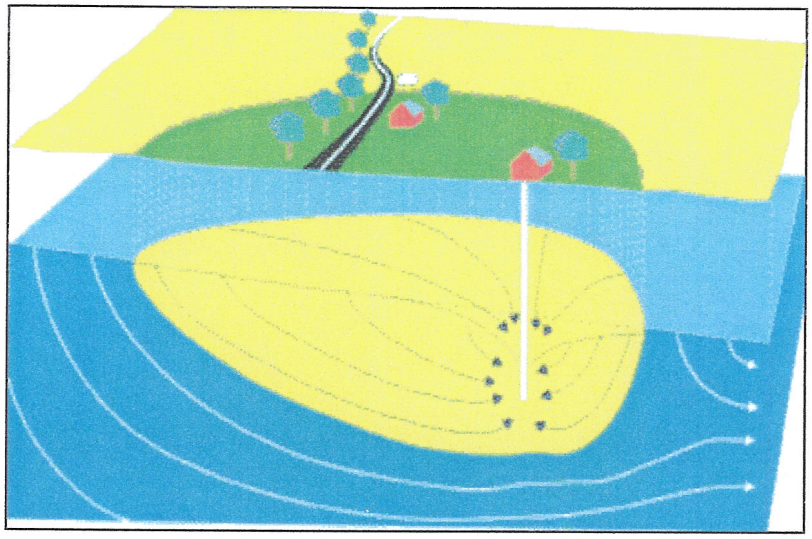
SOURCE WATER ASSESSMENT
for
CAMP FRETTERED
BALTIMORE COUNTY, MD



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SUMMARY

The Maryland Department of the Environment's (MDE's) Water Supply Program (WSP) has conducted a Source Water Assessment for Camp Frettered, a military training facility located near Reisterstown in Baltimore County, Maryland. This report delineates the area that contributes water to the well, identifies potential sources of contamination within the area and determines the susceptibility of the water supply to contamination. Recommendations for protecting the water supply conclude the report.

The source of Camp Frettered's water supply is one well in a fractured rock aquifer known as the Piney Run Formation. The aquifer appears to be unconfined at this location. The Wellhead Protection area was delineated using by the WSP using EPA-approved methods.

Point sources of contamination were sought within and near the assessment area from field inspections and MDE databases, but none were found. The Maryland Department of Planning's 2000 land use map for Baltimore County was used to identify non-point sources of contamination. Maps showing location of the well, potential sources of contamination, and land use are included at the end of this report.

The susceptibility analysis is based on a review of existing water quality data for the water system, the presence of potential sources of contamination, in the assessment area, well integrity and the inherent vulnerability of the aquifer.

It was determined that Camp Frettered's water supply is not susceptible to volatile organic compounds, synthetic organic compounds or microbiological contaminants. There may be a low susceptibility to nitrate as indicated by its frequent presence in water quality samples. There is also an unused well located on the periphery of the wellhead protection area. Although the well currently appears to be in good condition, it is a potential source of contamination to the aquifer. If the well will not be used in the future, it should be abandoned and sealed.

INTRODUCTION

The Water Supply Program has conducted a Source Water Assessment for Camp Frettered, a military training facility, which owns its own water and septic systems. Both systems are operated by Maryland Environmental Service (MES). There are about 30 permanent employees, who use about 750 gallons per day (gpd) at the camp. Biannual pumpage reports submitted to Maryland Department of the Environment (MDE) indicate actual use at the camp is about 7,500 gpd to 8,500 gpd, so over 90% of the camp's use is by transients attending the camp.

As defined as part of Maryland's Source Water Assessment Plan (SWAP), "large systems" are community and noncommunity water systems that have water appropriation and use permits with average annual appropriation permit exceeding 10,000 gpd. Camp Frettered's water appropriation and use permit allows for an average annual water use of 10,000 gpd, so the water supply has been assessed for an annual average water use of 10,000 gpd.

HYDROGEOLOGY

Camp Frettered is located southeast of the Piedmont Physiographic Province. This region is underlain crystalline igneous and metamorphic rock.

According to the 1977 Geologic Map of the Reisterstown Quadrangle, Maryland the geologic formation underlying Camp Frettered is known as the Piney Run Formation. Maryland Geological Survey describes the formation as "Fine-grained, plagioclase-muscovite-quartz schist, locally with chloritized biotite, and commonly bearing garnet. Includes 10 to 30 percent fine-grained biotite quartzite, in beds generally thinner than 10 centimeters. Locally has a "seamed" appearance due to close spaced laminae of milky quartz. Thickness about 1,500 meters. Replaces the Sykesville Formation along strike." In such rocks, water is stored in fractures and in the overlying saprolite and soils. The ground water is generally unconfined and the water table mimics the surface topography. Well yields are dependent on the number and nature of fractures penetrated by the well. Local well depths in the Piney Run Formation typically range from about 100 to 400 feet. Yields range from 3 to 60 gpm, with median yield around 11 gpm.

WELL INFORMATION

Well information for the system was obtained from the Water Supply Program's database, site visits, well completion reports and sanitary survey inspection reports. The Appendix consists of copies of the applications to drill the wells and the well completion reports. As indicated in Table 1, Camp Frettered currently has one production well and one unused well. The unused well is capped and will probably eventually be abandoned.

Table 1. Camp Frettered Well Inventory

Well #	Permit #	Total Depth	Casing Depth	Year Drilled	Pumping Rate
Well 1	BA816687	305'	21'	1987	60 gpm
Unused Well	BA881731	350'	40'	1990	10

SOURCE WATER ASSESSMENT AREA DELINEATION

For ground water systems, a Wellhead Protection Area (WHPA) is considered to be the source water assessment for the system. As defined by Maryland's SWAP, the wellhead protection area for a small public water system whose wells are completed in fractured crystalline rock is the drainage area that contributes water to the wells. This method was used to assess Camp Frettered's water supply. Figure 2 shows the 23.6-acre Wellhead Protection Area (WHPA) that was delineated.

The delineation shape accounts for surface water bodies, topography, significant land features and by using a conservative calculation of total ground water recharge during a drought. For conservative purposes, a drought condition of 400 gpd/acre or approximately 5.4 inches/year, was used to estimate the total ground water contribution area required to supply the well.

The current water appropriation and use permit for Camp Frettered allows an annual average use of 10,000 gpd. To determine the total ground water contribution during a drought, the following equation is used:

Recharge Area(in acres) = Average Annual Use(in gpd)/Drought Year Recharge

From the equation above, the total ground water contribution area during a drought is calculated to be about 25 acres. The WHPA delineated using topography is about 23.6 acres. The areas are similar, indicating that the well pumping at the permitted quantities would utilize all the recharge from this area during a drought year.

POTENTIAL SOURCES OF CONTAMINATION

Potential sources of contamination can be classified as either point or non-point sources. Examples of point sources are leaking underground storage tanks, ground and surface water discharges, landfills, animal feeding operations, and ground water contamination sites. These sites are usually associated with commercial or industrial facilities that use chemicals that may, if handled inappropriately, contaminate ground water via a discrete point location. Non-point sources are associated with land use practices, such as use of pesticides, fertilizer, animal wastes or septic systems, that lead to ground water contamination over a larger area.

Point sources of contamination were sought within and near the assessment area from field inspections and from MDE Water and Waste Management databases, but none were found. The only potential source of contamination is the unused well located on the periphery of the WHPA. The well is currently in good condition, however, as it could function as a direct conduit for contaminants if it falls out of repair or is damaged. Figure 2 shows the location of the unused well with respect to the WHPA.

The Maryland Office of Planning's 2000 land use map for Baltimore County was used to identify non-point sources of contamination (Figure 2). Two land use categories were identified within the delineated WHPA: commercial/institutional and forest.

Table 2. Land Use Summary for the Wellhead Protection Area

Land Use Categories	Total Area	Percentage of WHPA
Commercial	15.0	64%
Forest	8.6	36%

A review of Maryland Department of State Planning's Baltimore County Sewer Map shows that Camp Frettered and the entire WHPA is in an area with no planned sewer service. Camp Frettered's disposes of its waste water via three septic fields, none of which are in the WHPA. All surrounding properties are also served by private septic systems, but none are in the WHPA.

WATER QUALITY DATA

Water quality data from the Water Supply Program's (WSP) database was reviewed for Safe Water Drinking Act (SWDA) contaminants. In accordance with Maryland's SWAP, data submitted by the owner/operator of the system was compared with the Maximum Contaminant Levels (MCLs). If monitoring data is greater than 50% of the MCL, the assessment will describe the typical sources of that contaminant and locate the possible sources of the contaminant for this site. Camp Frettered's only water treatment is pH adjustment and gaseous chlorination.

Inorganic Compounds (IOCs)

Inorganic compounds (IOC's) have been measured 15 times but none have been detected in quantities greater than 50% of the MCL. Low levels of barium, selenium and sulfate have been detected on various occasions. Their presence is generally attributed to leaching of naturally occurring minerals in the aquifer rocks.

Nitrate levels ranging from 0 to 2.4 were detected in inorganic sampling from 1994 to present. Even though nitrates have never exceeded 50% of the MCL of 10 ppm, their consistent presence is of note. Their presence is attributed to use of fertilizers for landscaping or other purposes on land within the WHPA. There is no apparent trend in the data and the levels are well below established regulatory standards.

Volatile Organic Compounds (VOCs)

VOCs have been sampled on ten occasions from 1995 to 2006. Chloroform, dibromochloro methane, bromo dichloro methane and bromoform were detected. Table 3 indicates the dates, compounds and amounts that were detected. All four compounds are trihalomethanes, which are disinfection by-products formed by the reaction of chlorine used for disinfection and organic material in the water supply and are not related to ground water contamination.

Table 3. Table of VOC Detections

Date	VOC	PPM
12/5/1995	bromo dichloro methane	4.8
	chloroform	8.8
9/24/1996	chloroform	3.5
12/10/1997	bromo dichloro methane	2.0
	bromoform	0.8
	chloroform	2.0
	dibromo chloro methane	3.0
12/14/1998	bromo dichloro methane	2.6
	chloroform	3.2
	dibromo chloro methane	1.8
11/22/1999	bromo dichloro methane	7.2
	bromoform	0.7
	chloroform	11.0
	dibromo chloro methane	4.1
12/23/2002	bromo dichloro methane	1.9
	chloroform	2.6
	dibromo chloro methane	1.3
6/27/2005	chloroform	4.5
	dibromo chloro methane	1.7
9/2005	bromo dichloro methane	0.7
	chloroform	0.6
	dibromo chloro methane	0.7
2/7/2006	bromo dichloro methane	2.1
	chloroform	6.1
	dibromo chloro methane	1.0

Synthetic Organic Contaminants (SOCs)

Only one synthetic organic compound, di(ethylhexyl)phthalate, has been detected in the monitoring conducted at this water system. It was detected at 1.7 ppm on 6/28/1999 and 1.7 ppm on 6/27/2005. The phthalate was detected in the laboratory blanks on the same date. Hence, this SOC is not believed to represent the water quality.

Microbiological Contaminants

Raw water bacteriological sampling following rainfall of 1.1 inches was conducted in April 2004 to determine whether the supply well was under the influence of surface water. No coliform bacteria were detected in the water supply.

Routine bacteriological monitoring, which measures total coliform bacteria, is conducted in the finished water for each non transient non community water system on a quarterly basis. Total coliform bacteria are not pathogenic but are used as an indicator organism for other disease-causing microorganisms. In September 1993, a positive sample was obtained. No coliform bacteria have been documented since.

SUSCEPTIBILITY ANALYSIS

The well serving Camp Fretered wase completed in a unconfined crystalline rock aquifer. Wells completed in unconfined aquifers are generally more susceptible to contamination from surface sources. The susceptibility of source water to contamination is based on the following criteria: 1) the presence of natural and anthropogenic contaminant sources within the WHPA; 2) water quality data; 3) well integrity and 4) aquifer conditions. The susceptibility of Camp Frettered's water supply to various contaminants is shown in Table 5.

Table 4. Susceptibility Chart for Camp Frettered Water Supply

CONTAMINANT TYPE	Are Contaminant Sources present in the WHPA?	Are Contaminants detected in WQ samples at 50% of the MCL?	Is Well Integrity a Factor?	Is the Aquifer Vulnerable?	Is the System Susceptible to the Contaminant?
Inorganic Compounds)	NO	NO	NO	YES	NO
Volatile Organic Compounds	NO	NO	NO	YES	NO
Synthetic Organic Compounds	NO	NO	NO	YES	NO
Microbiological Contaminants	YES	NO	NO	YES	NO

Inorganic Compounds (IOCs)

No IOC's were reported above the 50% MCL in any of the water samples analyzed. The water supply at Camp Frettered is not susceptible to IOC's.

Volatile Organic Compounds (VOCs)

No VOC's greater than 50% MCL have been reported in the WHPA. Camp Frettered's water supply is not considered susceptible to VOCs.

Synthetic Organic Compounds (SOCs)

No SOCs have been detected the Camp Frettered water supply. The water supply is not considered susceptible to SOCs.

Microbiological Contaminants

No microbiological contaminants have been detected, however the measurements were made using treated water. The WHPA has a low susceptibility to microbiological contaminants.

MANAGEMENT OF SOURCE WATER ASSESSMENT AREA

The well serving Camp Frettered appears to be in good condition. Although nitrates are low, they are present and may be a result of local agricultural practices or landscaping practices. Recommendations for maintaining the integrity of this system are listed below:

- Continue maintenance and protection of the well.
- If the unused well will not be used again, it needs to be abandoned and sealed by a licensed well driller.
- Continue monitoring for VOCs, IOCs and SOCs.
- Annual sampling for microbiological contaminants is recommended. It is a good indicator of the integrity of the wellhead.
- Any increase in pumpage or addition of new wells to the system may require extension of the WHPA. The system is required to contact the Water Supply Program when an increase in pumpage is applied for when wells are being considered.
- All water systems should have a Contingency Plan their water system. Comar 26.04.91.22 requires all community water systems to prepare and submit for approval a plan for providing a safe and adequate drinking water under emergency conditions.

REFERENCES

Duigon, M.T., & M.T.Crowley, 1977, Hydrogeologic Quadrangle Atlas No.7, Reisterstown Quadrangle: Geology and Hydrogeology, Maryland Geological Survey, 6p.

Maryland Department of the Environment, Water Supply Program, 1999, Maryland's Source Water Assessment Plan, 36p.

Maryland Department of the Environment, Water Supply Program, 2002, Source Water Assessment for Small Systems in Cecil County, 17p.

FIGURES

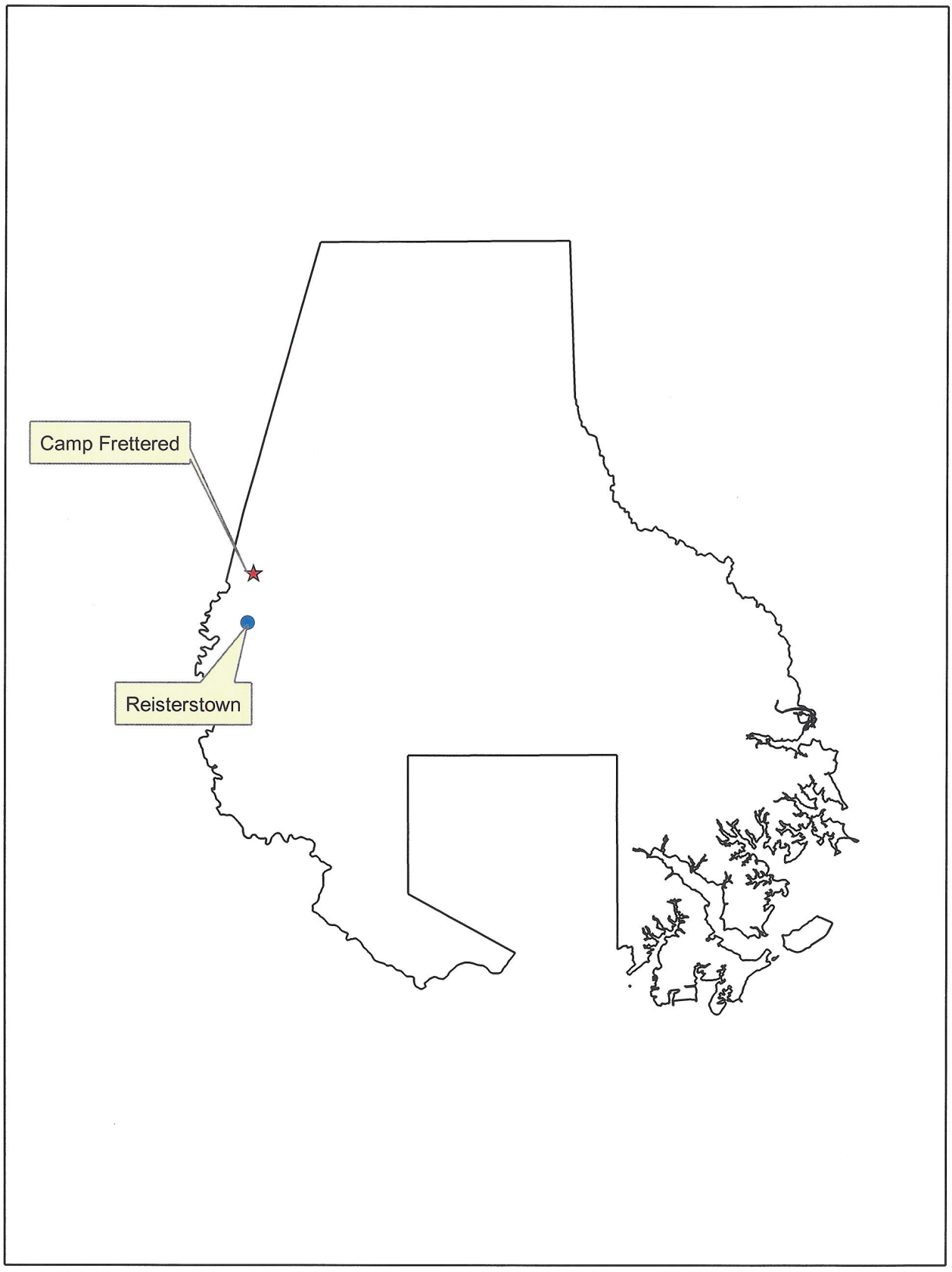

Figure 1. Location Map

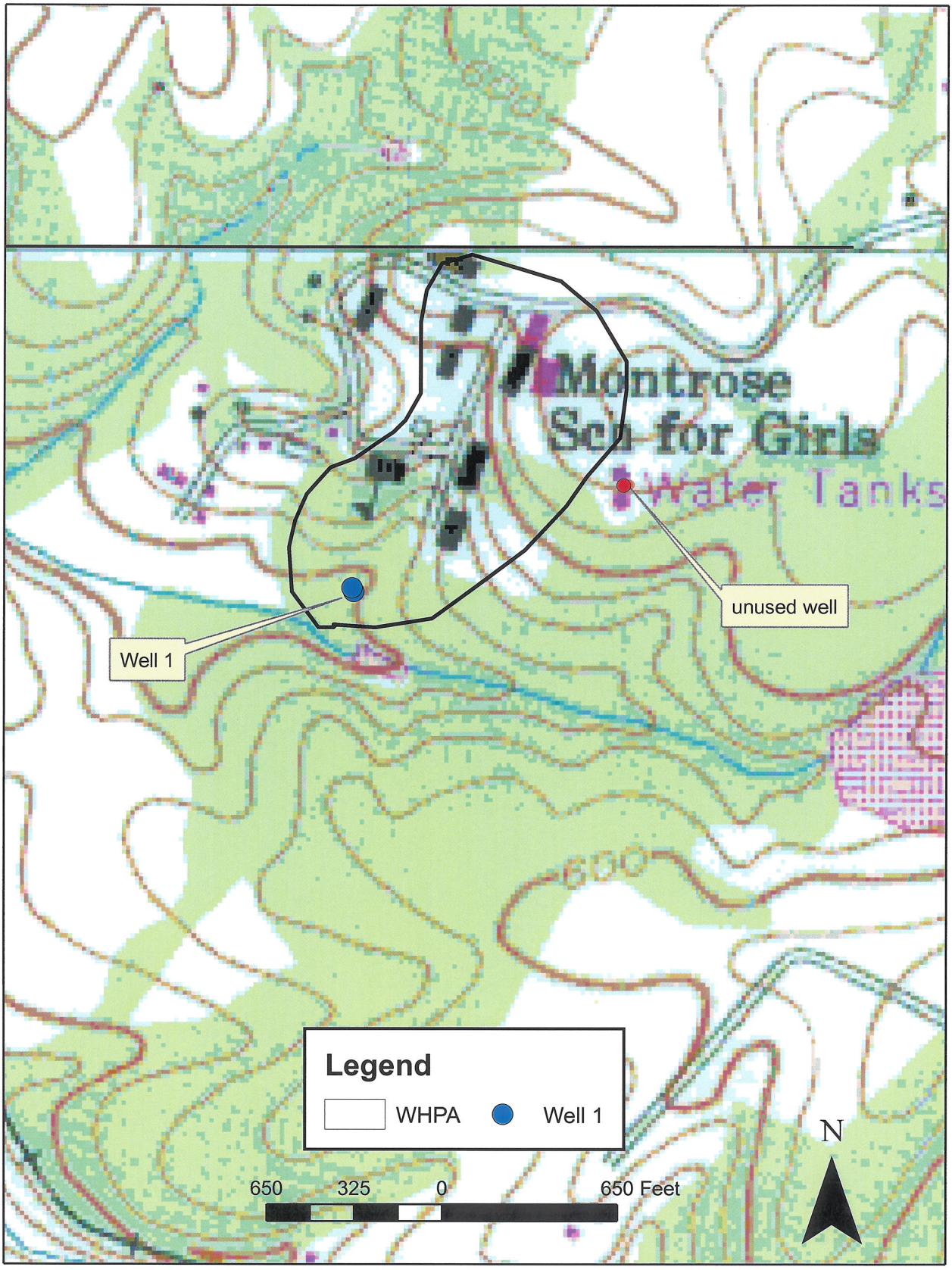

Figure 2. Wellhead Protection Area

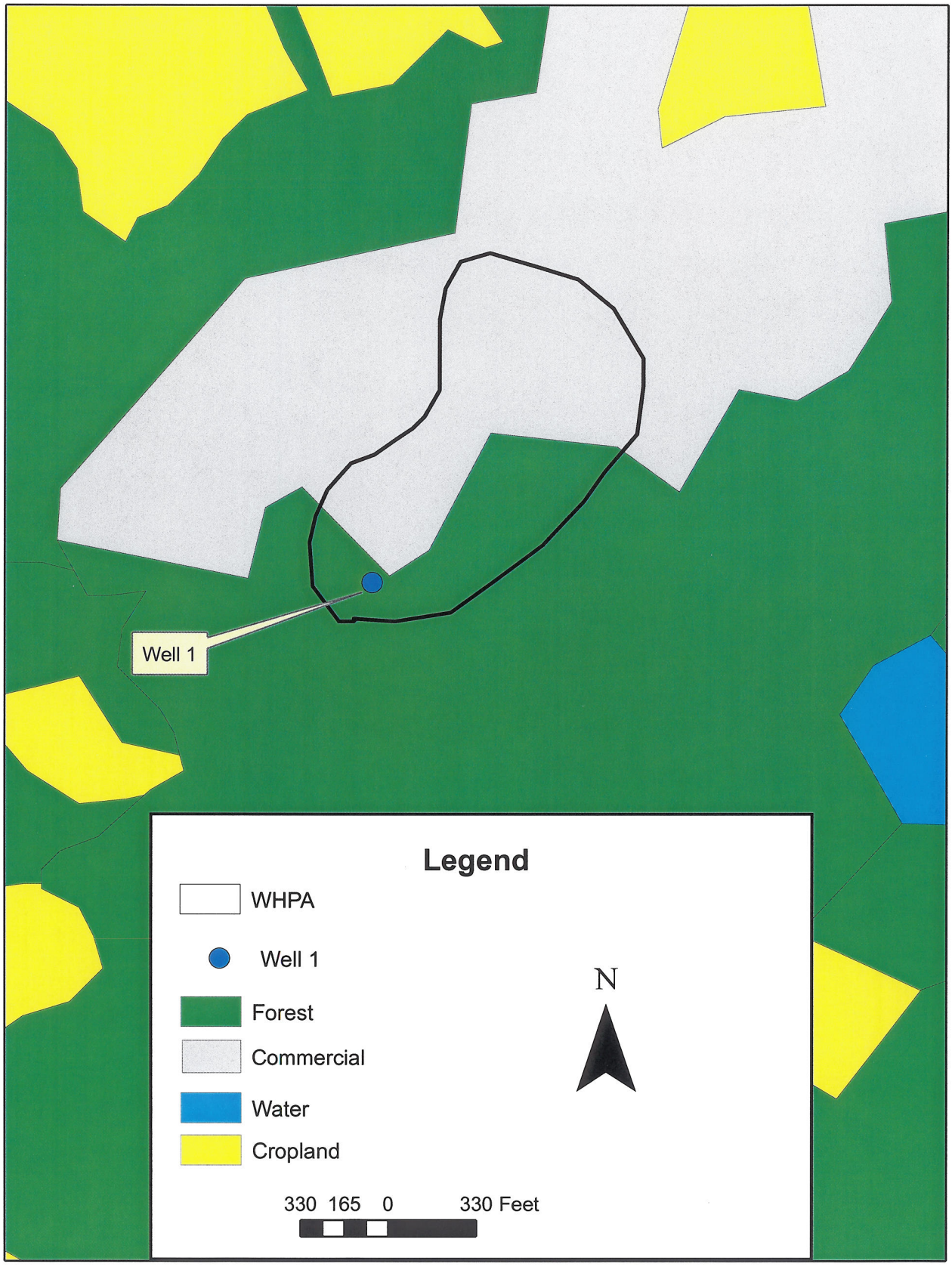

Figure 3. Land Use Map

APPENDIX