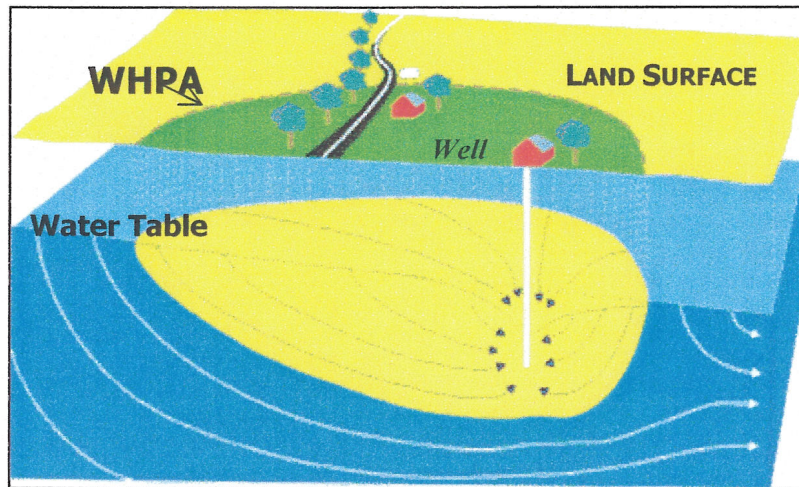


SOURCE WATER ASSESSMENT

for

FAHRNEY-KEEDY HOME AND VILLAGE

Washington County, MD



Prepared By

**WATER MANAGEMENT ADMINISTRATION
Water Supply Program**

June, 2005



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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for the Fahrney-Keedy Home and Village water system. 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 Fahrney-Keedy's water supply is one well in an unconfined fractured-rock aquifer, the Tomstown Dolomite. 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 investigated within the assessment area from field inspections, contaminant inventory databases, and previous studies. The Maryland Department of Planning's 2002 digital land use map for Washington County was used to identify non-point sources of contamination. Well information and water quality data were also reviewed. An aerial photograph and maps of potential contaminant 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 Fahrney-Keedy Home and Village water system, the presence of potential sources of contamination in the source water assessment area, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Fahrney-Keedy Home and Village water supply is not susceptible to inorganic compounds, volatile organic compounds, synthetic organic compounds, radionuclides or microbiological contaminants. It may be susceptible to radon depending on the MCL adopted by EPA.

INTRODUCTION

The Water Supply Program has conducted a Source Water Assessment for the Fahrney-Keedy Home and Village water system in Washington County. The Fahrney-Keedy Home and Village is located approximately 2 miles north of the Town of Boonsboro in Washington County on the east side of Route 66. The water system is owned by Fahrney-Keedy Home and Village and operated by Maryland Environmental Service (MES). The water system serves a population of approximately 250 persons.

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. Fahrney-Keedy Home and Village presently obtains its water supply from one well (Figure 1). A review of the well completion reports for the supply well indicates that it was drilled in 2000 and should meet the State's well construction standards, which were implemented in 1973. A recent site inspection revealed that the well was in good condition. The system also has two wells which are not in use. The casing for Well 2 was damaged by lawn mowing equipment and Well 3 was determined to be ground water under the influence of surface water (GWUDI) and was pumping mud. Two springs were the original sources of water supply to the system, but were determined to be GWUDI and were replaced by wells. Well information is shown in Table 1 below

SOURCE ID	STATUS	SOURCE NAME	PERMIT NO	TOTAL DEPTH (ft)	CASING DEPTH (ft)	YEAR DRILLED
03	Production	Well 1	WA940855	200	40	1997
04	Not in Use	Well 2	WA950856	250	40	1997
05	Not in Use	Well 3	WA943249	198	105	2003

Table 1. Fahrney-Keedy's Well Information.

Fahrney-Keedy Home and Village has an appropriation permit to pump water from the Tomstown Dolomite for an average annual use of 38,000 gallons per day (gpd) and a daily average of 57,000 gpd in the month of maximum use.

HYDROGEOLOGY

Fahrney-Keedy Home and Village lies within the Hagerstown Valley physiographic province, which is underlain by a sequence of metasedimentary limestones and shales that have eroded away to form the valley bound by South Mountain and the Bear Pond Mountains west of Clear Spring. In some areas the carbonate rock formations have developed into a karst-like aquifer. Duigon (2001) has identified sinkholes, wells that penetrate cavernous zones, and other karst features in the valley. Fahrney-Keedy's well obtains water from the Tomstown Formation, a sequence of interbedded light gray white and pink, thick-bedded limestone, light gray to yellow-gray, thin-bedded to massive dolomite, and thin-bedded calcareous shale (Edwards, 1978). This is a heterogeneous formation and can be very karstic in some areas, and in others much more like a crystalline fractured-rock aquifer. The Fahrney-Keedy well appears to be in an

area where karstic features like sinkholes are present (Figure 2) and may be influenced by them. Ground water moves principally through secondary porosity, like solution enlarged fractures and sinkholes, and is recharged by precipitation percolating through soil and saprolite.

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 with an average appropriation amount of greater than 10,000 gpd and drawing from fractured-rock aquifers is the watershed area that contributes to the well. This area is modified by geological boundaries, ground water divides and by annual average recharge needed to supply the well (MD SWAP, 1999). Fahrney-Keedy's Wells 1 and 2 were determined not to be GWUDI, but Well 3 and the Main Springs were determined to be GWUDI based on the presence of fecal coliform bacteria in its raw water samples. For water supply sources that are determined to be GWUDI, the MDE's SWAP (1999) recommends locating and mapping sinkholes and conducting a dye trace study to define the contributing area (WHPA) for the well.

Duigon (2001) conducted a study of the karst hydrogeology of the Hagerstown Valley in which he located and mapped the sinkholes in the area. MDE completed a dye trace study to determine the source of bacterial contamination to the San Mar well. (Evans and Holt, 2003). Fluorescent dyes were used to inoculate contamination sources: an unnamed tributary of Little Beaver Creek at the Fahrney-Keedy's WWTP outfall, an intermittent branch of the unnamed tributary flowing south, and San Mar's septic systems. Several sinkholes and potentially losing streams were not evaluated in this study. Fahrney-Keedy's Well 1 was used for this study. No tracer dyes were detected in this well supporting the raw water bacteriological sampling results that this well was not GWUDI.

The wellhead protection area (WHPA) is the drainage area upgradient of the stream receiving Fahrney-Keedy's well, including a 1000 ft. buffer downgradient of the well. The area of the delineated WHPA is about 230 acres (Figure 2) which is more than adequate to support the permitted daily average water use.

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. In addition, in karst areas (areas underlain by limestone), sinkholes may be point sources of contamination to the aquifer by receiving contaminated runoff and delivering the contamination directly into the aquifer. 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

Sinkholes were identified in the general vicinity of the WHPA (Duigon, 2001). Additional sinkholes not included in the Duigon, 2001 dataset were observed in the area (Evans and Holt, 2003). Potential contaminant point sources located at the edge of the WHPA include the discharge of wastewater from Fahrney-Keedy and the storage of controlled hazardous substances at Fahrney-Keedy. (Figure 2).

Non-Point Sources

The Maryland Office of Planning's 2002 digital land use coverage of Washington County was used to determine the predominant types of land use in the WHPA (Figure 3). The land use summary is shown in Table 2. The majority of the WHPA is made up of agricultural land (cropland), forested land and low density residential uses, with a smaller proportion of commercial and industrial areas.

LAND USE CATEGORIES	TOTAL AREA (acres)	PERCENTAGE OF WHPA
Low Density Residential	42.78	18.56
Commercial	18.70	8.11
Industrial	0.68	0.30
Cropland	90.52	39.26
Forest	77.79	33.77
Total	230.47	100

Table 2. Land Use Summary

Agricultural land is commonly associated with nitrate loading to ground water and also represents a potential source of SOCs depending on use of pesticides. Residential areas without sewer service can be a source of nitrate from septic systems and microbial pathogens if systems are not constructed in accordance with regulations. Additionally, residential areas may be a source of nitrate and SOCs if fertilizers, pesticides, and herbicides are not used carefully in lawns and gardens.

A review of the Maryland Department of Planning's 2002 Sewer Map for Washington County indicates that 31.2% of the WHPA is served by an existing sewer system (Fahrney-Keedy WWTP). There is no planned sewer service for the remaining 68.8% of the WHPA (Figure 4) WHPA. Other properties in the WHPA also have onsite septic systems. The onsite septic systems are sources of nitrate and microbiological contaminants.

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 treatment that the

Fahrney-Keedy Home and Village water system currently uses, include hypochlorination for disinfection and ion exchange for softening.

A review of the monitoring data since 1999 for Fahrney-Keedy Home and Village water supply indicates that it meets the current drinking water standards. Since the springs were taken out of service in late 2002, the water quality data after that is a reflection of the well water. The water quality sampling results are summarized in Table 3. Plant 3 which treats water from Well 1 is the only active plant. now.).

PLANT NO	Nitrate		SOCs		VOCs		IOCs (except nitrate)		Radionuclides	
	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	No. of Samples Collected	No. of samples > 50% MCL
1	8	0	3	0	9	0	5	0	4	1*
2	1	1	1	0	3	0	1	0	1	0
3	5	0	1	0	1	0	1	0	1	0

Table 3. Summary of Water Quality Samples for Fahrney-Keedy Home and Village Water Supply.

*based on the lower proposed MCL for Radon-222

Inorganic Compounds (IOCs)

The only IOCs detected above 50% of the MCL was nitrate in the Wishard Well Spring which is now no longer in service. The spring was located near a cow pasture which was the likely source of the elevated nitrate level. It was detected at 6.3 ppm in a sample collected on August 22, 1995. The MCL for nitrate is 10 ppm. Nitrates have been routinely detected in the water supply. The nitrate levels in the Main Spring water supply ranged from 0.6 to 1.65 ppm. It ranges from 3.26 to 4.21 ppm in the water supplied by Well 1.

Radionuclides

No radionuclides above 50% of the MCL have been detected in Fahrney-Keedy's water supply. Gross alpha and gross beta were detected in February 2003 at 2 pCi/Liter (pCi/L) and 3 pCi/L, respectively. The MCL for gross alpha is 15 pCi/L and for gross beta is 50 pCi/L. Radon-222 was detected in October 1999 from the Main Spring supply at 1870 pCi/L. At present there is no MCL for radon-222, however EPA has proposed an MCL of 300 pCi/L and an alternate MCL 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.

Volatile Organic Compounds (VOCs)

No VOCs above 50% of the MCL have detected in Fahrney-Keedy's water supply. Trihalomethanes (THMs) which are disinfection byproducts were detected at low levels. THMs are the result of reaction between the chlorine used for disinfection and organic matter in the raw water. The total of the THMS detected was 2.8 ppb in a sample collected in July 2003. The MCL for the total of the THMs is 80 ppb.

Synthetic Organic Compounds (SOCs)

A review of the SOC data indicates that no SOC's have been detected. in Fahrney-Keedy's water supply.

Microbiological Contaminants

Raw water bacteriological data is available from evaluation for ground water under the direct influence of surface water (GWUDI). A review of the data shows that no total coliform or fecal coliform bacteria were detected in the raw water from Well 1 following rainfall (Table 4) or in dry weather samples. Negative numbers in the table indicate absence of coliform bacteria. Well 3 and the Main Springs had total and fecal coliforms under similar sampling conditions. These sources were determined to be GWUDI and are no longer being used as sources of water supply

SOURCE NAME	RAIN DATE	RAIN AMOUNT (INCHES)	CONDITIONS	SAMPLE DATE	PH	TOTAL COLIFORM (MPN/100ml)	FECAL COLIFORM (MPN/100ml)
WELL 1	18-FEB-98	.50	WET SET 1	18-FEB-98	7.4	-2	-2
WELL 1	18- FEB -98	.50	WET SET 1	19-FEB-98	7.4	-2	-2
WELL 1	18- FEB -98	.50	WET SET 1	20-FEB-98	7.3	-2	-2
WELL 1	18- FEB -98	.50	WET SET 1	21-FEB-98	7.4	-2	-2
WELL 1	01-APR-98	1.8	WET SET 2	02-APR-98	7.2	-2	-2
WELL 1	01-APR-98	1.8	WET SET 2	03-APR-98	7.3	-2	-2
WELL 1	01-APR-98	1.8	WET SET 2	04-APR-98	7.2	-2	-2
WELL 1	01-APR-98	1.8	WET SET 2	05-APR-98	7.2	-2	-2
WELL1	20-MAY98	0	DRY SAMPLE 1	20-MAY-98	7.3	-2	-2
WELL1	09-JUN-98	0	DRY SAMPLE 2	09-JUN-98	7.5	-2	-2

Table 4. Raw Water Bacteriological Test results

SUSCEPTIBILITY ANALYSIS

The well serving the Fahrney-Keedy Home and Village water supply pumps water from unconfined carbonate, fractured-rock aquifer. Wells in unconfined aquifers especially in carbonate rock, 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 5 summarizes the susceptibility of Fahrney-Keedy's water supply to each of the groups of contaminants.

Inorganic Compounds

No IOCs have been detected in Fahrney-Keedy's current water supply source at above 50% of an MCL. Nitrates have been detected with levels ranging from 3.26 ppm to 4.21 ppm. The MCL for nitrate is 10 ppm. Sources of nitrate can generally be traced to land use. Septic systems and the fertilization of cropland and residential properties are all sources of nitrate loading in ground water. Agricultural land (cropland) and residential land comprise a large portion of the WHPA (table 2). Fertilization of agricultural fields and residential

lawns, and onsite septic systems are all sources of nitrate loading in ground water. The levels of nitrates do not show any trend of increasing over the past four years.

Based on the above analysis, Fahrney-Keedy's water supply **is not** susceptible to nitrate or other inorganic compounds.

Radionuclides

No radionuclides above 50% of the MCL have been detected in Fahrney-Keedy's water supply. Radon-222 was detected above at levels above the lower proposed MCL of 300 pCi/L. Radionuclides are naturally occurring contaminant and is present due to the decay or uranium bearing minerals in the bedrock (Bolton, 1996).

Based on the above analysis, Fahrney-Keedy's water supply maybe susceptible to radon but **is not** susceptible to other radionuclides.

Volatile Organic Compounds

The water supply **is not** susceptible to volatile organic compounds, based on water quality data and the lack of potential contaminant sources within the WHPA. No VOCs were detected in the water supply.

Synthetic Organic Compounds

No SOC's have been detected in Fahrney-Keedy's water supply. No point sources of SOC's were identified within the source water assessment area. Potential sources of SOC's within the WHPA may be pesticide or herbicide use in the agricultural or residential 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.

Based on the above analysis, Fahrney-Keedy's water supply **is not** susceptible to SOC's.

Microbiological Contaminants

Fecal coliform and total coliform bacteria were detected in Fahrney-Keedy's Well 3 and Main Springs. These sources are no longer being used for water supply. No coliform bacteria has been detected in the current supply Well 1 in raw water samples taken after rainfall or dry weather. Based on the raw water quality data and dye study results, for Well 1, Fahrney-Keedy's 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	NO	NO	YES	NO
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
Radionuclides	YES* (Radon-222)	YES**	NO	YES (Radon-222)	MAYBE (Radon-222)
Microbiological Contaminants	YES	NO	NO	YES	NO (WELL 1)

Table 5. Susceptibility Summary for Fahrney-Keedy's water supply.

*Naturally occurring

**Proposed MCL for Radon-222

MANAGEMENT OF THE SOURCE WATER ASSESSMENT AREA

Public Awareness and Outreach

- The Consumer Confidence Report should list that this report is available to the customers through their county library or by contacting the Water Supply Program.

Monitoring

- The system should continue to monitor for all Safe Drinking Water Act contaminants as required by MDE.
- Annual raw water bacteriological sampling is a good check on well integrity.

Planning/ New Development

- Washington County Department of Planning is encouraged to adopt a wellhead protection ordinance that provides protection for all community water systems relying on ground water. (MDE has a model ordinance that can be used as a starting point. Grant funding is available.)

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.

Nutrient Management

- Agricultural producers within the wellhead protection area should be encouraged to apply for MDA Cost Share money for cover crop implementation. Cover crops have been shown to reduce nitrate levels in ground water.

Well Abandonment and Contaminant Source Inventory

- Wells 2 and 3 should be properly sealed and abandoned as per State standards to prevent contamination of the aquifer
- The system should conduct its own periodic surveys of the WHPA to ensure that there are no new or additional potential sources of contamination.

Contingency Plan

- Fahrney-Keedy Home and Village should have a Contingency Plan for its water system. COMAR an 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.

Changes in Use

- The Fahrney-Keedy Home and Village 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

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- Duigon, M.T., 2001, *Karst Hydrogeology of the Hagerstown Valley, Maryland*, MGS Report of Investigations 73, 128 pp.
- Duigon, M.T., and J.R. Dine, 1991, *Water Resources of Washington County, Maryland*, MGS Bulletin 36, 109 pp.
- Evans, W.N. and Holt, J.D., 2003, *An Investigation to Determine the Source and Bacterial Contamination of Multiple Community Drinking Water Systems near Boonsboro, MD, Using Fluoromatic Methods*, report submitted to Water Management Administration, Water Supply Program, 36 pp.
- MDE, Water Supply Program, 1999, *Maryland's Source Water Assessment Plan*, 36 p.
- 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 WA1997G003
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 Funkstown SE
USGS Topographic 7.5 Minute Quadrangles for Funkstown
Maryland Office of Planning 2002 Washington County Digital Land Use Map
Maryland Office of Planning 2002 Washington County Digital Sewer Map

FIGURES

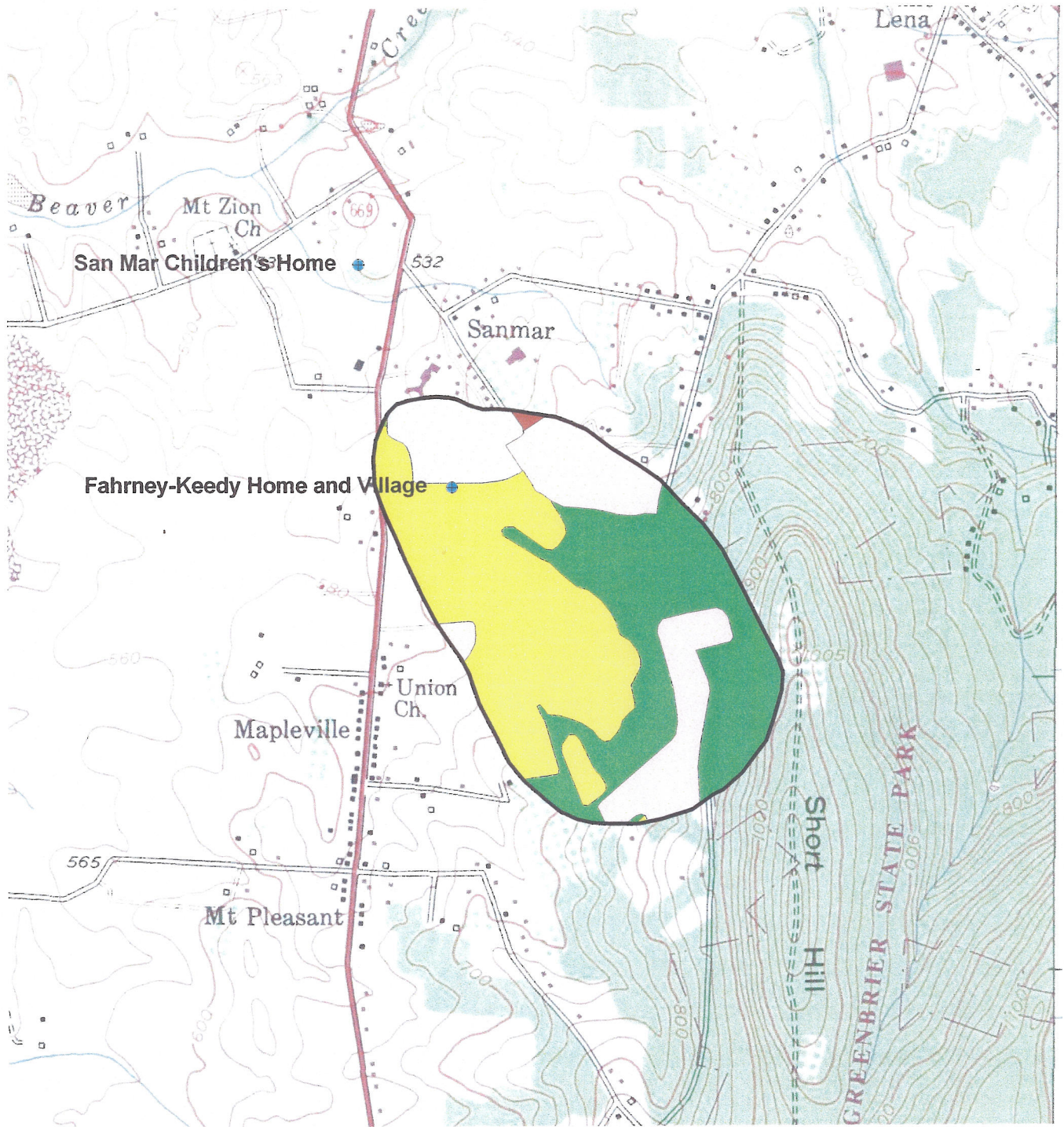
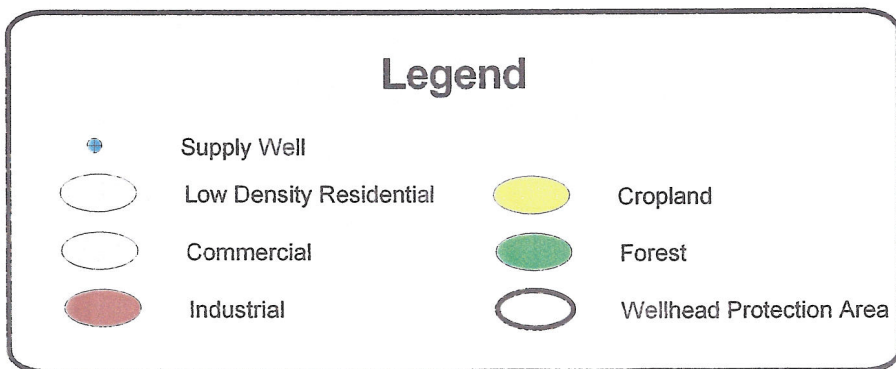


Figure 3. Land Use Map of the Fahrney-Keedy Home and Village WHPA



Base Map: USGS Topographic 7.5 minute quadrangles- Funkstown

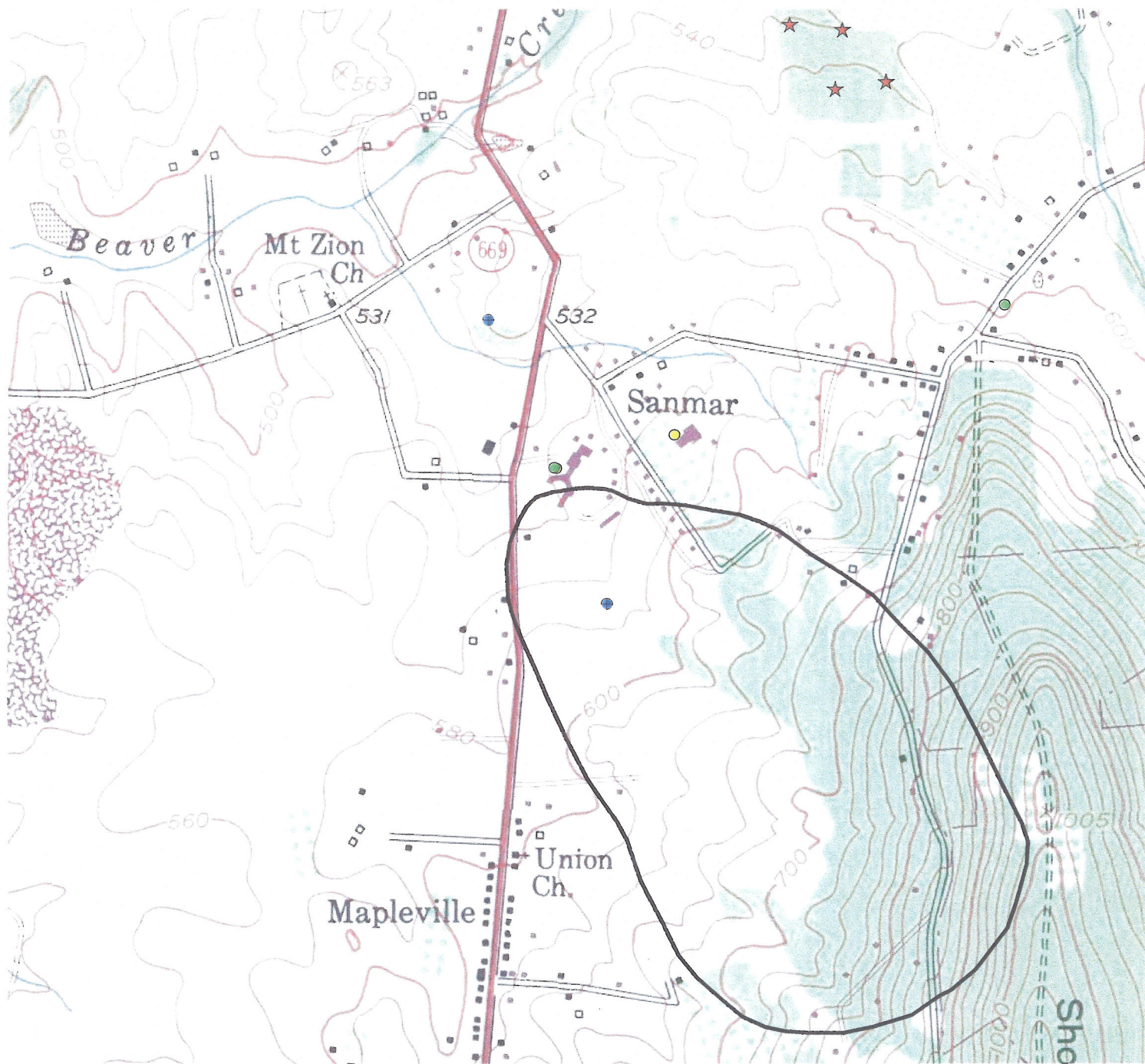
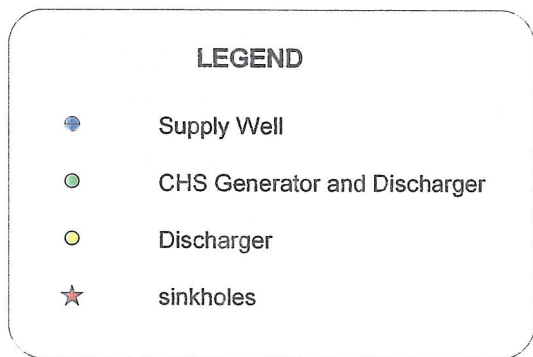


Figure 2. Fahrney-Keedy Home and Village WHPA with Potential Contaminant Sources



1000 0 1000 Feet



Base Map: USGS Topographic 7.5 minute Funkstown quadrangle

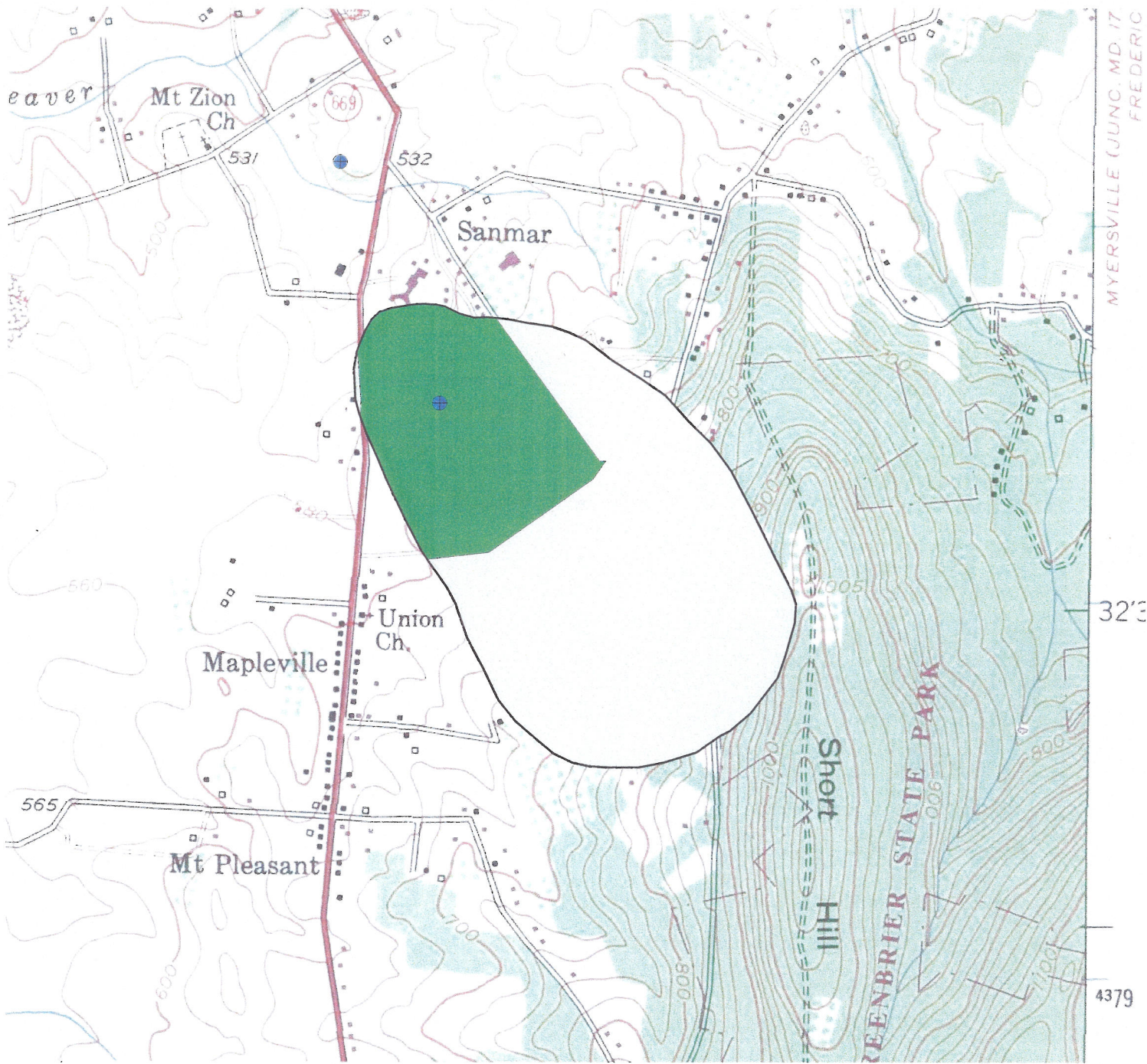




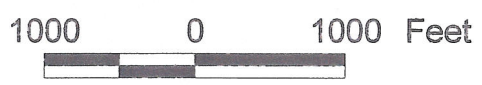


Figure 4. Sewer Map of the Fahrney-Keedy Home and Village WHPA

LEGEND

Sewer Service Categories

-  No Planned Service
-  Existing Service
-  Wellhead Protection Area
-  Supply Well



Base Map: USGS 7.5 Minute Funkstown Quadrangle