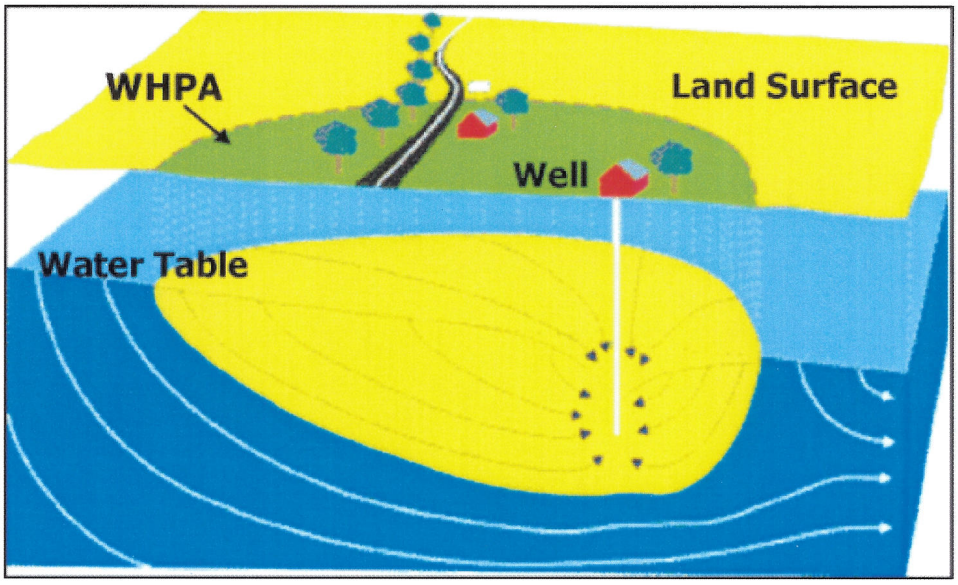
Source Water Assessment
for the Mount Aetna Water System
Washington County, Maryland



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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 Mount Aetna 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 sources of Mount Aetna's water supply are a well and two springs in unconfined fractured-rock aquifers. 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 Office of Planning's 2000 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 showing 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 Mount Aetna water systems, the presence of potential sources of contamination in the source water assessment area, well and springbox integrity, and the inherent vulnerability of the aquifer. The Mount Aetna water supply is susceptible to total coliform bacteria. Radon-222, a naturally occurring contaminant, may pose a risk to the water supply. It was determined that the water supply is not susceptible to contamination by inorganic compounds, other radionuclides, volatile organic compounds, synthetic organic compounds, or other microbiological contaminants.

INTRODUCTION

The Water Supply Program has conducted a Source Water Assessment for the Mount Aetna water system in Washington County. Mount Aetna is located in eastern Washington County at the foot of South Mountain eight miles east of the City of Hagerstown. The water system serves a population of 688 and has 130 service connections. The water system is owned and operated by the Washington County Water and Sewer department.

SOURCE INFORMATION

Source information was obtained from the Water Supply Program's database, site visits, well completion reports, sanitary survey inspection reports, and published reports. The Mount Aetna system presently obtains its water supply from two springs and a well (Fig. 1). Mount Aetna has also used an emergency intake on the unnamed stream adjacent to the springs in recent years during dry conditions, however without proper surface water treatment techniques, it is unlikely this source will be used in the future. A review of the well completion report for Mount Aetna's well indicates that it was drilled after 1973 and should meet construction standards for grouting and casing. An inspection of the spring boxes showed that they were in good condition and were fenced and locked to prevent improper entry. Source information is summarized in Table 1.

The Mount Aetna water system has three appropriation permits to draw water: One for the springs, another for the well, and the third for the stream (Table 1). The well is primarily used to supplement the springs when flow is usually at the lowest in the summer and early fall. However, due to recent drought conditions the well has been used on a year-round basis and the County has been exploring the possibility of drilling another well to supplement the system.

Source Id	Source Name	Appropriation Permit	Hydrologic Unit	Average Appropriated Amount (gpd)	Well Permit	Well Depth	Casing Depth	Year Drilled
01	Lower Springs	WA1975G101	Harpers Formation	80,000				
02	Upper Springs							
03	Mount Aetna Well	WA1994G003	Antietam Formation	7,200	WA-93-0382	400	26	1994
04	Emergency Stream Intake	WA1999S004	Unnamed Tributary	10,000				

Table 1. Mount Aetna source information.

HYDROGEOLOGY

Mount Aetna lies within the Blue Ridge physiographic province, which is the mountainous region around Catoctin and South Mountains and is underlain by the oldest sequence of rocks in the County. The Blue Ridge Province is mostly underlain by metamorphosed igneous and sedimentary rocks that are the eroded remnants of an overturned anticlinorium (Duigon and Dine, 1991). The Mount Aetna springs and well obtain water from the Harpers and Antietam formations, respectively, which are both unconfined, fractured-rock aquifers. The Harpers Formation is composed of a dark blue and green shale and gray laminated phyllite and the Antietam Formation is a white to gray, coarse-grained quartzite (Edwards, 1978). The primary porosity and permeability of these aquifers are small due to the dense nature of the metamorphosed rock. Ground water moves principally through secondary porosity, fractures, joint openings, and contacts and is recharged by precipitation percolating through soil and saprolite. The springs issue at the approximate location of the contact between these two formations and the change in rock type is likely to be a factor in their location. A broad definition of a spring is a concentrated discharge of ground water issuing from a more or less defined opening (Otton and Hilleary, 1985). Springs can be classified by many characteristics and in Maryland a common type of spring is known as a "contact" spring, in which ground water discharges at the surface due to the difference in permeability between two formations.

Ground water systems in crystalline rock tend to be localized and flow is within topographic divides towards the nearest perennial stream (Bolton, 1996). 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. Flow in springs is particularly sensitive to climactic conditions and will generally have their highest flow in the spring when the saprolite is recharged by precipitation and evapotranspiration rates are lowest. Conversely during the growing season and warm temperatures of summer, the saprolite is not recharged and spring flows diminish. 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.

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 and springs in fractured-rock aquifers is the watershed drainage area that contributes to the well. The recharge area for wells should be modified to account for geological boundaries, ground water divides, and by annual average recharge needed to supply the well (MD SWAP, 1999). The recharge area for springs follows topographic divides.

The WHPA is delineated as the watershed drainage area that supplies the springs. The WHPA is extended down gradient of the springs to include the well and the stream intake. The The WHPA is 340 acres and is illustrated in Figure 2.

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 no potential point sources of contamination within the WHPA.

Non-Point Sources

The Maryland Office of Planning's 2000 digital land use coverage of Washington County was used to determine the predominant types of land use in the WHPA The entire WHPA is covered by forested land. Forested areas within the WHPA serve as protective buffers for the water supply as they do not contribute contaminants and may take up nutrients (such as nitrogen) that may be introduced to ground water from animals or precipitation.

The Maryland Office of Planning's 1996 digital sewer map of Washington County shows that all of the WHPA is not planned for sewer service.

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 Mount Aetna water system currently has chlorination for disinfection and pH adjustment for corrosion control.

A review of the monitoring data for Mount Aetna's water system indicates that the water supply meets drinking water standards. Contaminants have not been detected above the SWAP threshold level, with two exceptions, one of which was confirmed in a

laboratory blank sample. The only contaminant detected at a level of concern is Radon-222, which does not currently have an MCL. The water quality sampling results are summarized in Table 3.

Contaminant Group	No. of Samples Collected	No. of Samples over 50% of an MCL
Inorganic Compounds (except Nitrate)	86	0
Nitrate	15	1
Radiological Contaminants	4	1 [1]
Volatile Organic Compounds	6	0
Synthetic Organic Compounds	3	1 [2]

Table 2. Summary of Water Quality Samples
[1]Proposed MCL
[2]Also detected in laboratory blank

Inorganic Compounds (IOCs)

Nitrate was detected in one sample above 50% of its MCL (5.6 ppm in May 1996), but all other samples were either less than 1 or non-detectable. Several unregulated compounds such as Sulfate and Sodium have been detected in the water supply but at very low levels.

Radionuclides

A review of the data shows that the only radionuclide at a level of concern was Radon-222. 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 was detected at 485 pCi/L in the water supply, which is greater than the lower proposed MCL, but below 50% of the higher proposed MCL.

Volatile Organic Compounds (VOCs)

A review of the data shows that VOCs have not been detected in the water supply.

Synthetic Organic Compounds (SOCs)

A review of the data shows that SOCs have not been detected above 50% of an MCL, with the exception of Di(2-Ethylhexyl)Phthalate for which the highest level reported was 13.8 ppb. This contaminant is commonly found in laboratory blank samples and it was confirmed to be present at ten times the level in the blank for this sample.

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 coliform bacteria were not detected in raw water from the well. The springs were originally determined to be GWUDI and were subsequently rebuilt to prevent surface water contamination and increase travel time from the surface to the ground in the immediate vicinity of the springs. Excavating the area around the spring boxes and installing an impermeable synthetic liner accomplished this. The methods were effective and upon retesting, the springs were found to be free of fecal coliform bacteria, but did have low concentrations of total coliform bacteria (Table 4).

RAIN DATE	RAIN AMT (inches)	LOCATION	SAMPLE DATE	TOTAL COLIFORM[3] (col./100 ml)	FECAL COLIFORM[3] (col./100 ml)
01-May-95 (Wet Set 1)	0.6	Upper Springs	02-May-95	-1.1	-1.1
			03-May-95	-1.1	-1.1
			04-May-95	-1.1	-1.1
			05-May-95	2.6	-1.1
		Lower Springs	02-May-95	-1.1	-1.1
			03-May-95	-1.1	-1.1
			04-May-95	4.6	-1.1
			05-May-95	8.0	-1.1
11-Jun-95 (Wet Set 2)	1.1	Upper Springs	12-Jun-95	1.1	-1.1
			13-Jun-95	-1.1	-1.1
			14-Jun-95	-1.1	-1.1
			15-Jun-95	-1.1	-1.1
		Lower Springs	12-Jun-95	1.1	-1.1
			13-Jun-95	2.6	-1.1
			14-Jun-95	2.6	-1.1
			15-Jun-95	2.6	-1.1

Table 3. GWUDI data from springs after rehab.

[3] Negative symbol indicates less than the detection limit

SUSCEPTIBILITY ANALYSIS

The well and springs serving the Mount Aetna water supply obtain water from unconfined fractured-rock aquifers. Wells in unconfined aquifers and springs 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 Mount Aetna's water supply to each of the groups of contaminants.

In fractured-rock areas, 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. Similarly, springs are inherently vulnerable, but properly constructed spring boxes with sealed access points will protect the spring water from surface contamination. Mount Aetna's wellhead protection area is entirely forested, which is a significant advantage for source water protection.

Inorganic Compounds

The water supply is **not** susceptible to inorganic compounds, based on water quality data and the lack of potential contaminant sources within the WHPA. One nitrate sample out of fifteen collected was above 50% of the MCL, but this is considered an anomaly based on the extremely low concentrations for the remaining samples and is not considered in the susceptibility analysis[4].

Radionuclides

The water supply **may be** susceptible to Radon-222. The source of radionuclides in ground water is the natural occurrence of uranium in rocks. The concentration of constituents such as Radon-222, Radium-226, and Radium-228 can vary considerably in the same aquifer to due to many factors such as pH, exposed surface area of minerals, and other natural conditions. The concentration of Radon-222 is above the lower proposed MCL of 300 pCi/L in the lone sample available. Depending on the MCL that is eventually adopted, the water supply may be determined susceptible to Radon. Gross-Alpha and Gross-Beta results indicate that other radionuclides are not likely to be a problem in the water supply.

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.

Synthetic Organic Compounds

The water supply is **not** susceptible to synthetic organic compounds, based on water quality data and the lack of potential contaminant sources within the WHPA.

Microbiological Contaminants

The wells are **not** susceptible to surface water pathogens such as *Giardia* and *Cryptosporidium,* based on GWUDI testing data after the springs were rehabilitated. Raw water data shows that total coliform bacteria were present and therefore the system is susceptible to total coliform, which may be used as an indicator for other microbiological contaminants, such as viruses. Without additional data however, it is not possible to determine whether or not the water supply is susceptible to viral contamination. Since the WHPA is well protected, the risk is likely to be minimal.

Contaminant Group	Are Contaminant Sources Present in WHPA?	Are Contaminants Detected Above 50% of MCL?	Is Well or Spring box Integrity a Factor?	Is the Aquifer Vulnerable?	Is the System Susceptible?
Nitrate	NO	YES[4]	NO	YES	NO
Inorganic Compounds (except nitrate)	NO	NO	NO	YES	NO
Radiological Compounds	NO	YES[5]	NO	YES	YES[5] (Radon only)
Volatile Organic Compounds	NO	NO	NO	YES	NO
Synthetic Organic Compounds	NO	NO	NO	YES	NO
Microbiological Contaminants	NO	YES (Total Coliform only)	YES	YES	YES (Total Coliform only)

Table 4. Susceptibility Analysis Summary.

[4] See statement in preceding text

[5] Proposed MCL for Radon

MANAGEMENT OF THE SOURCE WATER ASSESSMENT AREA

With the information contained in this report the Washington County Department of Water and Sewer are in a position to protect the Mount Aetna 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 Water and Sewer Department should contact the County Planning Department to form a local planning team to begin to implement a wellhead protection plan. The team should represent all the interests in the community, such as the water supplier, home association officers, the County Health Department, local business, developers, and property owners, and residents within and near the WHPA. The team should work to reach a consensus on how to protect the water supply.
- A management strategy adopted by 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.

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 Water and Sewer Department or MDE.
- Conduct educational outreach to residents to prevent unknown potential contaminant sources. Important topics include (a) appropriate use and application of fertilizers and pesticides, and (b) chemical storage (c) septic system maintenance.
- 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 and springbox integrity.

Planning/ New Development

- Review the State's model wellhead protection zoning ordinances for potential adoption. Coordinate with Washington County Department of Planning to adopt a wellhead protection ordinance.

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

- Mount Aetna should have a Contingency Plan for its water system. 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 Water and Sewer Department 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.

Changes in Use

- The Water and Sewer Department 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, 1991, Water Resources of Washington County, Maryland, MGS Bulletin 36, 109 pp.

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

Meyer G. and R.M. Beall, 1958, The Water Resources of Carroll and Frederick Counties: Department of Geology, Mines and Water Resources Bulletin 22, 355 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 WA1975G101, WA1994G003, WA1999S004
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 Myersville
USGS Topographic 7.5 Minute Quadrangles for Myersville
Maryland Office of Planning 2000 Washington County Digital Land Use Map
Maryland Office of Planning 1996 Washington County Digital Sewer Map

FIGURES

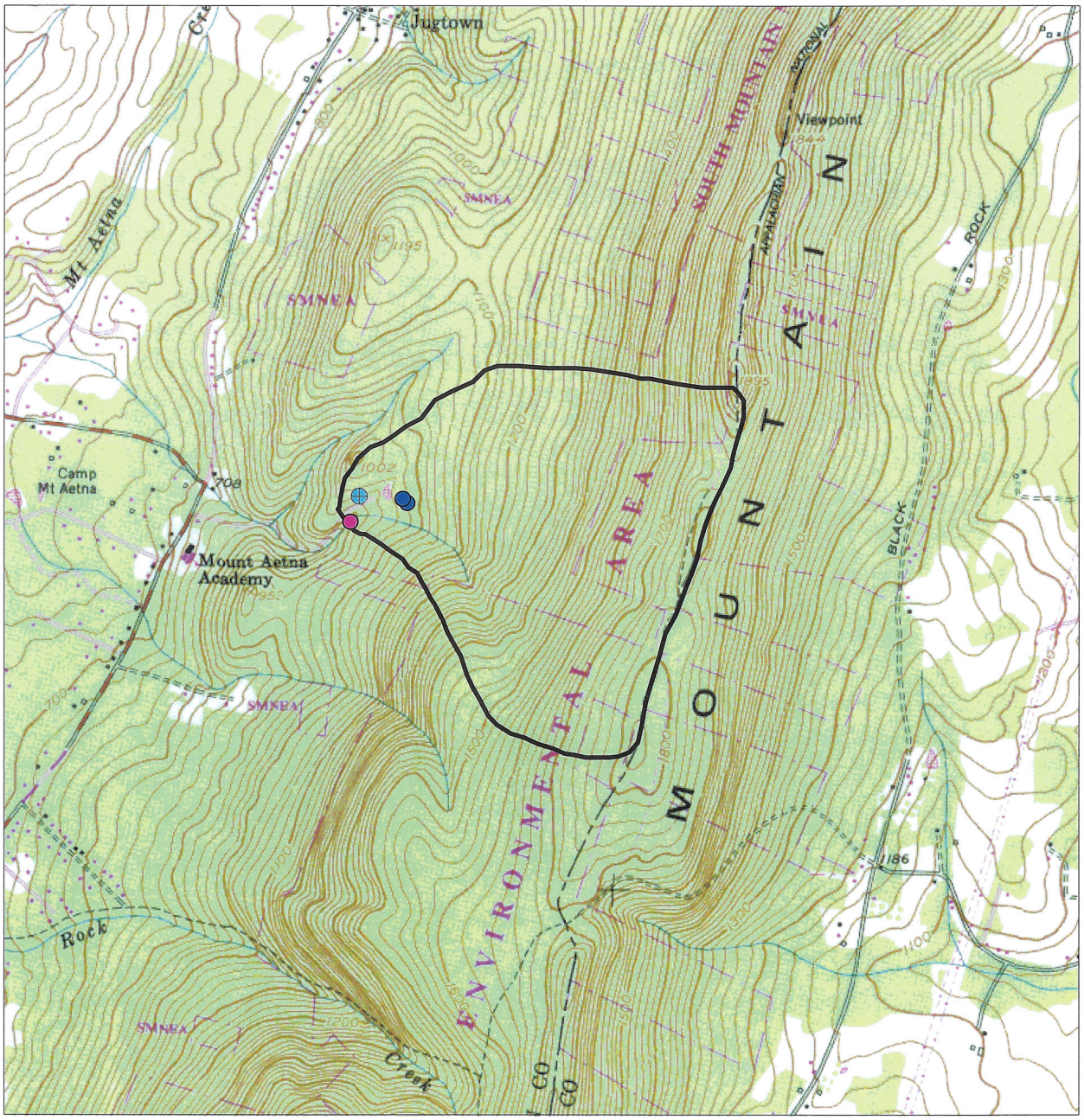

Figure 2. Mount Aetna Source Water Assessment Area

Legend

Drinking Water Sources

- Springs
- Well
- Emergency Stream Intake
- Source Water Assessment Area

N

1000 0 1000 2000 Feet

Base Map: USGS 7.5' Quadrangle for Myersville