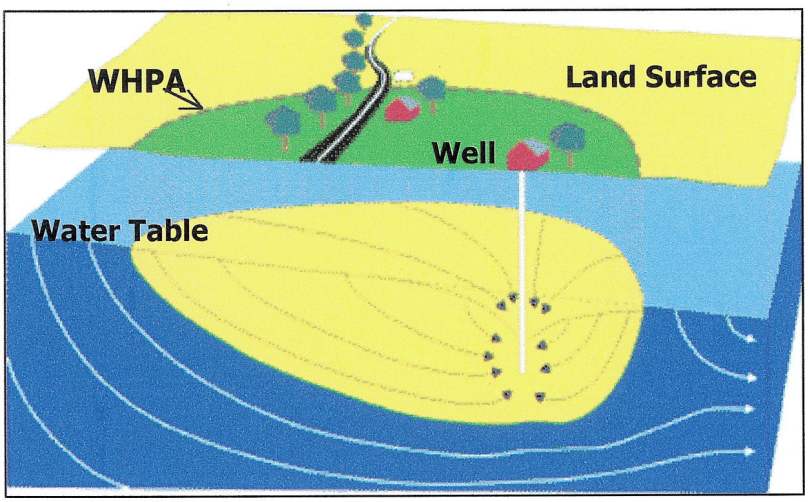
SOURCE WATER ASSESSMENT

FOR THE PLEASANT VALLEY WATER SUPPLY

CARROLL COUNTY, MD



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MDE

TABLE OF CONTENTS

Page

Summary 1

Introduction 2

Well Information 2
Table 1. Pleasant Valley Well Information

Hydrogeology 2

Source Water Assessment Area Delineation 3

Potential Sources of Contamination 3
Table 2. Land use summary for the Pleasant Valley WHPA

Water Quality Data 4
Table 3. IOC results above 50% of the MCL for Pleasant Valley's water supply since 1993
Table 4. Radon-222 results above 50% of the proposed MCL for Pleasant Valley's water supply since 1993

Susceptibility Analysis 6

Management of the WHPA 8

References 10

Other Sources of Data 10

Figures 11
Figure 1. Location Map for Pleasant Valley's Wells
Figure 2. Pleasant Valley Wellhead Protection Area with Potential Contaminant Sources
Figure 3. Land Use Map of Pleasant Valley Wellhead Protection Area

SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for the Pleasant Valley Water System. The major 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) an inventory of potential sources of contamination, and (3) determining the susceptibility of the water supply to contamination. Recommendations for management of the assessment area conclude this report.

The source of Pleasant Valley's water supply is an unconfined fractured-rock aquifer. One well is currently being used to draw the water out of the aquifer. A newer well will be placed into service in the near future. The Source Water Assessment Area for Pleasant Valley's wells was delineated by the Carroll County Bureau of Water Resources Management and the WSP 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 review, 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 of Pleasant Valley's 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 Pleasant Valley's water supply is susceptible to contamination by nitrates and Radon-222. The water supply is not susceptible to volatile organic compounds and synthetic organic compounds. Well No. 2 is not susceptible to bacteria or protozoans, but due to its location and well construction Well No. 1 is likely to be susceptible to bacteria and protozoans.

INTRODUCTION

Pleasant Valley is a residential community located approximately 5 miles northwest of Westminster, in Carroll County (figure 1). Pleasant Valley's water system is owned and operated by the Carroll County Department of Public Works (DPW). The system serves a population of 160. Currently, the water is supplied by one well (No.1). A new well (No. 2), drilled in 1997, will become the primary supply well once it is put into service (figure 1).

WELL INFORMATION

A review of well data and sanitary surveys of Pleasant indicates that Well No. 1 was drilled in 1937, prior to the implementation of the State's well construction regulations in 1973. No well completion report was available for this well. Well No. 2 was drilled in 1997 and meets the well construction standards. Table 1 contains a summary of the well construction data.

SOURCE ID	SOURCE NAME	PERMIT	TOTAL DEPTH	CASING DEPTH	AQUIFER
01	PLEASANT VALLEY WELL 1	N/A	60'	N/A	UPPER PELITIC SCHIST
03	PLEASANT VALLEY WELL 2	CL940945	300'	34'	UPPER PELITIC SCHIST

Table 1. Pleasant Valley Well Information.

Well No. 1 currently pumps at the rate of approximately 10 gallons per min (gpm). An aquifer test performed in December 1997 indicated that the Well No. 2 is capable of producing at least 15gpm.

HYDROGEOLOGY

The Pleasant Valley area is underlain by the Upper Pelitic Schist of the Wissahickon Formation. Pleasant Valley's wells obtain water from the Upper Pelitic Schist which is an unconfined fractured-rock aquifer. The Upper Pelitic Schist is a blue-gray closely folded biotitic and chloritic albite schist (Meyer and Beall, 1958). Weathering of the schist results in the formation of silty and clayey overburden material known as saprolite, below which is fractured bedrock. The well completion report for the new well indicates a saprolite zone of 29 feet.

In this type of aquifer, most of the ground water is stored in the saprolite and ground water flow is through fractures in the rock. In a rock type like schist, fractures usually form along planes of foliation and mineral layering (Nutter and Otton, 1969).

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. A WHPA was delineated for Pleasant Valley by the Carroll County Bureau of Water Resource Management as part of the County Water Resources Ordinance development. Hydrogeologic mapping was the method used for the delineation. This is the methodology recommended for fractured rock aquifers in the EPA approved Maryland's Source Water Assessment Plan (1999).

The delineated WHPA (figure 2) is the area that contributes water to the wells and is based on a fracture trace analysis and the watershed drainage area of two unknown tributaries of Bear Branch. The area of the WHPA is more than sufficient to cover the annual average recharge needed to supply the wells. Well No. 2 was determined not to be under the influence of surface water, hence the watershed drainage area for Bear Branch was not considered as an area on contribution for the wells. The total area of the WHPA is 409 acres.

POTENTIAL SOURCES OF CONTAMINATION

For this assessment MDE Waste and Water Management databases and Carroll County's database were reviewed, staff consulted, and field inspections conducted, to identify potential sources of contamination in and around the Pleasant Valley WHPA. In addition, MDE staff conducted a telephone interview with Mr. Charles Singer, the Water Superintendent for Pleasant Valley's water supply, to discuss water quality concerns. Mr. Singer indicated that the nitrate levels were his main concern. A follow up field survey of the WHPA was conducted on March 16, 2000. The only potential source of contamination that was identified is a kitchen and craftsman's shop that may handle and use chemicals for wood finishing (figure 2). Adjacent to it is a country store that at one time had leaking underground storage tanks. The tanks were removed and the site cleaned up. The case was closed several years ago by MDE's Oil Control Program and the site is not a threat to public health.

Based on the Maryland Office of Planning's 1997 Land Use Map, the land use categories within the WHPA are as shown in table 2. Figure 3 shows the land use in around the Pleasant Valley WHPA. It must be noted that the residential land use areas have sewer service since 1996, but no sewer service is planned for the other areas within the WHPA

LAND USE	TOTAL AREA (acres)	PERCENTAGE OF WHPA
Low Density Residential	52	12.7
Medium Density Residential	15	3.7
Commercial	1	0.2
Cropland	203	49.7
Pasture	19	4.6
Orchard	27	6.6
Forest	92	22.5

Table 2. Land Use Summary for the Pleasant Valley WHPA.

Application of fertilizers and pesticides on cropland and orchards could result in potential sources on nitrates and synthetic organic compounds (SOCs) to the water supply. Lawn maintenance and landscaping activities on residential land could also be potential sources of nitrate and SOCs. Old residential onsite septic systems may also be potential sources of nitrate. Pastures may be potential sources of fecal coliform from animal waste.

WATER QUALITY

Water Quality data was reviewed from the Water Supply Program's database and system files for Safe Drinking Water Act contaminants. The data described is from finished and raw water. The treatment currently used at Pleasant Valley is gas chlorination for disinfection.

In accordance with Maryland's SWAP, data from the water supply was compared with the Maximum Contaminant Levels (MCLs). If the monitoring data is greater that 50% of a MCL, the written assessment will describe the source of such a contaminant and, if possible, locate the specific sources which are the cause of the elevated contaminant level. A review of monitoring data since 1993 for Pleasant Valley's finished water indicates that the system's water supply currently meets drinking water standards. Nitrate was detected above 50% of the Maximum Contaminant Level (MCL) (table 3). In addition, radon-222 was detected above 50% of the proposed MCL (table 4).

Inorganic Compounds (IOC's)

The only IOC detected above 50% of the MCL was nitrate. The MCL for nitrate is 10ppm. Table 4 indicates that the nitrate levels have not increased or decreased significantly since 1993.

CONT ID	CONTAMINANT NAME	MCL (ppm)	SAMPLE DATE	RESULT (ppm)
1040	NITRATE	10	14-Jan-93	5.4
1040	NITRATE	10	18-Feb-93	5.8
1040	NITRATE	10	15-Apr-93	6.2
1040	NITRATE	10	12-Aug-93	5.23
1040	NITRATE	10	10-Jan-94	7.64
1040	NITRATE	10	09-May-94	7.18
1040	NITRATE	10	17-Aug-94	6.94
1040	NITRATE	10	14-Dec-94	6.45
1040	NITRATE	10	13-Feb-95	8.03
1040	NITRATE	10	15-May-95	6.75
1040	NITRATE	10	17-Aug-95	6.77
1040	NITRATE	10	13-Mar-96	5.2
1040	NITRATE	10	17-Apr-96	5.2
1040	NITRATE	10	15-May-96	5
1040	NITRATE	10	19-Jun-96	5.2
1040	NITRATE	10	24-Jul-96	5.2
1040	NITRATE	10	28-Aug-96	5.4
1040	NITRATE	10	18-Sep-96	5.3
1040	NITRATE	10	09-Oct-96	5.1
1040	NITRATE	10	14-Jul-97	5.3
1040	NITRATE	10	06-Aug-97	5.5
1040	NITRATE	10	19-Nov-97	5.6
1040	NITRATE	10	15-Dec-97	6.7
1040	NITRATE	10	14-Jan-98	5.6
1040	NITRATE	10	18-Feb-98	6.1
1040	NITRATE	10	18-Mar-98	5.4
1040	NITRATE	10	18-Mar-98	5.4
1040	NITRATE	10	15-Apr-98	5.4
1040	NITRATE	10	13-May-98	5.1
1040	NITRATE	10	25-Sep-98	5.5
1040	NITRATE	10	22-Oct-98	5.9
1040	NITRATE	10	02-Dec-98	6.1
1040	NITRATE	10	17-Dec-98	5.9
1040	NITRATE	10	21-Jan-99	5.6
1040	NITRATE	10	11-Feb-99	5.8
1040	NITRATE	10	18-Mar-99	5.7
1040	NITRATE	10	22-Apr-99	5.4
1040	NITRATE	10	20-May-99	5.5
1040	NITRATE	10	15-Jul-99	5.7
1040	NITRATE	10	19-Aug-99	5.8

Table 3. IOC results above 50% of the MCL for Pleasant Valley's water supply since 1993.

Volatile Organic Compounds (VOCs)

No VOCs were detected above 50% of the MCL in the Pleasant Valley water supply. Xylene, which has an MCL of 1000 ppb, was detected at 2 ppb in October 1997.

Synthetic Organic Compounds (SOCs)

No SOCs were detected above 50% of the MCL in the Pleasant Valley water supply.

Radionuclides

Currently there is no MCL for radon-222, however EPA has proposed an MCL of 300 picoCuries per liter (pCi/L0 and an alternate MCL of 4000 pCi/L. The levels of radon-222 in Pleasant Valley's water supply above 50% of the proposed MCLs are shown in Table 4.

CONTAM ID	CONTAMINANT NAME	PROPOSED MCL (pCi/L)	SAMPLE DATE	RESULT (pCi/L)
4004	RADON-222	300/4000	02-May-94	8680
4004	RADON-222	300/4000	29-Apr-97	3265
4004	RADON-222	300/4000	15-Dec-97	7560

Table 4. Radon-222 results above 50% of the proposed MCL for Pleasant Valley's water supply since 1993.

Microbiological Contaminants

Raw water samples were collected and tested for bacteria from Well No. 2 in June 1998 and August 1998 for four days following 0.5 inches of rainfall, to determine whether the source of supply to this well is ground water under the influence of surface water (GWUDI). The results were negative for the presence of total and fecal coliform for all the samples and the well water determined not to be GWUDI. No raw water testing for bacteria has been conducted on Well No. 1.

SUSCEPTIBILITY ANALYSIS

Pleasant Valley's wells obtain water from an unconfined fractured rock aquifer, and are therefore vulnerable to any activity on the land surface that occurs within the WHPA. Continued routine monitoring of contaminants is essential in assuring a safe drinking water supply. In order to determine the susceptibility to each group of contaminants the following criteria were considered: (1) presence of potential contaminant sources within the WHPA, (2) water quality data, (3) well integrity, and (5) aquifer characteristics.

Inorganic Compounds (IOCs)

Nitrate has been detected in Pleasant Valley's water supply at above the 50% MCL since 1993. Sampling data does not indicate any increase or decrease in nitrate levels for the past two years. Sources of nitrate can generally be traced to land use. Fertilization of cropland, orchards and residential properties are non-point sources of nitrate in ground water. Past onsite septic systems in the WHPA are also sources of nitrate which may decrease with time. The presence of nitrate may be mainly attributed to historical and current agricultural practices in the WHPA and areas surrounding it.

Based on the above analysis, Pleasant Valley's water supply **is** susceptible to nitrate contamination.

Volatile Organic Compounds (VOCs)

Xylene was the only VOC detected in Pleasant Valley's water supply. There are no known sources of VOCs in the WHPA. Leister's Store used to have leaking underground storage tanks that were removed after investigation by MDE's Oil Control Program. The site was cleaned up to standards protective of public health and the case closed. No VOC contamination to the water supply is expected from this site. The Kitchen and Craftman's store maybe a potential VOC contamination source if chemicals are improperly handled and stored on site.

Based on the above analysis Pleasant Valley's water supply **is not** susceptible to VOC contamination.

Synthetic Organic Compounds (SOCs)

SOCs have not been detected in the water supply. A large portion of the land use in and around the WHPA can be potential sources of SOC contamination if improper application of pesticides occurs. Hence, Pleasant Valley's water supply has the potential for susceptibility to SOC contamination if best management practices for land use are not implemented.

Currently, Pleasant Valley's water supply **is not** susceptible to SOC contamination.

Radionuclides

Radon is present in Pleasant Valley's water supply. The source of radon in ground water can be traced back to the natural occurrence of uranium in rocks. Radon is prevalent in ground water throughout the Piedmont region of Maryland due to radioactive decay or uranium bearing minerals in the bedrock (Bolton, 1996). MDE has informed the operator of the system to install treatment for removal of this contaminant.

Pleasant Valley's water supply **is** susceptible to radon due to the natural occurrence of this contaminant in aquifer material.

Microbiological Contaminants

Based on GWUDI testing, Pleasant Valley's Well No. 2 was determined **not** to be susceptible to protozoans or bacteriological contaminants. GWUDI testing was not conducted on Well No. 1. Well No. 1 is located in an area that is subject to flooding and was constructed prior to the establishment of the State's well construction standards. Hence it is likely to be susceptible to protozoans or bacteriological contaminants.

Both the wells maybe susceptible to viral contaminants, as these are much smaller, can survive longer, and may not be effectively filtered out by the aquifer as protozoans and bacteria. Future monitoring will be needed to determine susceptibility to viruses.

MANAGEMENT OF THE WHPA

Form a Local Planning Team

- The team should represent all the interests in the community. The County Public Works, Health Department, and Planning Department, residents, farmers, local businesses, and developers should work to reach a consensus on how to protect the water supply.

Planning/New Development

- The County developed Performance Standards and Management Criteria for Water Resource Management that were reviewed and approved by MDE. The County has not yet adopted these Performance Standards and is strongly encouraged to do so for protection of the water supply.
- The County Bureau of Water Resource Planning does site review of new developments prior to issuance of building permits, to ensure water supply source protection. The County should continue with this site review process to ensure that new developments do not degrade the quality or quantity of drinking water.
- The farms and orchards in the WHPA should use nutrient management plans to prevent excessive nitrate from getting into the ground water.

Public Awareness and Outreach

- Pamphlets, flyers and bill stuffers send to local residents, businesses and farmers will help educate the general public about Wellhead Protection.
- Placing signs at the WHPA boundaries is a good way to make the public aware of protecting their source of water supply. The County has placed signs at WHPA boundaries of some of the other water systems.

Monitoring

- Continue quarterly nitrate sampling and note any increase in concentrations of nitrate. If the trends were to show that the levels are likely to each the MCL, plans for treatment to remove nitrate will be required.
- Continue to monitor for all Safe Drinking Water Act contaminants as required by MDE.
- If left to be in service, GWUDI testing for Well No. 1 should be conducted to determine whether it is under the influence of surface water and susceptible to bacteria and protozoans.
- Annual sampling of microbiological contaminants is a good check on well integrity.

Cooperative Efforts with Other Agencies

- Request the assistance of the University of Maryland Agricultural Extension Service, the Soil Conservation Service to work with the farmers to adopt Best Management Practices (BMP's) for farms located within the WHPA.
- The farmers can also participate in the New Conservation Reserve Program (CREP) applicable to the cropland located within the WHPA. Government funding is available to qualified farmers equal to the cost and financial benefit of farming the area. The Natural Resources Conservation Service is responsible for determining the relative environmental benefits of each acre offered for participation.

Land Acquisition/Easements

- The availability of loans for purchase of and/or easements for the purpose of protecting water supplies is available from MDE. Loans are offered at zero percent interest and zero points.

Contingency Plan

- Comar 26.04.01.22 regualtions require all community water systems to prepare and submit for approval a plan for providing a safe and adequate drinking water supply under emergency conditions.

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 in pumpage is applied for or when new wells are being considered.

Contaminant Source Inventory/Well Inspections

- The County should review the potential sources of contamination within the WHPA and update them if necessary.
- Well No. 1 should be brought up to current well construction standards or properly abandoned to prevent contamination of the water supply.
- Periodic inspections and a regular maintenance program for the supply wells will ensure their integrity and protect the aquifer from contamination.

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.

Maryland Department of the Environment, Water Supply Program, 199, Maryland's Source Water Assessment Plan, 36 p.

Meyer, G., and Beall, R. M., 1958, The Water Resources of Carroll and Frederick Counties: Department of Geology, Mines and Water Resources Bulletin 22, 355p.

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.

R. E. Wright Associates, Inc., 1988, Phase II Report Carroll County Water Resources Study Volumes I and II.

R. E. Wright Associates, Inc., 1989, Recommended Water Resource Management Standards, Criteria, and Administrative Procedures.

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 CL1995G053
Public Water Supply Inspection Reports
MDE Water Supply Program Oracle Database
MDE Waste Management Sites Database
Carroll County WHP Database
Department of Natural Resources Digital Orthophoto Quarter Quadrangle for Littlestown
USGS Topographic 7.5 Minute Quadrangle: Littlestown
Maryland Office of Planning 1997 Carroll County Land Use Map

FIGURES

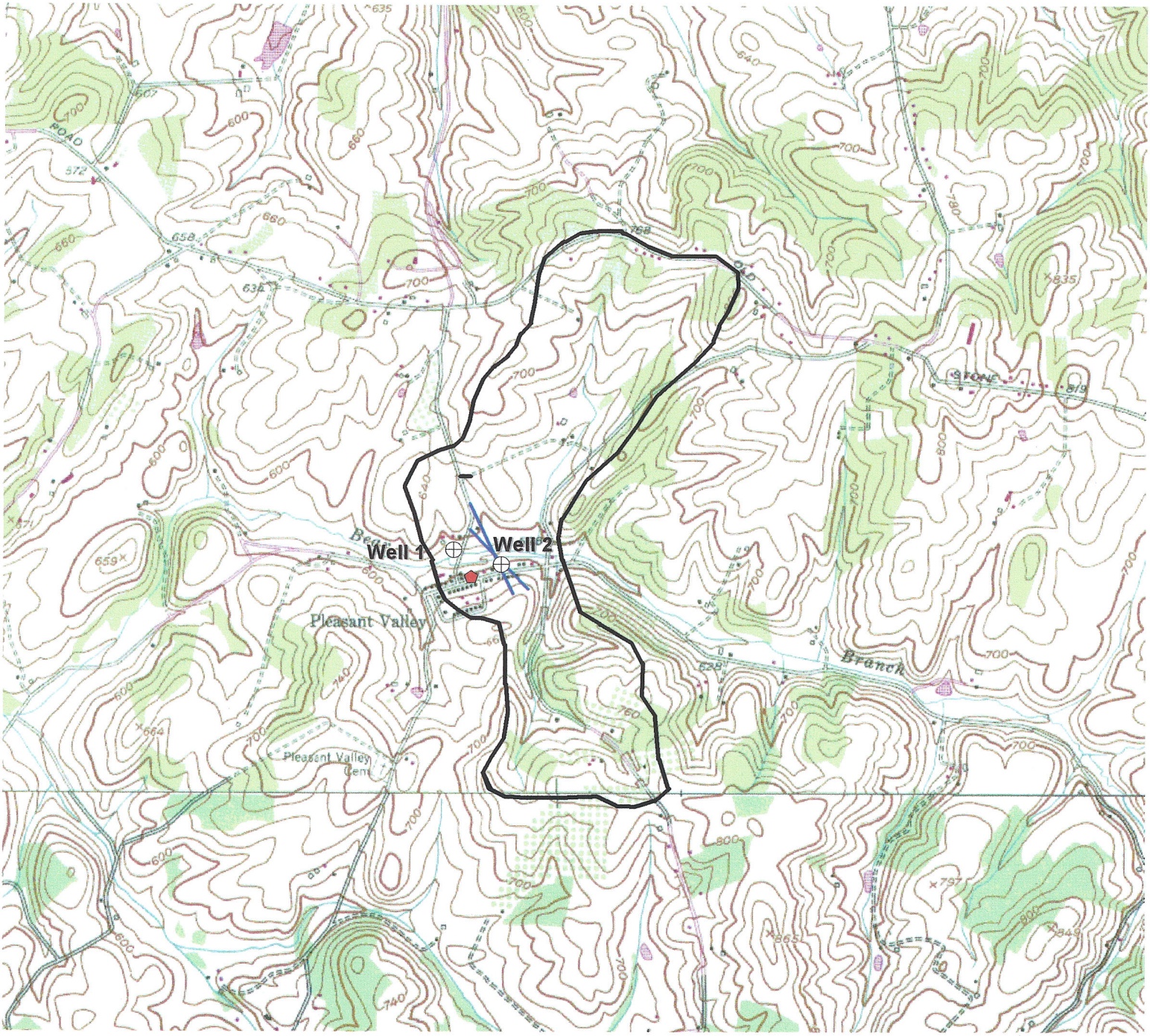

Figure 2. Pleasant Valley Wellhead Protection Area with Potential Contaminant Sources

Base Map: USGS Topographic 7.5 Minute Quadrangle - Littlestown, MD

Figure 3. Land Use Map of Pleasant Valley Wellhead Protection Area

LEGEND

Land Use Categories

- Low Density Residential
- Medium Density Residential
- Commercial
- Cropland
- Pasture
- Orchards
- Forest
- Wellhead Protection Area
- Supply Wells

N

2000 0 2000 Feet

Source: Maryland Office of Planning 1997 Land Use Map