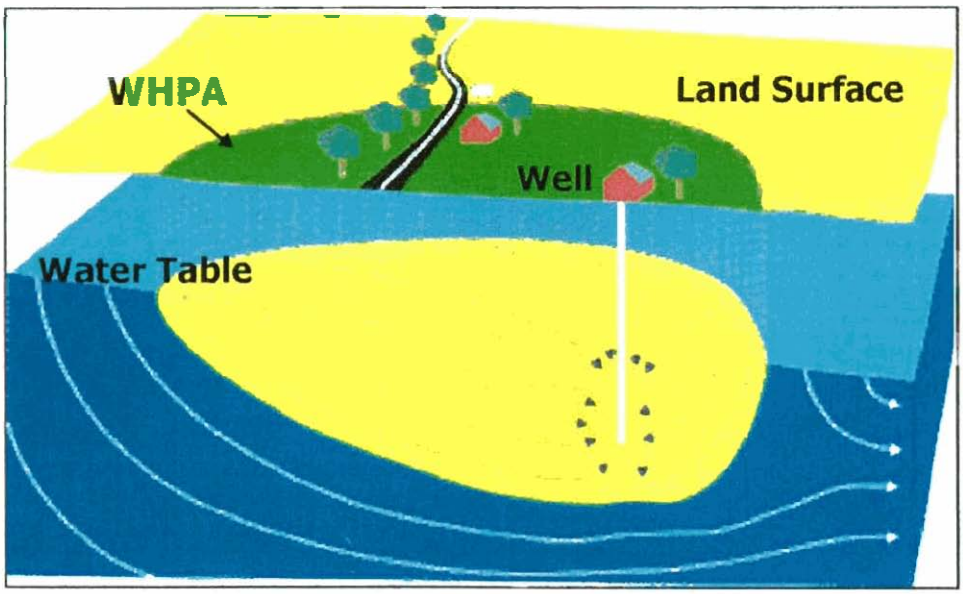
Source Water Assessment
for the Fountaindale Water Systems
Frederick County, Maryland



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MDE

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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for the Fountaindale water systems. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to the source, 2) identification of potential sources of contamination, and 3) determination of the susceptibility of the water supply to contamination. Recommendations for protecting the drinking water supply conclude this report.

The source of Fountaindale's water supply is an unconfined fractured-rock aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for this source type.

Point sources of contamination were identified within the assessment area from field inspections, contaminant inventory databases, and previous studies. The Maryland Office of Planning's 2000 digital land use map for Frederick County was used to identify non-point sources of contamination. Well information and water quality data were also reviewed. An aerial photograph and maps showing potential contaminants sources and land use within the Source Water Assessment area are included in the report.

The susceptibility analysis is based on a review of the existing water quality data for the Fountaindale water systems, the presence of potential sources of contamination in the WHPA, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Fountaindale water supply is susceptible to contamination by volatile organic compounds and microbiological contaminants. This water supply is not susceptible to contamination by inorganic compounds, radionuclides, or synthetic organic compounds.

INTRODUCTION

The Water Supply Program has conducted a Source Water Assessment for the Fountaindale North and South water systems in Frederick County. Fountaindale is located approximately five miles west of the City of Frederick at the foot of Catoctin Mountain. Fountaindale is bisected by US-Alternate Route 40, which splits the subdivision into two separate water systems that serve the developments on the north and south. The Fountaindale South water system also serves the community of Braddock Heights located to the east on the ridge of Catoctin Mountain. Due to their proximity to each other and the fact that the two water systems share a single ground water appropriation permit, they are assessed together in this report. The two systems serve a total population of 1882 and have 983 service connections. The water systems are owned and operated by the Frederick County Division of Utilities and Solid Waste Management.

WELL INFORMATION

Well information was obtained from the Water Supply Program's database, site visits, well completion reports, sanitary survey inspection reports, and published reports. The Fountaindale systems presently obtain their water supply from ten wells (Table 1). Three of these wells (Well Nos. 1, 7, and 8) will be disconnected from the system when construction of the new treatment plant is completed. The ten wells are located throughout the community (Fig. 1). A review of the well completion reports and sanitary surveys of Fountaindale's water systems indicate Well Nos. 1 and 2 were installed prior to 1973, when well construction regulations went into effect, and may not meet the current construction standards. The remaining wells were drilled after 1973 and should meet construction standards for grouting and casing. There were questions regarding the original construction of Well A and whether or not it was grouted due to the presence of coliform bacteria. However, subsequent investigation of this well did not reveal any construction defects and results of this are discussed in later sections of this report. A summary of the well information is located in Table 1.

The Fountaindale water systems have a combined appropriation permit to draw water from the Catoctin Metabasalt formation for an average use of 330,000 gallons per day (gpd) and a maximum of 500,000 gpd in the month of maximum use. This is a temporary allocation issued on November 1, 2001 for one year in order to "allow a reasonable amount of time for completion of repairs to the Braddock Heights water distribution system" which has only recently been combined with the Fountaindale systems and has significant leaks. Based on the most recent pumpage reports, it appears that the water use is already below the intended appropriation amount of 250,000 average gpd. The average daily use was 189,087 gallons in 1999 and 162,743 gallons in 2000. In the first six months of 2001, the average was 163,105 gpd. The months of maximum use

for the last two reported years were July 1999 and January 2000 with an average daily use of 214,144 and 212,632 gallons respectively.

SYSTEM	PLANT ID	SOURCE ID	USE CODE	WELL NAME	PERMIT	TOTAL DEPTH	CASING DEPTH	YEAR DRILLED
NORTH	01	01	PRODUCTION	FOUNTAINDALE 1	FR-66-0605	265	24	1966
NORTH	02	02	STANDBY	FOUNTAINDALE 2	FR-69-0207	220	70	1968
NORTH	03	03	PRODUCTION	FOUNTAINDALE 3	FR-73-0070	300	77	1973
SOUTH	01	04	PRODUCTION	FOUNTAINDALE 5	FR-73-2825	300	98	1975
SOUTH	01	05	PRODUCTION	FOUNTAINDALE 4	FR-73-2824	150	55	1975
SOUTH	02	06	PRODUCTION	FOUNTAINDALE 6	FR-73-3729	205	37	1976
SOUTH	03	07	STANDBY	FOUNTAINDALE 7	FR-73-7558	675	71	1980
SOUTH	04	08	PRODUCTION	FOUNTAINDALE 8	FR-73-8045	642	106	1981
SOUTH	01	09	PRODUCTION	WELL A BEECH TREE EAST	FR-88-4859	500	65	1995
SOUTH	01	10	PRODUCTION	WELL B BEECH TREE WEST	FR-88-4860	500	44	1995

Table 1. Fountaindale well information.

HYDROGEOLOGY

Fountaindale lies within the Blue Ridge physiographic province, which is bound by Catoctin and South Mountains and is underlain by the oldest sequence of rocks in the County. The underlying bedrock is composed of Precambrian gneiss, phyllite, and metabasalt, which forms the core of the South Mountain anticlinorium and is exposed in the Middletown Valley (Duigon and Dine, 1987). The Fountaindale wells obtain water from the Catoctin Metabasalt formation - an important aquifer in the Middletown Valley due to its aerial extent. The Catoctin Metabasalt is an unconfined, fractured rock aquifer, composed of a dense green crystalline rock believed to be a series of metamorphosed lava flows (Meyer and Beall, 1958). The primary porosity and permeability of this aquifer are small due to the dense nature of the metabasalt. Ground water moves principally through secondary porosity, fractures and joint openings, and is recharged by precipitation percolating through soil and saprolite. Due to the low primary porosity, large production wells are not common in this formation unless significant, water-bearing fractures are encountered. A fracture trace analysis was completed in 1996 by R.E. Wright, Inc. in a well exploration project (Appendix A, Fig. 1). Wells A and B were constructed based on this analysis and were tested at rates of 139 and 76 gallons per minute (gpm) but are reportedly able to produce significantly more.

Ground water systems in crystalline rock tend to be localized and flow is within topographic divides towards the nearest perennial stream (Bolton, 1998). The water table is generally in the saprolite, which is characterized by high porosity and thus, the amount of storage often depends on the thickness of the saprolite. Stream valleys tend to follow fracture traces and as a result wells drilled in draws and stream valleys tend to have higher yields than those on hilltops and slopes. Wells located along fracture traces in stream valleys may be hydraulically connected to the stream and it appears based on the

water quality of Well A that it receives some of its recharge from the adjacent unnamed tributary to Hollow Creek.

SOURCE WATER ASSESSMENT AREA DELINEATION

For ground water systems, a Wellhead Protection Area (WHPA) is considered the source water assessment area for the system. The source water assessment area for public water systems using wells in fractured-rock aquifers is the watershed drainage area that contributes to the well. The area should be modified to account for geological boundaries, ground water divides, and by annual average recharge needed to supply the well (MD SWAP, 1999).

As noted above, a fracture trace analysis was completed for the area around Fountaindale and the WHPA includes the watershed areas contributing to these fractures. The WHPA should cover an area large enough to supply water at the average appropriated amount using effective recharge. Drought year base flow (effective recharge) in the Catoctin Creek Basin was estimated by Duigon and Dine (1987) and further modified by Greenhorne and O'Mara (1994) at 365 gpd/acre. The recharge area for the wells using an average use of 330,000 gpd and the drought year recharge rate is calculated to be 904 acres. The WHPA boundaries follow topographic divides draining towards the identified fracture traces and is approximately 908 acres. Figure 2 shows the WHPA.

POTENTIAL SOURCES OF CONTAMINATION

Potential sources of contamination are classified as either point or non-point sources. Examples of point sources of contamination are leaking underground storage tanks, landfills, discharge permits, large scale feeding operations, and CERCLA sites. These sites are generally associated with commercial or industrial facilities that use chemical substances that may, if inappropriately handled, contaminate ground water via a discrete point location. Non-point sources of contamination are associated with certain types of land use practices such as use of pesticides, application of fertilizers or animal wastes, or septic systems that may lead to ground water contamination over a larger area.

Point Sources

A review of MDE contaminant databases revealed several potential point sources of contamination within the WHPA (Table 2). Underground storage tanks (UST) were identified in four facilities, three of which are currently in use and in close proximity to some of the wells (Fig. 3). In addition, the Frederick County Division of Utilities and Solid Waste Management has an NPDES permit to discharge in the unnamed tributary downstream and to the west of Wells A and B.

ID*	Type	Facility Name	Address	Comments
1	UST	Fountaindale Sunoco	4304 Old National Pike	6 tanks in use, gasoline, diesel and heating oil
2	UST	Texaco	4301 Old National Pike	
3	UST	Fogles Automotive	4315 Old National Pike	Tank status unknown
4	UST	Middletown United Methodist	7102 Fern Ln	Tank removed from ground
5	NPDES	Fountaindale WWTP		

Table 2. Potential Contaminant Sources in Fountaindale WHPA (*See Figure 3)

Underground Storage Tanks (UST's) are a potential source of volatile organic compounds from petroleum products if they leak. Newer tanks are less likely to leak due to new construction standards, however leaks may still be common in underground piping. Leaks often go undetected unless a water supply is impacted, because they are located in the subsurface.

A National Pollution Discharge Elimination System (NPDES) has been issued for the Fountaindale wastewater treatment plant. Wastewater effluent can contain a variety of contaminants; including pathogens, partially treated organic compounds and inorganic compounds such as nitrates or metals that are not completely removed by the treatment process.

Non-Point Sources

The Maryland Office of Planning's 2000 digital land use coverage of Frederick County was used to determine the predominant types of land use in the WHPA (Fig. 4). The land use summary is given in Table 3. The majority of the WHPA is made up of residential land that is covered by the Fountaindale subdivisions. The remainder of the WHPA is agricultural and forested land, with smaller pockets of commercial areas.

Land Use Type	Total Acres	Percent of WHPA
Low Density Residential	49	5.4
Medium Density Residential	356	39.2
Commercial	44	4.9
Cropland	271	29.8
Forest	189	20.8
Total	909	100

Table 3. Land Use Summary

Agricultural land is commonly associated with nitrate loading of ground water and also represents a potential source of SOCs depending on fertilizing practices and use of pesticides. Residential areas without sewer service may be a source of nitrate from septic systems. Additionally, residential areas may be a source of nitrate and SOCs if fertilizers, pesticides, and herbicides are not used carefully in lawns and gardens. Commercial areas are generally associated with facilities that may have point sources of contamination as described above.

The Maryland Office of Planning's 1996 digital sewer map of Frederick County shows that the approximately most of the WHPA has existing sewer service or is planned for service in the near future (Fig. 5). The remaining area is in an area of the county that is not planned for service and is primarily forested or agricultural land. Table 4 summarizes the sewer service categories in the WHPA.

Service Category	Total Acres	Percent of WHPA
Existing Service	391	43.0
3 Year Planned Service	46	5.1
4 to 6 Year Planned Service	77	8.5
Unknown	15	1.6
Not Planned for Service	380	41.8
Total	909	100

Table 4. Sewer Service Area Summary

WATER QUALITY DATA

Water Quality data was reviewed from the Water Supply Program's database for Safe Drinking Water Act (SDWA) contaminants. The State's SWAP defines a threshold for reporting water quality data as 50% of the Maximum Contaminant Level (MCL). If a monitoring result is greater than 50% of a MCL, this assessment will describe the sources of such a contaminant and if possible, locate the specific sources that are the cause of the elevated contaminant level. All data reported is from the finished (treated) water unless otherwise noted. The Fountaindale water system has seven points of entry or plants, which have varying treatment that are outlined in Table 5. As mentioned earlier some of these plants will be abandoned when the new treatment plant is completed.

SYSTEM	PLANT ID	TREATMENT	PURPOSE
NORTH	01	pH ADJUSTMENT	CORROSION CONTROL
NORTH	01	HYPOCHLORINATION, POST	DISINFECTION
NORTH	02	HYPOCHLORINATION, POST	DISINFECTION
NORTH	03	pH ADJUSTMENT	CORROSION CONTROL
NORTH	03	HYPOCHLORINATION, POST	DISINFECTION
SOUTH	01	INHIB., POLYPHOSPHATE	CORROSION CONTROL
SOUTH	01	pH ADJUSTMENT	CORROSION CONTROL
SOUTH	01	HYPOCHLORINATION, POST	DISINFECTION
SOUTH	02	pH ADJUSTMENT	CORROSION CONTROL
SOUTH	02	HYPOCHLORINATION, POST	DISINFECTION
SOUTH	03	HYPOCHLORINATION, POST	DISINFECTION
SOUTH	03	FILTRATION, CARTRIDGE	PARTICULATE REMOVAL
SOUTH	04	pH ADJUSTMENT	CORROSION CONTROL
SOUTH	04	HYPOCHLORINATION, POST	DISINFECTION

Table 5. Treatment Methods in Fountaindale Plants

A review of the monitoring data since 1993 for Fountaindale's water indicates that the water supply meets drinking water standards. Of the inorganic compounds, nitrate was the only contaminant detected above the SWAP threshold level in one well. The only volatile organic compound that has been detected in significant concentrations is MTBE, which does not currently have an MCL. Radiological contaminants were not present above 50% of an MCL. No synthetic organic compounds, other than Di(2-ethylhexyl)Phthalate, which is routinely found in laboratory blanks, were detected. The water quality sampling results are summarized in Tables 6a-b.

	North Plant 01		North Plant 02		North Plant 03	
Contaminant Group	No. of Samples Collected	No. of Samples > 50% of an MCL	No. of Samples Collected	No. of Samples > 50% of an MCL	No. of Samples Collected	No. of Samples > 50% of an MCL
Inorganic Compounds (except Nitrate)	5	0	3	0	5	0
Nitrate	9	0	8	0	10	0
Radiological Contaminants	2	0	1	0	2	0
Volatile Organic Compounds	19	0	4	0	20	0
Synthetic Organic Compounds	9	0	3	0	9	0

Table 6a. Summary of Water Quality Samples for Fountaindale North Plants

	South Plant 01		South Plant 02		South Plant 03	
Contaminant Group	No. of Samples Collected	No. of Samples > 50% of an MCL	No. of Samples Collected	No. of Samples > 50% of an MCL	No. of Samples Collected	No. of Samples > 50% of an MCL
Inorganic Compounds (except Nitrate)	7	0	7	0	7	0
Nitrate	10	0	10	0	10	0
Radiological Contaminants	4	0	2	0	1	0
Volatile Organic Compounds	8	0	10	0	6	0
Synthetic Organic Compounds	9	0	9	0	8	0

Table 6b. Summary of Water Quality Samples for Fountaindale South Plants

	South Plant 04		Raw Water Well A		Raw Water Well B	
Contaminant Group	No. of Samples Collected	No. of Samples > 50% of an MCL	No. of Samples Collected	No. of Samples > 50% of an MCL	No. of Samples Collected	No. of Samples > 50% of an MCL
Inorganic Compounds (except Nitrate)	9	0	2	0	2	0
Nitrate	11	0	3	0	2	1
Radiological Contaminants	2	0	1	0	1	0
Volatile Organic Compounds	8	0	1	0	1	0
Synthetic Organic Compounds	9	0	1	0	1	0

Table 6b. Summary of Water Quality Samples for Fountaindale South Plants (cont.)

Inorganic Compounds (IOCs)

The nitrate levels in the water supply fluctuate between non-detected and 6.7 ppm and average about 3 ppm. One sample of raw water from Well B had a level above 5 ppm. The MCL for nitrate is 10 ppm. No other inorganic compounds were detected above 50% of an MCL.

Radionuclides

A review of the data shows that no radionuclides were detected above 50% of an MCL. There is currently no MCL for Radon-222, however EPA has proposed an MCL of 300 pCi/L or an alternate of 4000 pCi/L for community water systems if the State has a program to address the more significant risk from radon in indoor air. The EPA received many comments in response to their proposed rule, and promulgation may be delayed. Radon-222 results have been reported below the lower proposed MCL.

Volatile Organic Compounds (VOCs)

A review of the data shows that VOCs have not been detected above 50% of an MCL. Methyl-Tert-Butyl-Ether (MTBE) has been detected in levels close to the taste and odor threshold of 20 ppb in two of Fountaindale South's plants (Table 7).

PLANT ID	SAMPLE DATE	RESULT (PPB)
02	17-Apr-95	-0.5
02	26-Aug-96	17.1
02	13-Nov-96	11.7
02	11-Dec-96	7
02	14-Jan-97	6.1
02	01-Jun-98	3.7
02	29-Feb-00	-0.5
03	26-Aug-96	17.1
03	14-Jan-97	-0.5

Table 7. MTBE Results in Fountaindale South

Synthetic Organic Compounds (SOCs)

The only SOC detected was Di(2-Ethylhexyl)Phthalate for which the hightest level reported was 2.7 ppb. This contaminant is commonly found in laboratory blank samples and the method for analyzing this contaminant was just starting to be used in 1995 and had many false positive results.

Microbiological Contaminants

Raw water bacteriological data is available for each of the wells from evaluation for ground water under the direct influence of surface water (GWUDI). Well No. 5, Well A, and Well B have had persistent total and fecal coliform (Tables 8a-c). The other wells were free of fecal coliform bacteria, although some had positive total coliform results in the first samples collected. Minor repair work was completed on the wellheads and subsequent samples proved free of coliform bacteria.

RAIN DATE	RAIN AMT (inches)	REMARK	SAMPLE DATE	TOTAL COLIFORM (col./100 ml)	FECAL COLIFORM[1] (col./100 ml)
	0	DRY DATA	25-Sep-96	3.6	-1.1
	0	DRY DATA	13-Nov-96	5.1	-1.1
	0	DRY DATA	11-Dec-96	2.2	1.1
	0	DRY DATA	11-Feb-97	-1.1	-1.1
	0	DRY DATA	17-Apr-97	-1.1	-1.1
19-Dec-96	0.5	WET SAMPLE	19-Dec-96	2.2	-1.1
10-Jan-97	3.0	WET SAMPLE	10-Jan-97	12	-1.1
23-Jan-98	0.5	WET SAMPLE	23-Jan-98	5.1	1.1
04-Feb-98	1.8	WET SAMPLE	05-Feb-98		
29-Jul-99	1.0	WET SET	29-Jul-99	23	12
			30-Jul-99	9.2	3.6
			31-Jul-99	6.9	3.6
			01-Aug-99	6.9	2.2
26-Aug-99	1.7	MPA RESULT = HIGH RISK	25-Aug-99		
		MPA RESULT = HIGH RISK	26-Aug-99		
20-May-01	1.95	WET SET (5/20 0.5", 5/21 0.6", 5/22 0.85")	21-May-01	6.9	-1.1
			22-May-01	5.1	-1.1
			23-May-01	23.1	-1.1
			24-May-01	23.1	-1.1
22-May-01	0.85	MPA RESULT = HIGH RISK	23-May-01		
		MPA RESULT = HIGH RISK	24-May-01		

Table 8a. GWUDI data from Well 5

[1] Negative symbol indicates less than the detection limit

RAIN DATE	RAIN AMT (inches)	REMARK	SAMPLE DATE	TOTAL COLIFORM (col./100 ml)	FECAL COLIFORM[1] (col./100 ml)
			16-Sep-99	23.1	23.1
			17-Sep-99	23.1	23.1
			18-Sep-99	23.1	16.1
16-Sep-99	1	WET SET 1	19-Sep-99	23.1	2.2
			22-Mar-01	1.1	-1.1
			23-Mar-01	-1.1	-1.1
			24-Mar-01	-1.1	-1.1
21-Mar-01	0.6	WET SET	25-Mar-01	-1.1	-1.1
21-Mar-01	0.6	MPA RESULT = HIGH RISK	22-Mar-01		
21-Mar-01	0.6	MPA RESULT = HIGH RISK	23-Mar-01		
			21-May-01	12	-1.1
			22-May-01	23.1	-1.1
		WET SET (5/20 0.5", 5/21 0.6",	23-May-01	23	-1.1
20-May-01	1.95	5/22 0.85")	24-May-01	3.6	-1.1
22-May-01	0.85	MPA RESULT = HIGH RISK	24-May-01		
22-May-01	0.85	MPA RESULT = HIGH RISK	25-May-01		

Table 8b. GWUDI data from Well A

RAIN DATE	RAIN AMT (inches)	REMARK	SAMPLE DATE	TOTAL COLIFORM (col./100 ml)	FECAL COLIFORM[1] (col./100 ml)
			28-Sep-99	23.1	23.1
			29-Sep-99	16.1	3.3
			30-Sep-99	23.1	23.1
28-Sep-99	1	WET SET	01-Oct-99	5.1	-1.1
16-Nov-99	0.5	MPA RESULT = MODERATE RISK	16-Nov-99		
16-Nov-99	0.5	MPA RESULT = MODERATE RISK	17-Nov-99		
			21-May-01	-1.1	-1.1
			22-May-01	9.2	-1.1
		WET SET (5/20 0.5", 5/21 0.6",	23-May-01	16.1	-1.1
20-May-01	1.95	5/22 0.85")	24-May-01	3.6	-1.1
20-May-01	0.5	MPA RESULT = HIGH RISK	21-May-01		
20-May-01	0.5	MPA RESULT = HIGH RISK	22-May-01		

Table 8c. GWUDI data from Well B

SUSCEPTIBILITY ANALYSIS

The wells serving the Fountaindale water supply draw water from unconfined fractured-rock aquifers. Wells in unconfined aquifers are generally vulnerable to any activity on the land surface that occurs within the wellhead protection area. Therefore, continued monitoring of contaminants is essential in assuring a safe drinking water supply. The *susceptibility* of the source to contamination is determined for each group of contaminants based on the following criteria: 1) the presence of potential contaminant sources within the WHPA, 2) water quality data, 3) well integrity, and 4) the aquifer conditions. Table 9 summarizes the susceptibility of Fountaindale's water supply to each of the groups of contaminants.

In the Piedmont region, if a well is constructed properly with the casing extended to competent rock and with sufficient grout, the saprolite serves as a natural filter and protective barrier. Properly constructed wells with no potential sources of contamination in their WHPA should be well protected from contamination.

Inorganic Compounds

Nitrate was detected above 5 ppm in only one sample in Well B (Table 6b). The MCL for nitrate is 10 ppm. Sources of nitrate can generally be traced back to land use. Fertilization of agricultural fields and residential lawns, residential septic systems, and areas with high concentrations of livestock are common sources of nitrate loading in ground water. The residential areas within the WHPA that have sewer service are immediately upgradient from the wells, but there is a small area of low-density residential land along the ridge of Catoctin Mountain that is still on individual septic systems. Agricultural land makes up approximately 40% of the WHPA and presents another source of nitrate to the water supply.

Levels of nitrate in the water supply would suggest that it is **not** susceptible to this contaminant. However, due to the vulnerability of the aquifer to land activity, and the presence of nitrate sources in the WHPA, the nitrate levels should be monitored closely to ensure that they do not rise.

The water supply is **not** susceptible to inorganic compounds other than nitrate, based on water quality data and lack of potential contaminant sources within the WHPA. However, the wells that have been determined under the direct influence of surface water may be susceptible to discharges into the stream water. The Fountaindale waste water treatment plant discharges treated sewage that may contain other inorganic contaminants just downstream from Well B. Based on water quality from Wells A and B, the WWTP has not presented a source of IOC's thus far.

Radionuclides

The water supply is **not** susceptible to radionuclides. The source of radionuclides in ground water is the natural occurrence of uranium in rocks. Based on the low levels detected in the water supply, the aquifer is not a source of these contaminants in this area.

Volatile Organic Compounds

The water supply is susceptible to contamination by VOC's, due to the presence of contaminant sources in the WHPA and the presence of MTBE in some of the wells. Other VOC's have not been detected at a level of concern. The levels of MTBE in the wells are relatively low and thus the source is not likely to be a leaking UST. But the proximity of the UST's to the wells does present a significant threat and VOC's should be monitored regularly.

Synthetic Organic Compounds

The wells are **not** susceptible to synthetic organic compounds. SOCs were not detected in the water supply. A potential source of SOCs in the WHPA may be pesticide or herbicide use in the agricultural areas. However, because these contaminants have not been detected, it appears that any chemicals that may be used in the WHPA are degrading or being attenuated in the soil and are not reaching the wells.

Microbiological Contaminants

Three of the wells (Nos. 5, A, and B) have been determined to be ground water under the direct influence of surface (GWUDI) sources due to the presence of fecal coliform bacteria in their raw water samples. These wells **are** susceptible to any microbiological contaminant that may be present at the surface including *Giardia* and *Cryptosporidium*.

The remaining wells were determined not under the direct influence of surface water but all of them, with the exception of Well No. 7, had at least one sample that had low concentrations of total coliform. Therefore, the wells **are** susceptible to contamination by total coliform. Total coliform bacteria, which are ubiquitous in the environment and *may* be indicators of organisms with longer survival rates such as viruses. Without additional data however, it is not possible to determine whether or not the water supply is susceptible to viral contamination. Well construction may be a factor in the positive total coliform results if, for example, the grout seal is not intact or is not completed to the bottom of the casing. Several of the wells predate construction standards. Other factors could be shallow casing, loose caps, or unscreened vents that would allow coliform into the well.

Contaminant Group	Are Contaminant Sources Present in WHPA?	Are Contaminants Detected Above 50% of MCL?	Is Well Integrity a Factor?	Is the Aquifer Vulnerable?	Is the System Susceptible?
Nitrate	YES	YES (Well A only) NO for other wells	NO	YES	NO
Inorganic Compounds (except nitrate)	YES (for GWUDI sources only - NPDES discharge)	NO	NO	YES	NO
Radiological Compounds	NO	NO	NO	NO	NO
Volatile Organic Compounds	YES	NO	NO	YES	YES
Synthetic Organic Compounds	YES	NO	NO	YES	NO
Microbiological Contaminants	YES	YES	YES	YES	YES -Wells 5, A, B (Other wells – Total Coliform only)

Table 9. Susceptibility Analysis Summary.

MANAGEMENT OF THE SOURCE WATER ASSESSMENT AREA

With the information contained in this report the Frederick County Division of Utilities and Solid Waste Management is in a position to protect the Fountaindale water supply by staying aware of the area delineated for source water protection and evaluating future development and land planning. Specific management recommendations for consideration are listed below:

Form a Local Planning Team

- The Division of Utilities and Solid Waste Management should continue to work with the County Planning Department and Wellhead Protection committee to implement a County Wellhead Protection Ordinance. The committee should ensure that all interests in the community are represented, such as the water supplier, home association officers, the County Health Department, local businesses, developers, and property owners, and residents within and near the WHPA.
- A management strategy adopted by the Division and the County should be consistent with the level of resources available for implementation. MDE remains available to assist in anyway we can help the process.
- MDE has grant money available for Wellhead Protection projects, such as developing and implementing wellhead protection ordinances, digitizing layers that would be useful for wellhead protection (such as geology), and developing additional protection strategies. An application can be obtained by contacting the water supply program.

Public Awareness and Outreach

- The Consumer Confidence Report should list that this report is available to the general public through their county library, by contacting the Division or MDE.
- Conduct educational outreach to the facilities and residents of the community focusing on activities that may present potential contaminant sources. Important topics include: (a) compliance with MDE and federal guidelines for gasoline and heating oil UST's, (b) monitoring well installation and maintenance of UST's, (c) appropriate use and application of fertilizers and pesticides, and (d) hazardous material disposal and storage.
- Road signs at the WHPA boundary are an effective way of keeping the relationship of land use and water quality in the public eye, and help in the event of spill notification and response.

Monitoring

- Continue to monitor for all Safe Drinking Water Act contaminants as required by MDE.
- Annual raw water bacteriological samples are a good test for well integrity. For GWUDI wells, sampling during rain events will provide further valuable information.

Land Acquisition/Easements

- Loans are available for the purchase of property or easements for protection of the water supply. Eligible property must lie within the designated WHPA. Loans are currently offered at zero percent interest and zero points. Contact the Water Supply Program for more information.

Contingency Plan

- Fountaindale's Contingency Plan was submitted to MDE for a review and approved in November 2001. COMAR 26.04.01.22 requires all community water systems to prepare and submit for approval a plan for providing a safe and adequate drinking water supply under emergency conditions.
- Develop a spill response plan in concert with the Fire Department and other emergency response personnel.

Contaminant Source Inventory Updates/ Inspections

- The Division should conduct their own field survey of the source water assessment area to ensure that there are no additional potential sources of contamination.
- Periodic inspections and a regular maintenance program for the supply wells will ensure their integrity and protect the aquifer from contamination.
- Through tracer or other tests, the Division may want to determine if the wastewater discharge into the tributary to Hollow Road Creek is impacting Well A or B.

Changes in Use

- The Division is required to notify MDE if new wells are to be put into service. Drilling a new well outside the current WHPA would modify the area; therefore the Water Supply Program should be notified if a new well is being proposed.

REFERENCES

Bolton, D.W., 1996, Network Description and Initial Water-Quality Data from a Statewide Ground-Water-Quality Network in Maryland: Maryland Geological Survey Report of Investigations No. 60, 167 pp.

Committee on Health Risks of Exposure to Radon, 1999, Health Effects of Exposure to Radon: BEIR VI, (http://www.epa.gov/iaq/radon/beirvi1.html).

Duigon, M.T., and J.R. Dine, 1987, Water Resources of Frederick County, Maryland, MGS Bulletin 33, 101 pp.

MDE, Water Supply Program, 1999, Maryland's Source Water Assessment Plan, 36 p.

Nutter, L.J. and E.G. Otton, 1969, Ground Water Occurrence in the Maryland Piedmont: Maryland Geological Survey Report of Investigations No. 10, 56 pp

U.S. Environmental Protection Agency, 1991, Delineation of Wellhead Protection Areas in Fractured Rocks: Office of Ground Water and Drinking Water, EPA/570/9-91-009, 144 pp.

OTHER SOURCES OF DATA

Water Appropriation and Use Permit FR1966G012
Public Water Supply Sanitary Survey Inspection Reports
MDE Water Supply Program Oracle® Database
MDE Waste Management Sites Database
Department of Natural Resources Digital Orthophoto Quarter Quadrangles for Middletown
USGS Topographic 7.5 Minute Quadrangles for Middletown
Maryland Office of Planning 2000 Frederick County Digital Land Use Map
Maryland Office of Planning 1996 Frederick County Digital Sewer Map

FIGURES

Figure 1. Fountaindale Water Sources

Base photo: DNR DOQQ
Middletown NE, SE and
Frederick NE, SE 4/8/93.

500 0 500 Feet

N

Frederick County Locator Map
(not to scale)

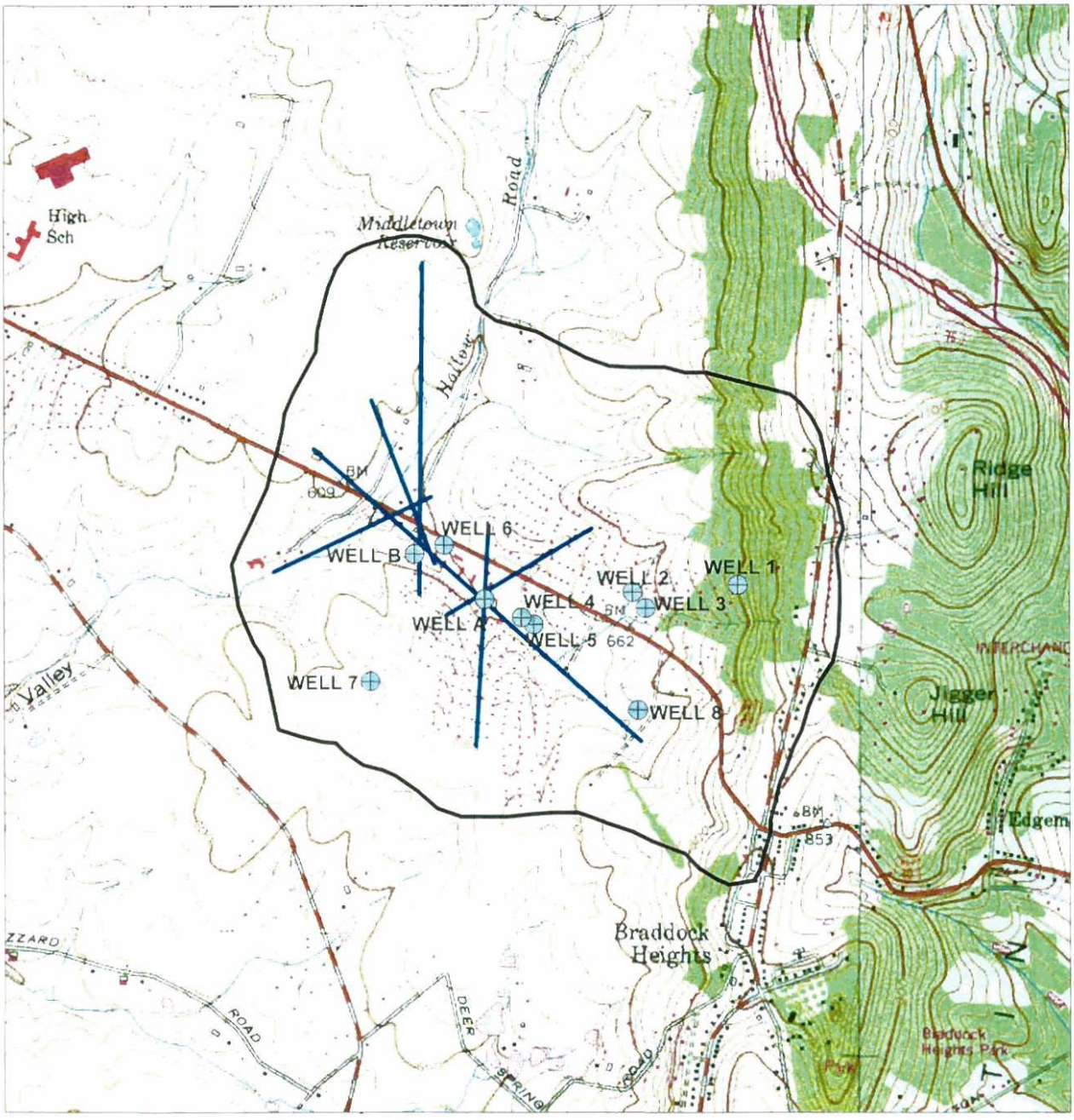


Figure 2. Fountaindale Wellhead Protection Area

Legend

- Wells
- Fracture Trace
- Wellhead Protection Area (WHPA)

1000 0 1000 2000 Feet

Base Map: USGS Topographic 7.5 Minute Quadrangle for Middletown

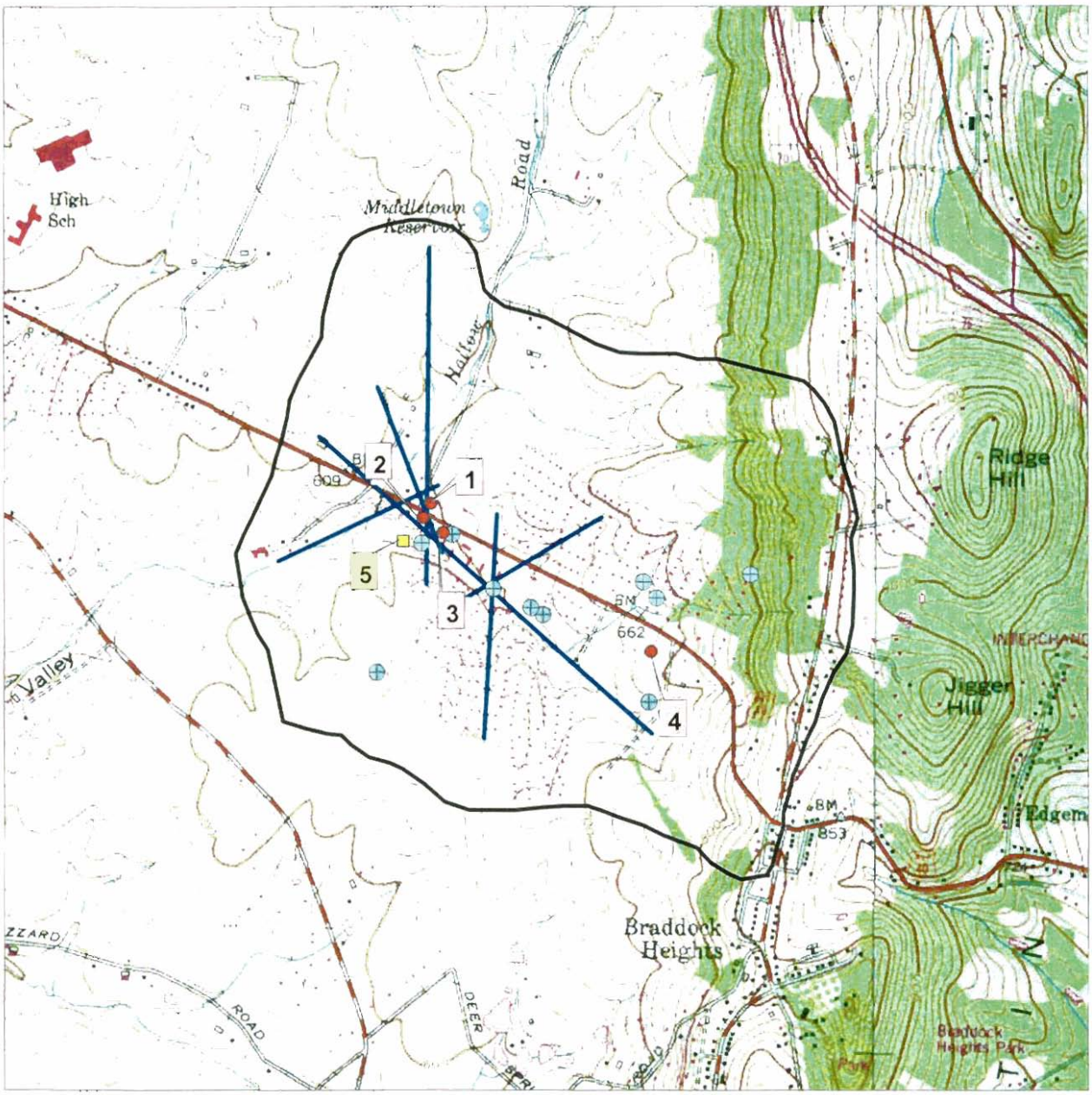


Figure 3. Fountaindale WHPA with Potential Contaminant Sources.

Legend

Wells

Fracture Trace

WHPA

Potential Contaminant Sources
(See Table 2 in text)

UST

NPDES

1000 0 1000 2000 Feet

Base Map: USGS Topographic 7.5 Minute Quadrangle for Middletown

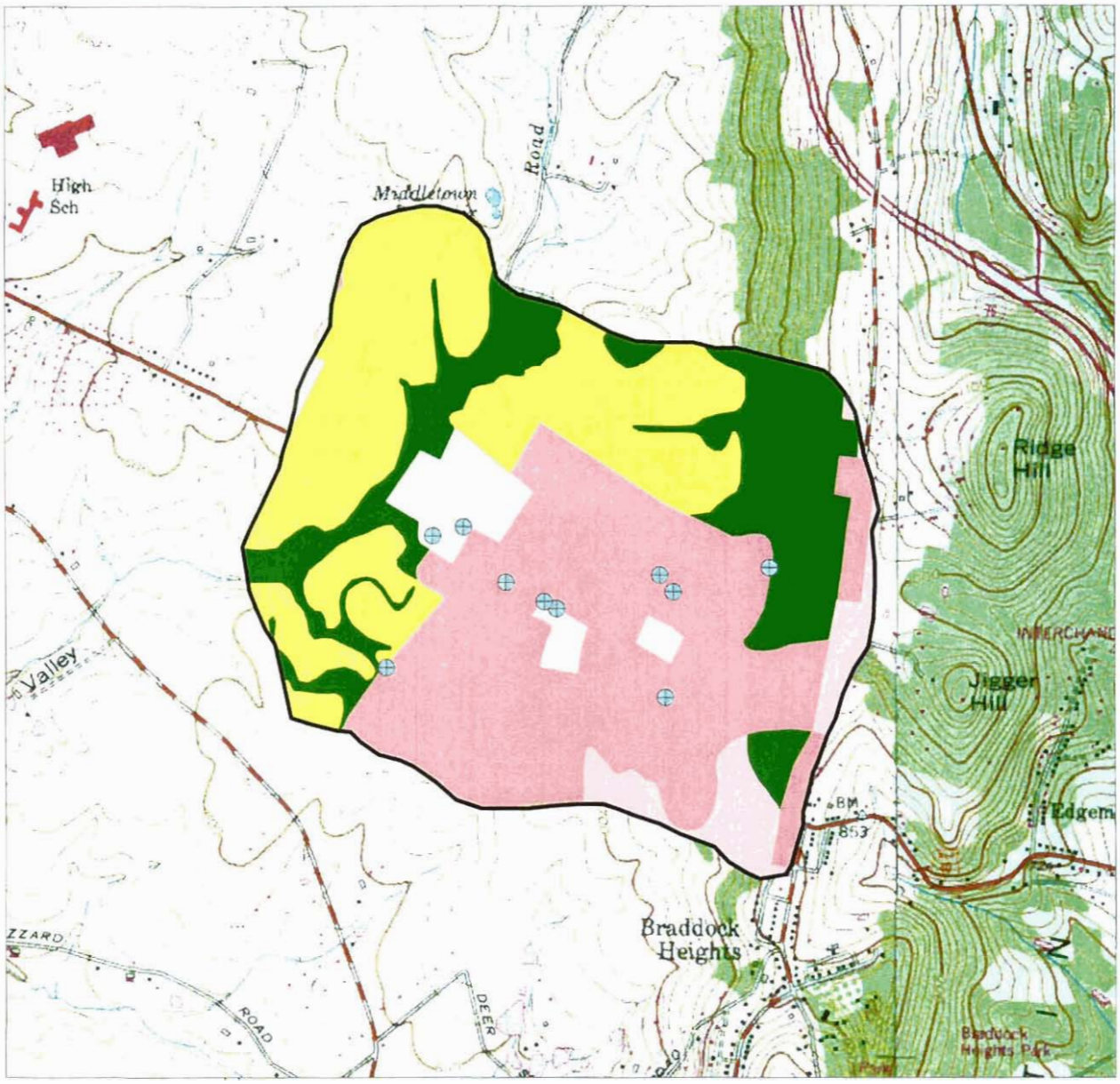


Figure 4. Land Use in the Fountaindale WHPA.

Legend

Wells

WHPA

1000 0 1000 2000 Feet

Frederick County 2000 Land Use

- Low Density Residential
- Medium Density Residential
- Commercial
- Cropland
- Forest

Base Map: USGS Topographic 7.5 Minute Quadrangle for Middletown

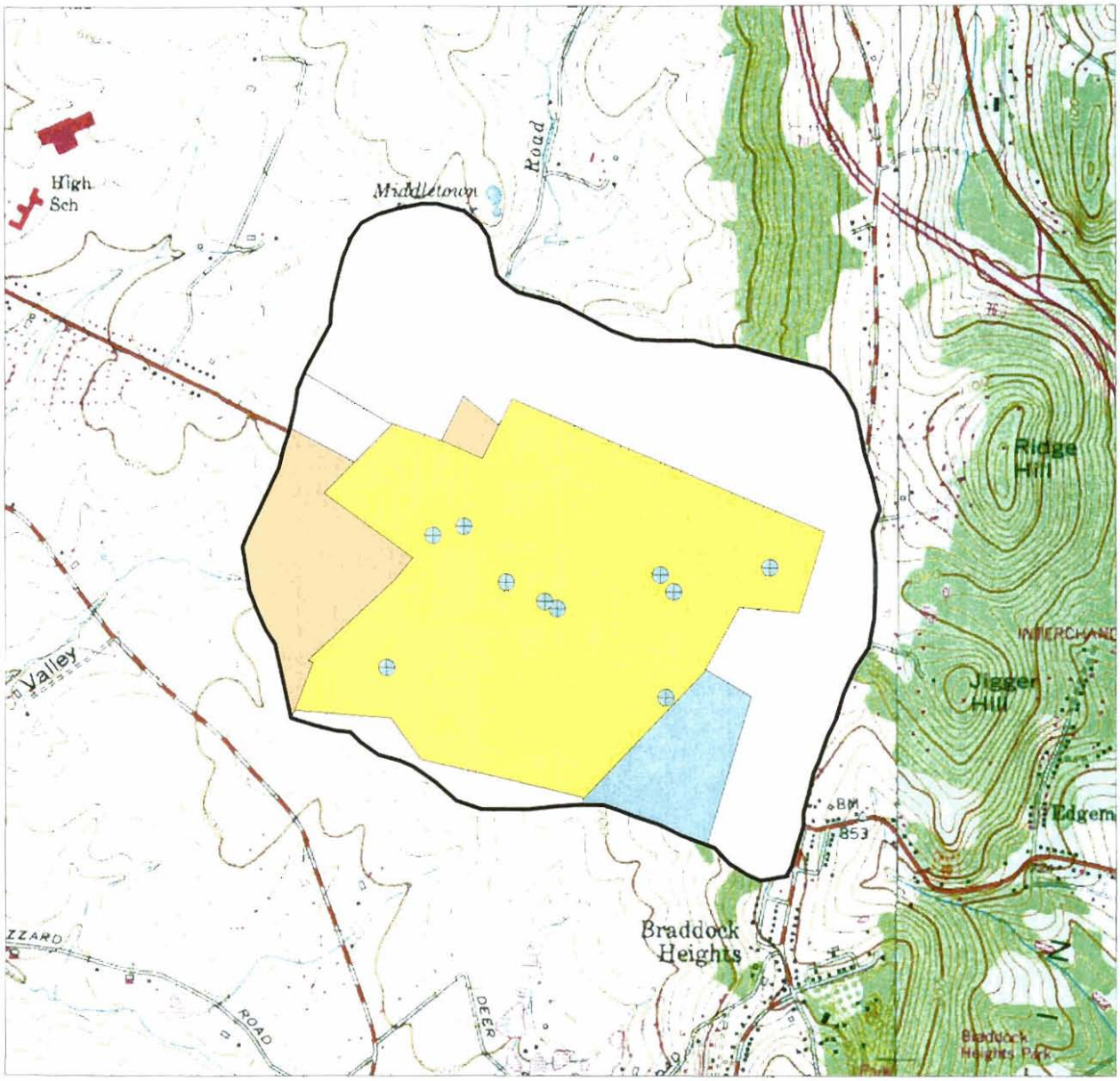


Figure 5. Sewer Service Areas in the Fountaindale WHPA.

Legend

Wells

WHPA

Frederick County Sewer Service Areas

Existing Service

3 Year Planned Service

4 to 6 Years

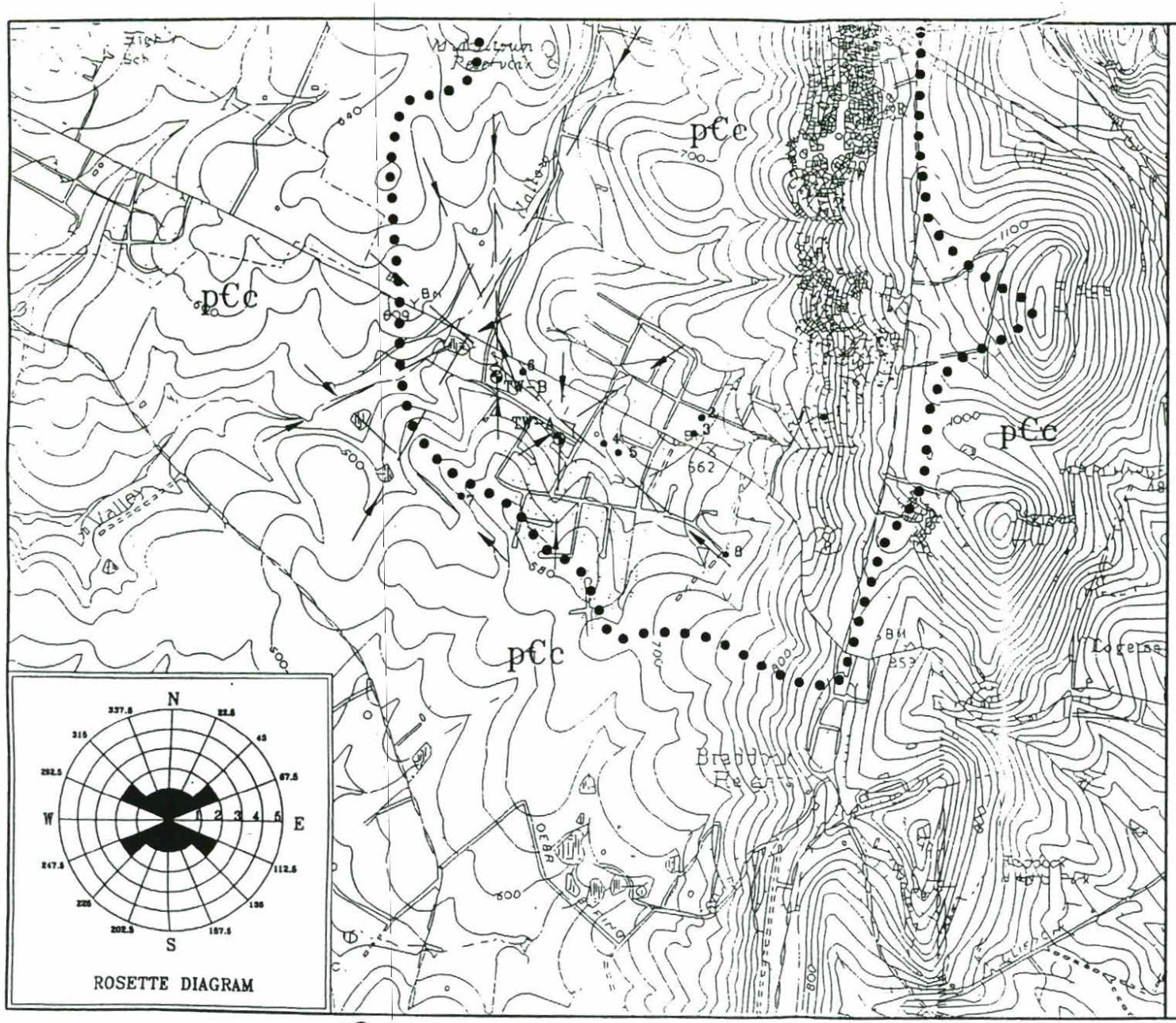
Not Planned for Service

Unknown

1000 0 1000 2000 Feet

Base Map: USGS Topographic 7.5 Minute Quadrangle for Middletown

APPENDIX



LEGEND

- TW-A — TEST WELL SITE
- 1 — EXISTING PRODUCTION WELL
- pCc — CATOCTIN METABASALT
- TOPOGRAPHIC WATER-SHED BOUNDARY
- PHOTOGEOLOGIC FRACTURE TRACE

CONTOUR INTERVAL = 20 FT.

BASE MAP TAKEN FROM THE MIDDLETOWN, AND FREDERICK, MD 7 1/2 MIN. USGS TOPOGRAPHIC QUADRANGLES (PHOTOREVISED 1979 AND 1986)

1200' 0 1200'
SCALE IN FEET

FIGURE 1

FREDERICK COUNTY
DEPARTMENT OF PUBLIC WORKS

HYDROGEOLOGIC BASE MAP
FOUNTAINDALE SERVICE AREA

drawn MDS | checked | drawing no. M97143-002-A
date 06/24/96 | approved

r.e. wright environmental, inc.
total environmental solutions
middletown, pa exton, pa westminster, md va beach, va

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