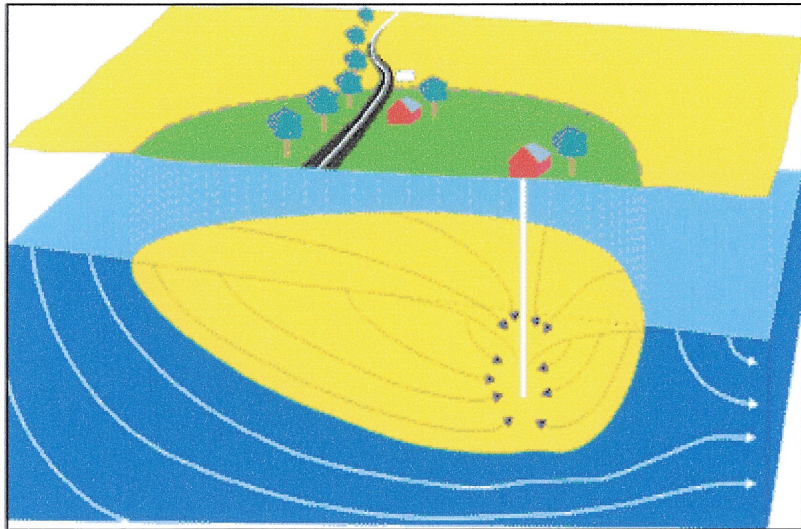


SOURCE WATER ASSESSMENT
for
THE MEMBER'S CLUB AT FOUR STREAMS
MONTGOMERY COUNTY, MD



Prepared By
Water Management Administration
Water Supply Program
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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for Member's Club at Four Streams. The required components of this report as described in Maryland's Source Water Assessment Plan (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 the Member's Club at Four Streams water supply is an unconfined fractured rock aquifer, known as the Ijamsville Phyllite. The system currently uses one well to obtain its drinking water. The Source Water Assessment Area was delineated by the Water Supply Program using U.S. EPA approved methods specifically designed for each source.

Potential sources of contamination within the assessment area were identified based on site visits, database reviews and land use maps. Well information and water quality data were also reviewed. Figures showing land uses and potential contaminant sources within the Source Water Assessment Area and an aerial photograph of the well location are enclosed at the end of the report.

The susceptibility analysis for the Member's Club at Four Streams water supply is based on a review of the water quality data, potential sources of contamination, aquifer characteristics, and well integrity. It was determined that the Member's Club at Four Streams water supply is susceptible to contamination by nitrate, but not to volatile organic compounds, synthetic organic compounds, microbiological contaminants, or other inorganic compounds.

INTRODUCTION

The Water Supply Program has conducted a source water assessment for the Member's Club at Four Streams (Member's Club) water supply located approximately 4 miles north of Poolesville in Montgomery County (figure 1). The Member's Club water supply is considered a nontransient noncommunity (NTNC) water system, which is defined as a public water system that regularly serves at least 25 of the same individuals over six months per year. The Member's Club is an 18-hole championship golf course with 37 employees and has a clubhouse that can seat unto 100 members. The facility owns and operates its own water system.

WELL INFORMATION

The drinking water for the Member's Club is supplied by one well. The facility also has three other wells for irrigation of the golf course. Well information was researched from the Water Supply Program's database, site visits, well completion reports, sanitary survey inspection reports and published reports. The supply well was drilled in 1997 after the implementation of State's well construction regulations in 1973 and should be compliance with current standards for grouting. Well information is shown in Table 1 below.

SOURCE ID	SOURCE NAME	PERMIT NO	TOTAL DEPTH (ft)	CASING DEPTH (ft)	YEAR DRILLED
01	Four Streams Well1	MO940395	150	120	1997

Table 1. Member's Club at Four Streams Well Information

Member's Club has a Water Appropriation Permit that allows it to use an average of 70,000 gallons per day (gpd) and 270,000 gpd in the month of maximum use of ground water. The ground water is used for golf course irrigation and clubhouse use. The facility also has another Water Appropriation Permit to withdraw water from two ponds on its property for golf course irrigation.

HYDROGEOLOGY

Member's Club is located in the Piedmont physiographic province and is underlain primarily by the Ijamsville Phyllite. Smaller, western portions of the property are underlain by the Sam's Metabasalt and the New Oxford Formation. The supply well is drilled into the Ijamsville Phyllite which is an unconfined, fractured rock aquifer and is described as a gray and green foliated rock composed mainly of very fine mica and chlorite (Froelich, 1975). In this type of setting, the underlying crystalline rocks have negligible primary porosity and permeability and ground water is stored in and moves through fractures in the rocks. Ground water flow rates depend upon the openness of the fractures and their degree of interconnection. Unconsolidated overburden (saprolite) above the crystalline rock frequently has

much greater primary porosity and permeability than the rock has, allowing additional ground water to be stored (Duigon, 1994). Ground water systems in crystalline rock tend to be localized and flow is within topographic divides towards the nearest perennial streams. (Bolton, 1998).

SOURCE WATER ASSESSMENT AREA DELINEATION

For ground water systems, a Wellhead Protection Area (WHPA) is considered to be the source water assessment area for the system. Based on a hydrogeologic report (C.E. M., 1996) submitted to MDE for the Member's Club appropriation permit, and a review of the facility's water use, 6,000 gpd was determined to be the amount used for the clubhouse. The source water assessment area for public water systems with an average appropriation amount of less than 10,000 gpd and drawing from fractured-rock aquifers is a fixed radius of 1000 ft around the supply well (MD SWAP, 1999). This radius is based on calculating the land area needed to provide a yield of 10,000 gpd assuming drought recharge conditions of 400gpd/acre, and a safety factor. This method was used to delineate the WHPA for Member's Club. The total area of the WHPA is 72.16 acres.

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, ground water discharge permits, large scale feeding operations and Superfund sites. These sites are generally associated with commercial or industrial facilities that use chemical substances that may, if inappropriately handled, contaminate ground water via discrete point location. Non-point sources of contamination are associated with certain types of land use practices such as the 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 as well as a field survey revealed no point sources of contamination in the WHPA.

Non-Point Sources

The Maryland Department of Planning's 2002 digital land use map for Montgomery County was used to determine the predominant types of land use in the WHPA (figure 3). Table 2 shows the land use categories within the Member's Club WHPA. Open Urban Land makes up the largest portion of the WHPA (86.9%) which represents golf course usage.

LAND USE CATEGORIES	TOTAL AREA	PERCENTAGE
	(acres)	OF WHPA
Open Urban Land	62.72	86.9
Forest	5.83	8.1
Water	3.61	5.0
Total	72.16	100.00

Table 2. Land Use Summary for the Member's Club WHPA.

Landscaping and maintenance of the golf course can contribute nitrates to the ground water. Such activities are also a potential source of SOCs and IOCs depending on the type of pesticides used.

Maryland Department of Planning's 2004 digital Montgomery County Sewer was used to determine the sewer service area categories in the WHPA. The entire WHPA and the adjacent properties are designated for no planned sewer service. Member's Club has a septic system for wastewater disposal located in the WHPA downgradient of the supply well (see figure 3) and is therefore less likely to affect the supply well. Onsite septic systems are sources of nitrogen compounds and potentially sources of microbial pathogens.

WATER QUALITY DATA

Water Quality data was reviewed from the Water Supply Program's database and system files for Safe Drinking Water Act 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 at or greater than 50% of a MCL, this assessment will describe the sources of such a contaminant and, if possible, locate the specific sources which may be the cause of the elevated contaminant level. The Member's Club water system treats its raw water before distribution. The two treatment processes used are pH adjustment (calcite filters) for corrosion control and ion exchange (water softener). It was not clear from the records if the softeners are for softening the water or from iron removal.

A review of the monitoring data since 1998 for Member's Club' water supply indicates that it meets the current drinking water standards. The water quality sampling results are summarized in Table 3

PLANT NO	Nitrate		SOCs		VOCs		IOCs (except nitrate)	
	No. of Samples Collected	No. of samples > 50% MCL	No. of Samples Collected	No. of samples > 50% MCL	No. of Samples Collected	No. of samples > 50% MCL	No. of Samples Collected	No. of samples > 50% MCL
01	12	2	1	0	5	0	1	0

Table 3. Summary of Water Quality Samples for the Member's Club' Water Supply.

Inorganic Compounds (IOCs)

Nitrate was the only IOC detected above 50% of the MCL in the Member's Club water supply. Nitrate has an MCL of 10 mg/l and has been detected two times at concentrations above 50% of the MCL. These detections are shown in Table 4. Nitrate has also been detected several times at levels below 50% of the MCL.

CONTAMINANT NAME	MCL (mg/l)	SAMPLE DATE	RESULT (mg/l)
NITRATE	10	16-Jun-98	5.8
NITRATE	10	6-Jan-00	5.8

Table 4. Inorganic Compounds detected above 50% of the MCL

Volatile Organic Compounds (VOCs)

No VOCs have been detected in the Member's Club water supply

Synthetic Organic Compounds (SOCs)

One sample was collected for SOC's on February 19, 2004. The only SOC detected was di(ethylhexyl)phthalate at 0.9ppb. The MCL for this SOC is 6 ppb. This SOC was also detected in the laboratory blank on the same date and therefore does not represent the water quality of the Member's Club water supply.

Microbiological Contaminants

Ground water under the influence of surface water (GWUDI) testing was conducted for the Member's Club well. The well was classified as a moderate risk source to surface water influence. As a result the system was required to collect raw water samples for bacteria (total and fecal coliform). No coliform bacteria were detected in the raw water sample. All nontransient noncommunity systems are required to conduct quarterly routine bacteriological sampling for their water supply as required by the Safe Drinking Water Act. These samples are generally collected from finished (treated) water, which may not be indicative of the source water conditions. Out of the thirteen routine bacteriological samples collected for the Member's Club water supply have shown any coliform detection, total coliform was detected in a sample collected on September 2004. Follow-up samples did not indicate the presence of total coliform.

SUSCEPTIBILITY ANALYSIS

The Member's Club' well obtains water from an unconfined fractured-rock aquifer. Wells in unconfined aquifers are generally vulnerable to any activity on the land surface that occurs within the WHPA. Therefore, managing this area to

minimize the risk to the supply and continued routine monitoring of contaminants is essential in assuring a safe drinking water supply. The susceptibility of the wells to contamination is determined for each group of contaminants based on the following criteria: (1) available water quality data, (2) presence of potential contaminant sources in the WHPA, (3) aquifer characteristics, (4) well integrity, and (5) the likelihood of change to the natural conditions.

In the non-carbonate rocks of 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 from microbial contamination. Properly constructed wells with no potential sources of contamination in their WHPA should be well protected from contamination. The susceptibility of the water supply to the various types of contaminants is summarized in Table 5.

Inorganic Compounds (IOCs)

Nitrate has been detected two times at levels above 50% of the MCL in the Member's Club water supply (table 4). A review of the nitrate data shows that nitrate levels appear to be dropping off. The average of the past 9 samples is 3.5 mg/l. Sources of nitrate can generally be traced to land use. Fertilizer applied to the golf course maybe a source of nitrate loading in ground water. Certain pesticides can also be a source of inorganic compounds such as arsenic. In addition, the onsite septic system for wastewater disposal may also be source of nitrate in the ground water.

Based on above analysis the Member's Club water supply **is** susceptible to contamination by nitrate but **not** to other inorganic compounds.

Volatile Organic Compounds (VOCs)

No VOCs have been detected in the Member's Club water supply. No potential sources of VOC contamination have been identified in the WHPA.

Based on the above discussion, the Member's Club water supply **is not** susceptible to VOC contamination.

Synthetic Organic Compounds (SOCs)

No SOC's have been detected above 50% of the MCL in the Member's Club water supply. Application of pesticides for golf course maintenance may be a source of SOC's. Based on the very limited data available the Member's Club supply well **is not** susceptible to SOC contamination

Microbiological Contaminants

Based on raw water bacteriological data the Member's Club well was determined not to be GWUDI. Total coliform bacteria were only detected one time during routine bacteriological sampling and were attributed to the kitchen sink and not the water supply.

Based on the above discussion, the Member's Club water supply is **not** susceptible to microbiological contaminants.

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
Nitrate	YES	YES	NO	YES	YES
Inorganic Compounds (except nitrate)	NO	NO	NO	YES	NO
Volatile Organic Compounds	NO	NO	NO	YES	NO
Synthetic Organic Compounds	YES	NO	NO	YES	NO
Microbiological Contaminants	YES	NO	NO	YES	NO

Table 5. Susceptibility Summary for the Member's Club water supply.

MANAGEMENT OF THE WHPA

Contaminant Source Inventory/Well Inspection

- Periodic inspections and a regular maintenance program for the supply well and irrigation wells will ensure their integrity and protect the water supply from microbial contamination.
- Ensure that any storage of pesticides and fertilizers does not present a risk to ground water.
- Ensure that pesticide and fertilizer application in golf course and other areas in the property are according to best management practices.
- Arsenic containing compounds are not recommended for application as these have affected ground water quality in other areas.

Cooperative Efforts with Other Agencies

- Work closely with Montgomery County Health Department to identify any unused wells in the WHPA and to ensure that they are abandoned and sealed in compliance with the State's well construction standard
- Work with the local Soil Conservation District or Cooperative Extension to implement Best Management Practices for the golf course maintenance.

Monitoring

- Continue to monitor for all Safe Drinking Water Act contaminants as required by MDE.

- Carefully monitoring the nitrate data to determine whether the decreasing levels continue or increase with time.

Changes in Use

- Any increase in pumpage or addition of new wells to the system may require revision of the WHPA. The system is required to contact the Water Supply Program when an increase pumpage is applied for or when new wells are being considered.

REFERENCES

- Bolton, David 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 p.
- Chesapeake Environmental Management (CEM) Inc., 1996, Water Resources Availability and Impact Assessment, Four Streams Golf Club, Montgomery County, Maryland, 28 p.
- Dingman, R. J., and Meyer G. M., 1954, The Water Resources of Howard and Montgomery Counties: Maryland Department of Geology, Mines and Water Resources Bulletin 14, 260p.
- Froelich, A.J., 1975, Bedrock Map of Montgomery County, Maryland: U.S. Geological Survey Map I-920-D.
- Maryland Department of the Environment, Water Supply Program, 1999, Maryland's Source Water Assessment Plan, 36 p.
- Nutter, L.J., and Otton, E.G., 1969, Ground-Water Occurrence in the Maryland Piedmont: Maryland Geological Survey Report of Investigations No. 10, 56 p
- U.S. Environmental Protection Agency, 1991, Delineation of Wellhead Protection Areas in Fractured Rocks: Office of Water and Drinking Water, EPA/570/9-91-009, 144 p.

OTHER SOURCES OF DATA

Water Appropriation and Use Permit: MO1999G009
Public Water Supply Inspection Reports
MDE Water Supply Program Oracle Database
MDE Waste Management Sites Database
Department of Natural Resources Digital Orthophoto Quarter Quadrangle: Poolesville- SE (1993)
USGS Topographic 7.5 Minute Poolesville Quadrangle
Maryland Department of Planning 2002 Montgomery County Land Use Map
Maryland Department of Planning 2004 Montgomery County Sewer Map

FIGURES

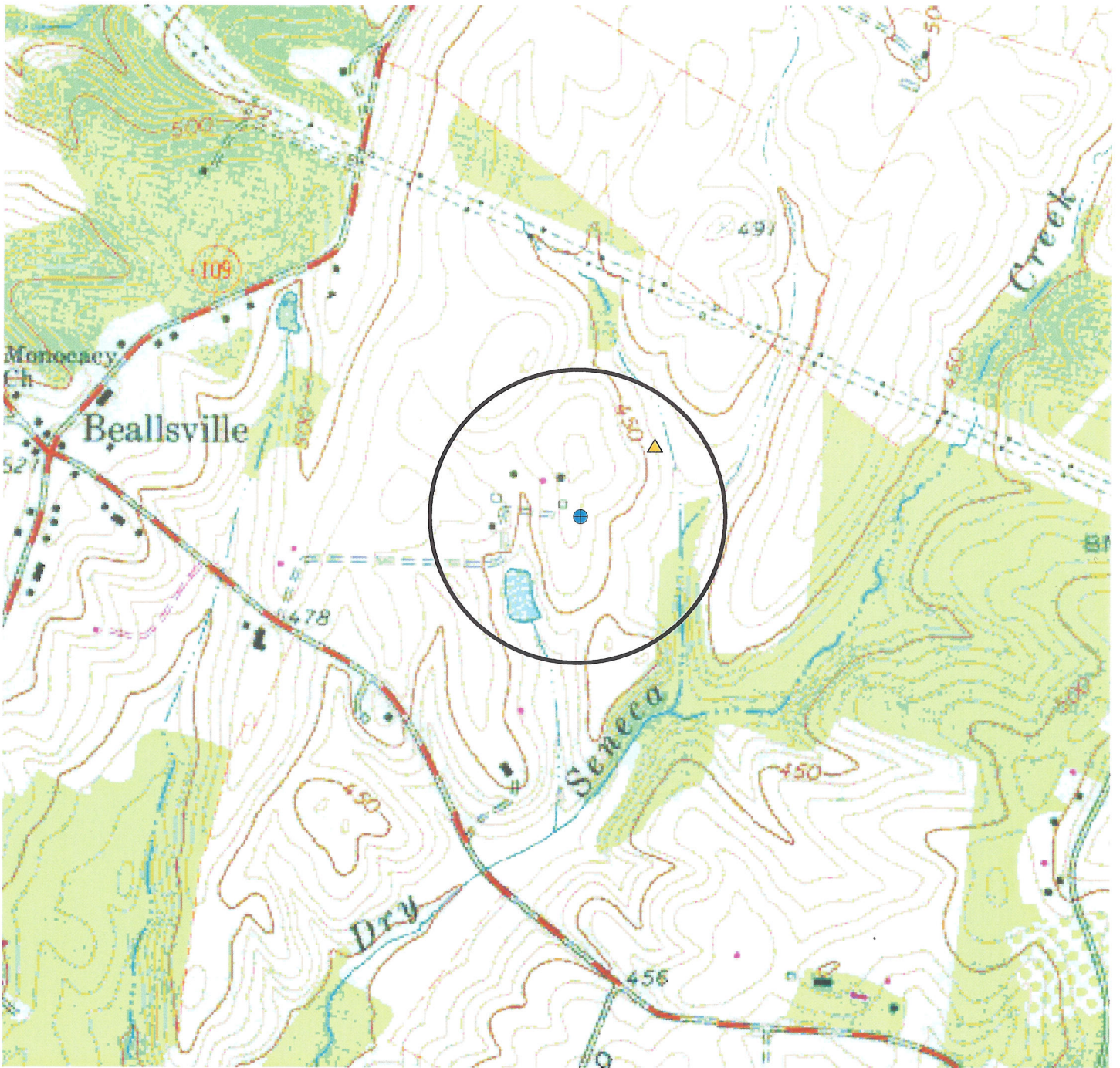
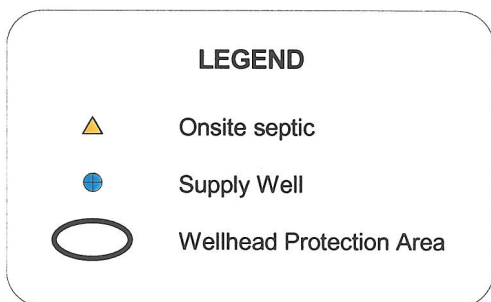


Figure 2. Wellhead Protection Area for The Member's Club a with Potential Contaminant Sources



Base Map: USGS 7.5 minute Topographic Quadrangle - Poolesville

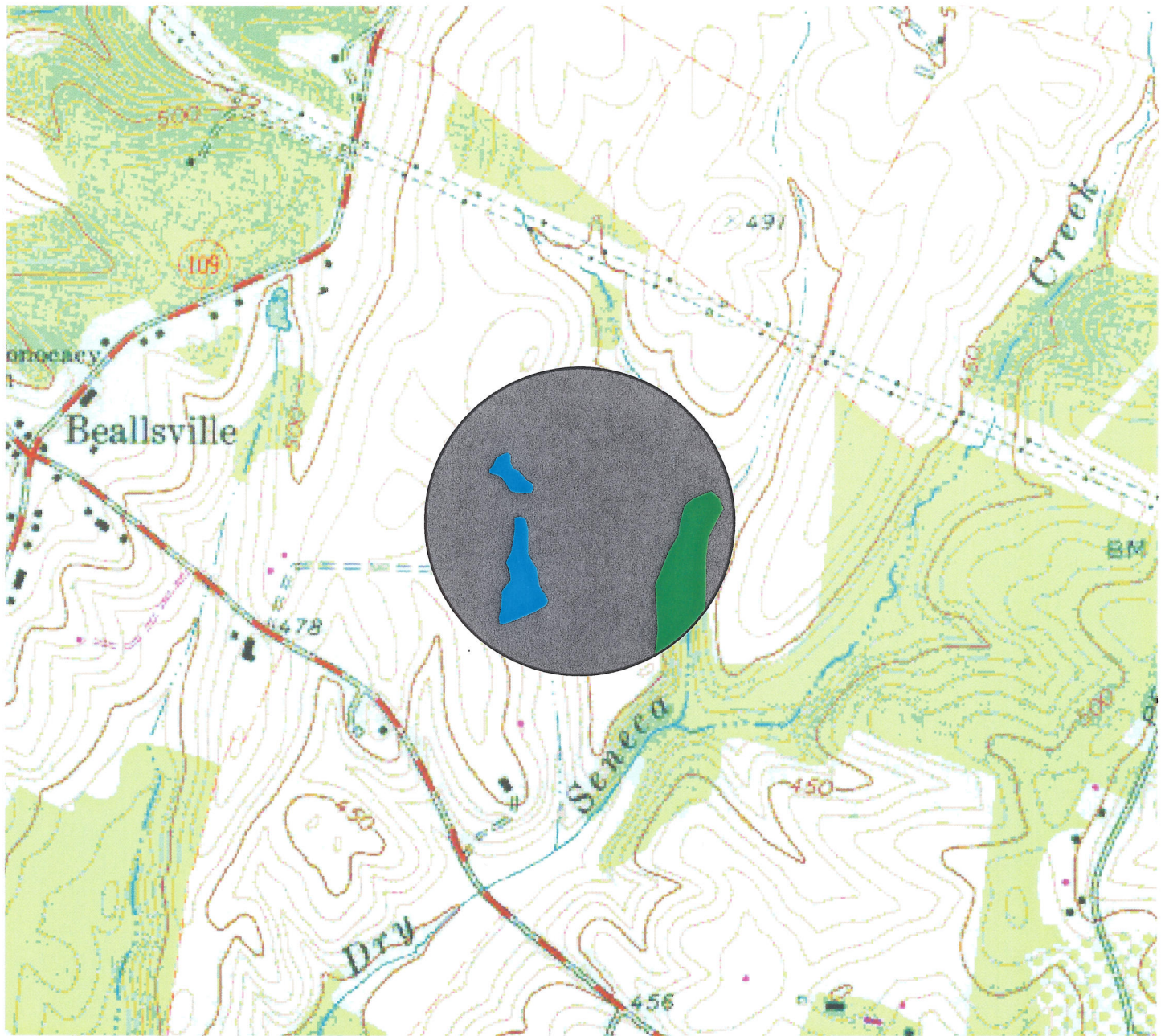
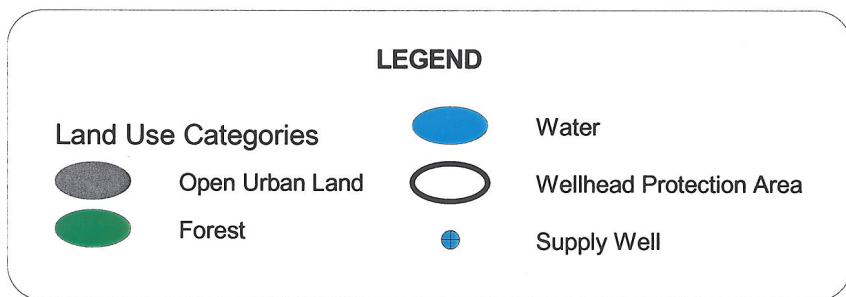


Figure 3. Land Use within the Wellhead Protection Area for The Member's Club at Four Streams



Base Map: USGS 7.5 minuter Topographic Quadrangle- Poolesville
 Source: MD Dept. of Planning Land Use Map (2002)