	3.9	3.08	11
1151075	New Hope Presbyterian Church	4.9	4.57	7
1151022	Old Anglers Inn	2.4	1.47	10
1151057	Owens Park	12.2	2.30	6
1151024	Poole's General Store	6.6	4.65	11
1151023	Poolesville Public Golf Course	3.8	3.10	6
1151042	Potomac Oak Center I	13.2	7.19	16
1151064	Potomac Oak Center II	10.8	3.24	37
1151013	Potomac Oak Center III	7.9	2.91	15
1151025	Potomac Swim and Recreation Association	5.1	3.42	5

PWSID	Location Name	Maximum Result (mg/L)	Average Result (mg/L)	Number of Samples
1151026	Red Door Store	1.43	0.53	19
1151048	Ross Body Community Center	3.7	3.43	4
1151084	Smokey Glen Farm Grove Area	2.45	2.26	2
1151028	Smokey Glen Farm Pavilion Area	31	6.85	21
1151030	St. Mary's Church	3.7	2.49	11
1150048	Stadler Nursery	3.6	3.35	6
1151050	Sunshine General Store	7.5	4.47	11
1151033	Tex's Place	7.2	5.65	11
1151078	Tri County Baptist Church	8.7	7.88	4
1151070	Trotters Glen Golf Course	3.8	3.26	9
1151079	Waters Landing Golf Park	3.3	1.70	5
1151035	White's Ferry Store	7.6	3.38	13

Table 15 provides a summary of the total coliform results for the transient systems. The column labeled “Sample Count” indicates the number of microbial samples that were collected during the periods for which data are available. A listing of the sample date ranges for each of the systems can be found in Table 1 on page 4. The total count of detections is shown in the “Detection Count” column, although these values can provide an inaccurate representation of the level of bacterial contamination seen at the various sites. On several occasions, more than one bacterial sample was collected on a given day, potentially returning multiple detections. To correct for this, the column “Unique Detections” shows the number of discrete sampling dates for which a positive total coliform result was recorded. Based on the Unique Detections column, none of the systems investigated show a greater than 25% occurrence of total coliform detections. Fourteen systems were completely free of coliform detections during the period for which data are available. The remaining 25 systems have one or more total coliform detections on record.

Table 15 Summary of Total Coliform Results for Transient, Non-Community, Public Water Supplies in Montgomery County

PWSID	Location Name	Sample Count	Detection Count	Unique Detections
1151038	Boyds Presbyterian Church	40	5	4
1151003	Camp Bennett Lodge	60	9	6
1151081	Camp Bennett Office and Rec Center	10	-	-

PWSID	Location Name	Sample Count	Detection Count	Unique Detections
1151004	Camp Brighton Woods	30	-	-
1151066	Camp Friendship	13	-	-
1151005	Camp Waredaca	35	6	3
1151008	Comus Inn South	18	5	4
1151009	Darnestown Swim and Racquet Club	44	9	6
1151010	Dayspring Church Center	50	2	2
1151082	Dayspring Church Jacob's Well	17	-	-
1151011	Dickerson Market	22	3	2
1151036	Etchison Country Store	28	3	3
1151041	Hyattstown Deli	42	17	9
1151046	Laytonsville Golf Club	53	17	12
1151065	Little Bennett Golf Course Clubhouse	38	4	4
1151083	Little Bennett Golf Course Driving Range	30	11	3
1151019	Montgomery Country Club Primary	29	-	-
1151020	National Capital Skeet and Trap Club	26	-	-
1151075	New Hope Presbyterian Church	6	-	-
1151022	Old Anglers Inn	24	-	-
1151057	Owens Park	36	14	8
1151024	Poole's General Store	31	8	7
1151023	Poolesville Public Golf Course	45	11	7
1151042	Potomac Oak Center I	35	3	3
1151064	Potomac Oak Center II	25	1	1
1151013	Potomac Oak Center III	30	3	3
1151025	Potomac Swim and Recreation Association	5	-	-
1151026	Red Door Store	58	18	10
1151048	Ross Body Community Center	15	-	-
1151084	Smokey Glen Farm Grove Area	6	-	-
1151028	Smokey Glen Farm Pavilion Area	37	2	2
1151030	St. Mary's Church	43	5	4
1150048	Stadler Nursery	18	2	2
1151050	Sunshine General Store	28	-	-
1151033	Tex's Place	19	2	2
1151078	Tri County Baptist Church	14	-	-
1151070	Trotters Glen Golf Course	17	-	-
1151079	Waters Landing Golf Park	16	1	1
1151035	White's Ferry Store	25	6	6

While total coliform results can provide some information about the sanitary conditions of a given system, detections can be easily caused by non-threatening sources. Detections of E. Coli or fecal coliform, however, pose a health threat and need to be promptly addressed. Table 16 provides a summary of the E. Coli and fecal coliform results for the

systems investigated. Five of the 39 systems have experienced one or more detections of these microorganisms.

Table 16 Summary of E. Coli and Fecal Coliform Results in colonies per 100 mL for Transient, Non-Community, Public Water Supplies in Montgomery County

PWSID	Location Name	Sample Date	Constituent	Result
1151003	Camp Bennett Lodge	6/5/2003	E. Coli	1
1151057	Owens Park	6/4/2003	E. Coli	DET
1151024	Poole's General Store	5/28/2003	E. Coli	DET
1151024	Poole's General Store	4/30/1998	Fecal Coliform	1
1150048	Stadler Nursery	9/24/2002	Fecal Coliform	DET
1151035	White's Ferry Store	4/4/1996	Fecal Coliform	DET
1151035	White's Ferry Store	9/26/1996	Fecal Coliform	4

6.2 Susceptibility Analysis

Montgomery County comprises a mixture of land uses with rural, low-density housing, recreations, and/or agricultural land use predominating within the wellhead protection areas around the transient, non-community public water supplies in this study. The predominantly fractured bedrock aquifers throughout the county coupled with thin soil profiles can result in rapid transport of contaminants from the surface into the fractures that ultimately transmit groundwater toward public supply wells.

The agricultural land uses and presence of on-lot septic systems appear to affect water quality in nearby wells resulting in elevated nitrate levels or coliform bacteria detections in many wells. A combination of proper well construction (including a properly grouted well casing), proper nutrient management, channeling of surface flow away from wells, inspecting septic systems, public education, and use of agricultural best management practices can greatly reduce the threat of degraded water quality from potential contaminant sources. Periodic water quality testing of wells is recommended for nitrates and coliform bacteria in those areas with significant agricultural land use or on-lot septic systems, while water quality analysis for volatile organic compounds is recommended for areas near underground storage tanks or industrial facilities.

6.3 Summary of Recommendations

Of the water systems surveyed, 16 (40.1%) were designated as highly susceptible to future contamination. An additional 12 (30.8%) were designated moderately or

moderately to highly susceptible. For these wells, the recommendations above should be given serious consideration. Additionally, the following recommendations apply:

- The sanitary survey reports written by MDE for each system should be read and the recommendations contained within should be closely followed. Proper sanitation should be preserved whenever any service or repair work is performed. Disinfections following such work should also be carried out.
- Coliform sampling can provide a valuable indicator as to whether sanitary conditions are being maintained at a system. In many cases, the installation of new tightly fitting well caps and sealing of electrical conduits can prevent insect activity. In cases where bacterial influences are present, immediate corrective action is required.
- If a well is near an area that is subject to flooding, or if the well appears to be easily influenced by surface water, a watertight well cap should be installed coupled with an inspection of the grout seal.
- Seasonal water facilities should be closely examined and disinfected and flushed prior to use after a period of inactivity.
- Physical access to conspicuously located wells should be controlled through the use of locking caps. In areas where vehicles may collide with the well casing, brightly painted cement bollards should be installed.
- The sanitary surveys and water sampling program carried out by MDE provides valuable information for protecting the health of those that consume the water supplied by the transient system owners. These practices should be continued.

7 References

Maryland Geologic Survey, *Geologic Map of Maryland*, 1968,
<http://www.mgs.md.gov/esic/geo/mon.html>

Figures

All of the maps included as Figure 1 through Figure 34 share the following attributes:

1. The maps are displayed using the Maryland State Plane projection, which employs the Lambert Conformal Conic projection based upon the Geodetic Reference System of 1980 Ellipsoid (GRS 80). Horizontal map units are in United State Survey feet and use the North American Datum of 1983 (NAD 83). The Maryland State Geographic Information Committee recommended that map data for the state be displayed in the Maryland State Plane projection, NAD 83, with horizontal units of meters. The digital orthophotographic basemaps, however, were referenced to survey feet and necessitated this variance from the recommendations of the Committee. All GIS data collected in the field by VIEW Engineering personnel were reprojected from feet to meters prior to final submittal to the Maryland Department of the Environment.
2. Digital orthophotographic imagery was obtained from the Montgomery County, Maryland Geographic Information Systems Services Department. *The Color Digital Orthophoto MrSID 1ft Maps of Montgomery County* were taken during March of 1998 and published on June 12, 1999. As per the license agreement for the data, the following applies to all of the figures with orthophotographic bases: The planimetric information shown on these maps is based, in part, on copyrighted GIS Data from The Maryland-National Capital Park and Planning Commission (M-NCPPC), and may not be copied or reproduced without express written permission from M-NCPPC. Additional meta-data for this imagery are presently available at: <http://gis.montgomerycountymd.gov/apps/gis/metadetail.asp?ldNum=113>.
3. Additional GIS data were provided by the Maryland Department of the Environment.

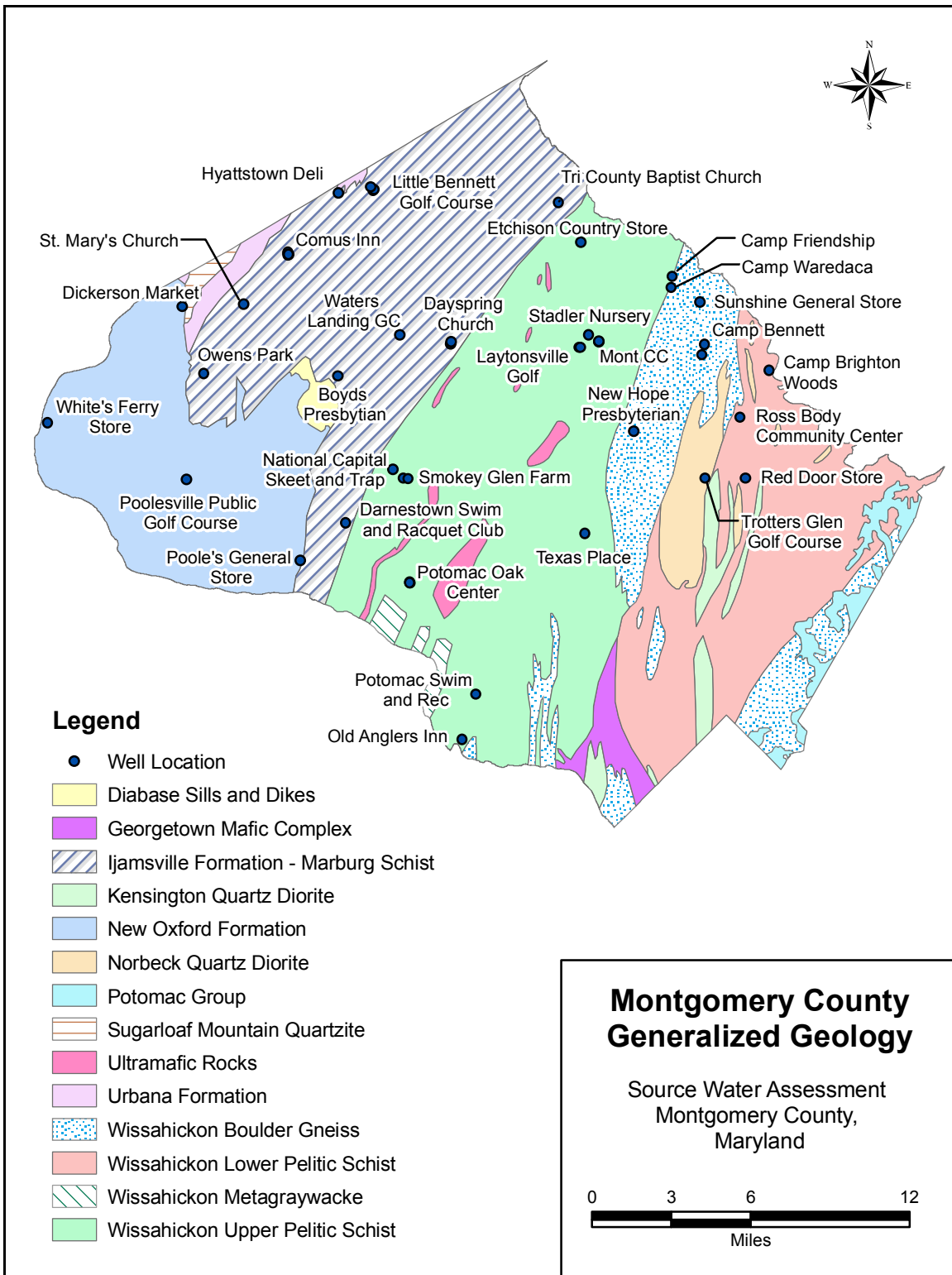


Figure 1 Montgomery County Generalized Geologic Map Showing Transient, Non-Community Water Supply Locations

