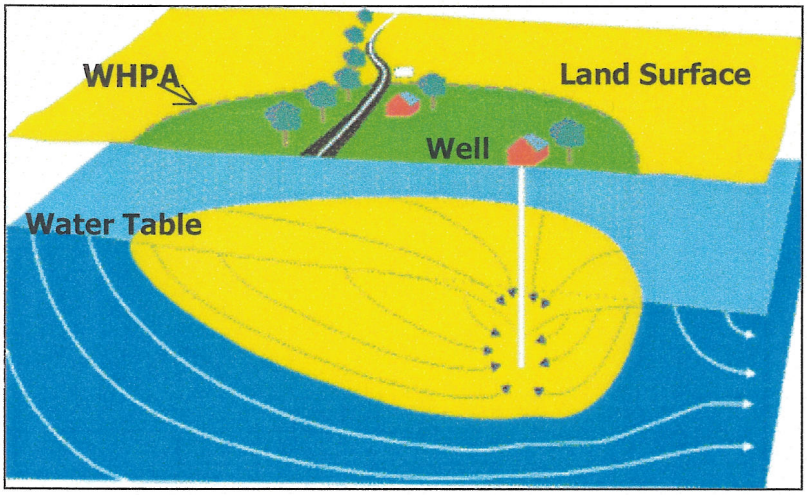
SOURCE WATER ASSESSMENT

FOR GAITHER MANOR APARTMENTS

CARROLL COUNTY, MD



Prepared By
Water Management Administration
Water Supply Program
October 2002

MDE

TABLE OF CONTENTS

SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for Gaither Manor Apartments. 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 Gaither Manor Apartment's water supply is an unconfined fractured rock aquifer, known as the Wissahickon Formation. The system currently uses two wells 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 locations are enclosed at the end of the report.

The susceptibility analysis for Gaither Manor Apartment'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 all of Gaither Manor Apartments water supply is susceptible to contamination by nitrates, volatile organic compounds and radon, but not to synthetic organic compounds, other inorganic compounds or radionuclides. Well No. 1 is not susceptible to microbiological contaminants. Raw water quality data was not available for Wells 1A and 3 to make a susceptibility determination for microbiological contaminants.

INTRODUCTION

The Gaither Manor Apartment complex is located about half a mile west of the Town of Sykesville in Carroll County (figure 1). The apartment complex owns and operates its water supply system that serves a population of 450. Currently, the water is supplied by two wells (Nos. 1 and 1A). The water that is pumped from these wells is treated at one plant. Well No. 2 is not in use due to high nitrates in its water supply. Well No. 3, the newest well, will be placed into service once all the required water quality testing is completed.

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. A review of well data and sanitary surveys of Gaither Manor Apartments water system indicates that Well Nos. 1, 1A and 2 were drilled prior to 1973, when the State's well construction regulations went into effect, and may not meet current construction standards. Well No.3 was drilled after 1973 and should meet construction standards for grouting and casing. Well information is shown in Table 1 below.

PLANT ID	SOURCE ID	SOURCE NAME	PERMIT NO	TOTAL DEPTH (ft)	CASING DEPTH (ft)	YEAR DRILLED
01	01	Gaither Manor 1	CL051269	124	44	1963
02	02	Gaither Manor 2	CL028503	80	unknown	1957
02	03	Gaither Manor 3	CL920572	85	36	1995
01	04	Gaither Manor 1A	CL660706	104	35	1966

Table 1. Gaither Manor Apartments Well Information.

The yields of Well Nos. 1, 1A and 3 are 25, 5 and 30 gallons per minute (gpm), respectively. The apartment complex has a Water Appropriation Permit that allows it to use an average of 20,000 gallons per day (gpd) and 25,000 gpd in the month of maximum use. Based on the 2001 reported pumpage, the apartment complex used an average of 19,100 gpd and 22,000 gpd in the month of maximum use.

HYDROGEOLOGY

The Gaither Manor Apartment complex lies in the Piedmont physiographic province and is underlain by the Wissahickon Formation. The Wissachickon Formation is an unconfined, fractured rock aquifer composed of schist and quartzite and in intensely folded and cleaved. (Cleaves, et al, 1968). 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. The WHPA for Gaither Manor Apartment's water supply was delineated by the WSP. 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 Gaither Manor Apartments WHPA is based on the watershed of an unknown tributary to the Patapsco River, in which the wells are located (figure 2). The delineated WHPAs represent the areas which contribute ground water to the wells. The boundary of the WHPA is based on the ground water flow direction and ground water divides inferred from topography, ground water discharge areas and permitted withdrawal rates. The total area of the Gaither Manor WHPA is about 78 acres, which is more than sufficient to support the daily permitted average.

POTENTIAL SOURCES OF CONTAMINATION

Potential sources of contamination are classified as either point of 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. The WSP conducted a field survey of the WHPA in February 2002 and met with Mr. Charles Schneider, owner and operator of the water system, to discuss potential contamination sources and water quality concerns.

Point Sources

A review of MDE and Carroll County contaminant databases as well as the field survey revealed three point sources of contamination in and adjacent to the WHPA. Figure 2 identifies an Underground Storage Tank (USTs) site, a former leaking UST site, and a Junkyard (JUNK). Table 2 lists the facilities identified and their potential types of contaminants. Potential contaminants are grouped as

Volatile Organic Compounds (VOC), Synthetic Organic Compounds (SOC), Heavy Metals (HM), and Metals (M).

ID	Type	Site Name	Address	Potential Contaminant	Status
1	JUNK	East West Auto	Gaither Road	VOC, HM, M	Active
2	LUST	Gaither Manor Store	Beth Way & Gaither Rds	VOC	Tank removed, no tanks on site
3	UST	Kenneth Marshall	601 Gaither Road	VOC	1 Heating Oil Tank

Table 2. Potential Contaminant Point Sources within the Gaither Manor Apartments WHPA (see figure 2 for locations).

Non-Point Sources

The Maryland Office of Planning's 2000 digital land use map for Carroll County was used to determine the predominant types of land use in the WHPA (figure 3). A large portion of the WHPA is made of residential land (82.5%). Forest and cropland make up the rest of the WHPA with a minor portion used for commercial activity (table 3).

LAND USE CATEGORIES	TOTAL AREA (acres)	PERCENTAGE OF WHPA
Low Density Residential	46.95	60.09
High Density Residential	17.60	22.53
Commercial	0.36	0.47
Cropland	6.34	8.12
Forest	6.87	8.79
Total	78.12	100.00

Table 3. Land Use Summary for the Gaither Manor Apartments WHPA.

Cropland is commonly associated with nitrate loading of ground water. Cropland represents a potential source of SOCs depending on fertilizing practices and use of pesticides. Some of the cropland is used for animal grazing and may be potential sources of microbiological pathogens due to animal wastes. Residential areas may be a source of nitrates and SOCs if fertilizers and pesticides are not used carefully for lawns and gardens.

A review of the Maryland Office of Planning's 1995 Carroll County Sewer Map indicates that about 18% of the WHPA has no planned sewer service and the rest of the area is supposed to have sewer service within 6 years. The field visit and the meeting with Mr. Schneider indicated the sewage treatment owned and operated by his company treats the apartment wastes. A few years ago the Gaither Manor Store and three homes located upgradient of Well Nos. 1 and 1A and with onsite sewage systems were connected to the sewage treatment plant. All the other homes in the WHPA have onsite sewage systems and may be potential sources of the nitrates to the supply wells.

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 are the cause of the elevated contaminant level. All data reported is from the finished (treated) water unless otherwise noted. The Gaither Manor Apartments water system currently uses one plant which has ph adjustment and hypochorination (post) for treatment. The purpose of the treatment is for corrosion control and disinfection, respectively.

A review of the monitoring data since 1993 for Gaither Manor Apartments water supply indicates that it meets the current drinking water standards. The water quality sampling results are summarized in Table 4. It must be noted that the radionuclide numbers used in this table include detections of radon-222 using proposed MCLs.

	Nitrate		SOCs		VOCs		IOCs (except nitrate)		Radionuclides	
PLANT NO	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
01	32	28	3	0	9	0	4	0	4	1

Table 4. Summary of Water Quality Samples for Gaither Manor Apartments Water Supply.

Inorganic Compounds (IOCs)

The only IOC detected above 50% of the MCL was nitrate. The MCL for nitrate is 10 ppm. The nitrate detections above 50% of the MCL in Gaither Manor Apartments water supply are shown in Table 5.

PLANT ID	CONTAMINANT NAME	MCL (ppm)	SAMPLE DATE	RESULT (ppm)
01	NITRATE	10	22-Feb-93	5
01	NITRATE	10	9-Aug-93	11.7
01	NITRATE	10	27-May-94	6.63
01	NITRATE	10	23-May-95	7.43
01	NITRATE	10	23-Aug-95	6.1
01	NITRATE	10	23-Jan-96	6.4
01	NITRATE	10	9-Apr-96	5.6
01	NITRATE	10	26-Nov-96	6.6
01	NITRATE	10	25-Feb-97	7.5
01	NITRATE	10	29-Apr-97	8.5
01	NITRATE	10	8-Jul-97	6.5
01	NITRATE	10	29-Oct-97	7.1
01	NITRATE	10	17-Feb-98	7
01	NITRATE	10	21-Apr-98	9.4
01	NITRATE	10	28-Jul-98	7.3
01	NITRATE	10	27-Oct-98	6.6
01	NITRATE	10	12-Dec-98	7
01	NITRATE	10	26-Jan-99	7.7
01	NITRATE	10	20-Apr-99	5.1
01	NITRATE	10	20-Jul-99	7.5
01	NITRATE	10	20-Jul-99	7.5
01	NITRATE	10	29-Feb-00	7.9
01	NITRATE	10	17-May-00	8
01	NITRATE	10	23-May-00	7.4
01	NITRATE	10	18-Jul-00	8.2
01	NITRATE	10	24-Oct-00	7.7
01	NITRATE	10	30-Jan-01	8.6
01	NITRATE	10	24-Apr-01	8.1

Table 5. Nitrate results above 50% of the MCL for Gaither Manor Apartments Water Supply.

Volatile Organic Compounds (VOCs)

No VOCs above 50% of the MCL have been detected in Gaither Manor Apartments water supply since 1993. The only VOCs detected were methyl-tert-butyl-ether (MTBE) and chloroform. MTBE has a taste and odor threshold of 20 ppb. MTBE was detected at levels between 4.2 ppb and 19 ppb.

Chloroform is part of a group of four VOCs known as trihalomethanes (THMs) which are disinfection byproducts. The MCL for the total of all the THMs is 80 ppb. Choroform was detected at levels between 0.7 ppb and 1.1 ppb. Disinfection byproducts are the result of a reaction between chlorine used for disinfection and organic material in the water supply.

Synthetic Organic Compounds (SOCs)

No SOCs have been detected in Gaither Manor Apartments water supply.

Radionuclides

No radionuclides above 50% of the MCL were detected in Gaither Manor Apartments water supply. Gross alpha and gross beta were detected one time at 4 picoCuries per liter (pCi/L) and 6 pCi/L, respectively. The MCL for gross alpha is 15 pCi/L and 50 pCi/L for gross beta. Radon-222 was also detected at 3930 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.

Microbiological Contaminants

In August 1993, fecal coliform was detected in Gaither Manor's water supply. Retesting included raw water sampling of Well No. 1 which showed an absence of any bacteria. It was determined that the fecal coliform may have been due to a leak in an in-ground water storage tank. Testing of raw water for bacteria from all the wells is necessary to determine whether these sources are ground water under the influence of surface water (GWUDI). Well Nos. 1 and 1A are classified as low risk wells to GWUDI and required one dry weather bacteriological sample. Well No. 3 is classified as high risk to GWUDI and requires two dry weather and two sets of wet weather samples. No raw water results are available for Well Nos. 1A and 3. The system is in the process of completing the necessary sampling.

SUSCEPTIBILITY ANALYSIS

Gaither Manor's wells obtain 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 6.

Inorganic Compounds (IOCs)

Nitrate has been detected in Gaither Manor Apartments water supply above 50% of the MCL (table 5). Sources of nitrate can generally be traced to land use. Onsite septic systems are non-point sources of nitrate in ground water. Fertilization of cropland and residential properties are also non-point sources in ground water. A large portion of the WHPA (53%) is residential land which does not have public sewer. The apartment complex, a grocery store and three houses in the WHPA have are connected to a private wastewater treatment plant belonging to the apartment complex, the rest of the residences in the WHPA have onsite septic systems for waste disposal. Well No. 2 is not in service because nitrate levels exceeded the MCL. A septic system belonging to a local business and located 100 feet upgradient of it probably contributed to the excess nitrate in the ground water. Animals wastes in areas of animal grazing are also source nitrates to ground water. A review of the nitrate monitoring data for Gaither Manor Apartments water supply shows that nitrate levels appear to be slowly increasing (Figure 4).

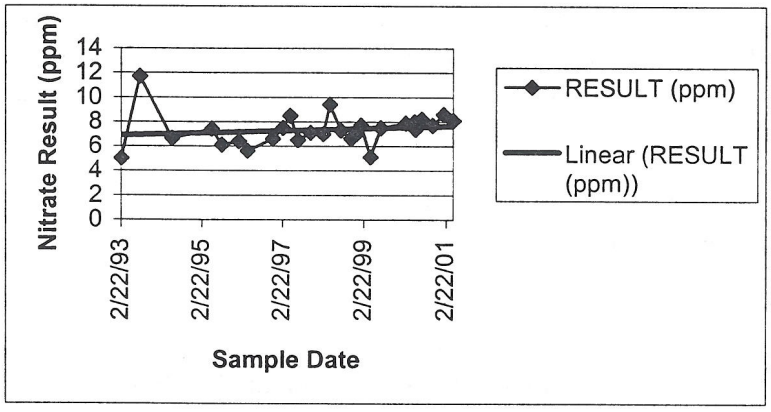


Figure 4. Nitrate Trend in Gaither Manor Apartments Water Supply.

Based on the above analysis, Gaither Manor Apartments water supply **is** susceptible to nitrate contamination but is **not** susceptible to other inorganic compounds.

Volatile Organic Compounds (VOCs)

MTBE has been detected in Gaither Manor Apartments water supply since 1995. MTBE is used as an additive to gasoline for cleaner burning. A leaking UST which was removed at the Gaither Manor Store site several years ago may have been the source of the MTBE. A major road passes through the western edge of the WHPA. Runoff from the road may also be a source of the MTBE. A review of the MTBE data indicates that the concentration of MTBE in the water supply is decreasing (Figure 5).

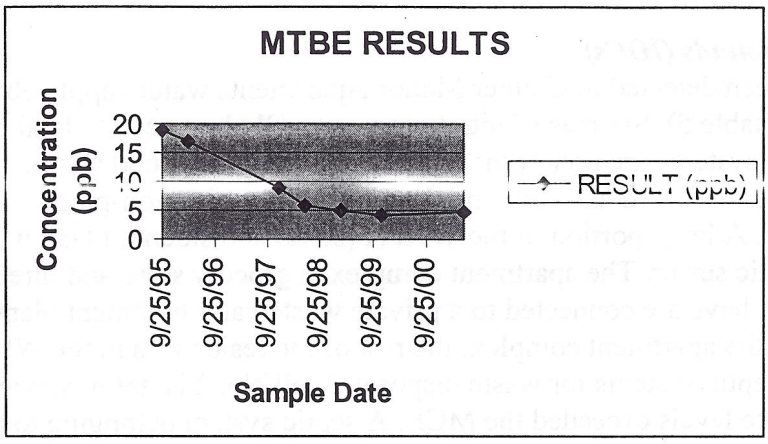


Figure 5. MTBE trend in Gaither Manor Apartments Water Supply.

Based on the above water quality data and potential sources, Gaither Manor Apartments water supply **is** susceptible to VOC contamination.

Synthetic Organic Compounds (SOCs)

No SOCs have been detected in Gaither Manor Apartments water supply. Application of pesticides in residential properties and cropland can be sources of SOCs. But so far, due to combination of proper application, aquifer and well characteristics no SOCs have been detected in the water supply.

Based on the above analysis, Gaither Manor Apartments water supply is **not** susceptible to SOC contamination.

Radionuclides

No radionuclides above 50% of the MCL have been detected in Gaither Manor Apartments water supply. Radon-222 has been detected at 3930 pCi/L. Radon is prevalent in ground water due to the radioactive decay of uranium bearing minerals in the bedrock (Bolton, 1996).

Based on the above analysis, Gaither Manor Apartments water supply **is** susceptible to radon but **not** to other radionuclides.

Microbiological Contaminants

Based on raw water bacteriological data Well No.1 was determined not to be under the direct influence of surface water. Hence Well No.1 is **not** susceptible to any microbiological contaminant present at the surface including *Giardia and Cryptosporidium*. Raw water bacteriological data is not available for Well Nos. 1A and 3, therefore susceptibility determinations to microbiological contaminants cannot be made for these wells at the present time.

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	YES	NO	NO	YES	YES
Synthetic Organic Compounds	NO	NO	NO	YES	NO
Radionuclides (except radon)	NO	NO	NO	YES	NO
Radon	YES	YES	NO	YES	YES
Microbiological Contaminants	YES	NO (Well 1) NOT AVAILABLE (Well 1A & 3)	NO	YES	NO (Well1) CANNOT BE DETERMINED (Well 1A & 3)

Table 6. Susceptibility Summary for Gaither Manor Apartments water supply.

MANAGEMENT OF THE WHPA

Form a Local Planning Team

- The team should represent all the interests in the community like the owners and operators of the system, residents, other property owners in the WHPA, and Carroll County Planning and Health Departments.
- MDE has grant money available for countywide Wellhead Protection projects.

Public Awareness and Outreach

- The Consumer Confidence Report should include a summary of this report and information that this report is available to the general public through their county library, or MDE.
- 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 along several county roads and may be able to assist in this effort.

Cooperative Efforts with Other Agencies

- The farmers can 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.

Monitoring

- Continue to monitor for all Safe Drinking Water Act contaminants as required by MDE.
- Complete the required raw water bacteriological testing for determining whether the wells are under the influence of surface water.

Land Acquisition/Easements

- Loans are available for the purchase of property or easements for the protection of the water supply. Eligible property must lie within the designated WHPA. Loans are currently being offered at zero percent interest and zero points. Contact the WSP for more information.

Contingency Plan

- COMAR 26.04.01.22 regulations 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 pumpage is applied for or when new wells are being considered.

Contaminant Source Inventory/Well Inspection

- The system owners should review the potential sources of contaminants within the WHPA and update them if necessary, including a consideration of historical uses.
- The system owners should inform property owners that failing onsite septic systems would impact Gaither Manor Apartment water quality and that they should conduct regular maintenance on them.
- Periodic inspections and a regular maintenance program for the supply wells will ensure their integrity and protect the aquifer from contamination.
- Wells that are not planned for use anymore should be abandoned according to State well construction standards.

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.

Duigon, Mark T., 1994, Sykesville Quadrangle, Maryland Geological Survey, Quadrangle Atlas No. 24.

Maryland Department of the Environment, Water Supply Program, 1999, 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, 56p.

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: CL1963G001
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 Quadrangles: Finksburg SW and Sykesville NW
USGS Topographic 7.5 Minute Winfield Quadrangle
Maryland Office of Planning 2000 Carroll County Land Use Map
Maryland Office of Planning 1995 Carroll County Sewer Map

FIGURES

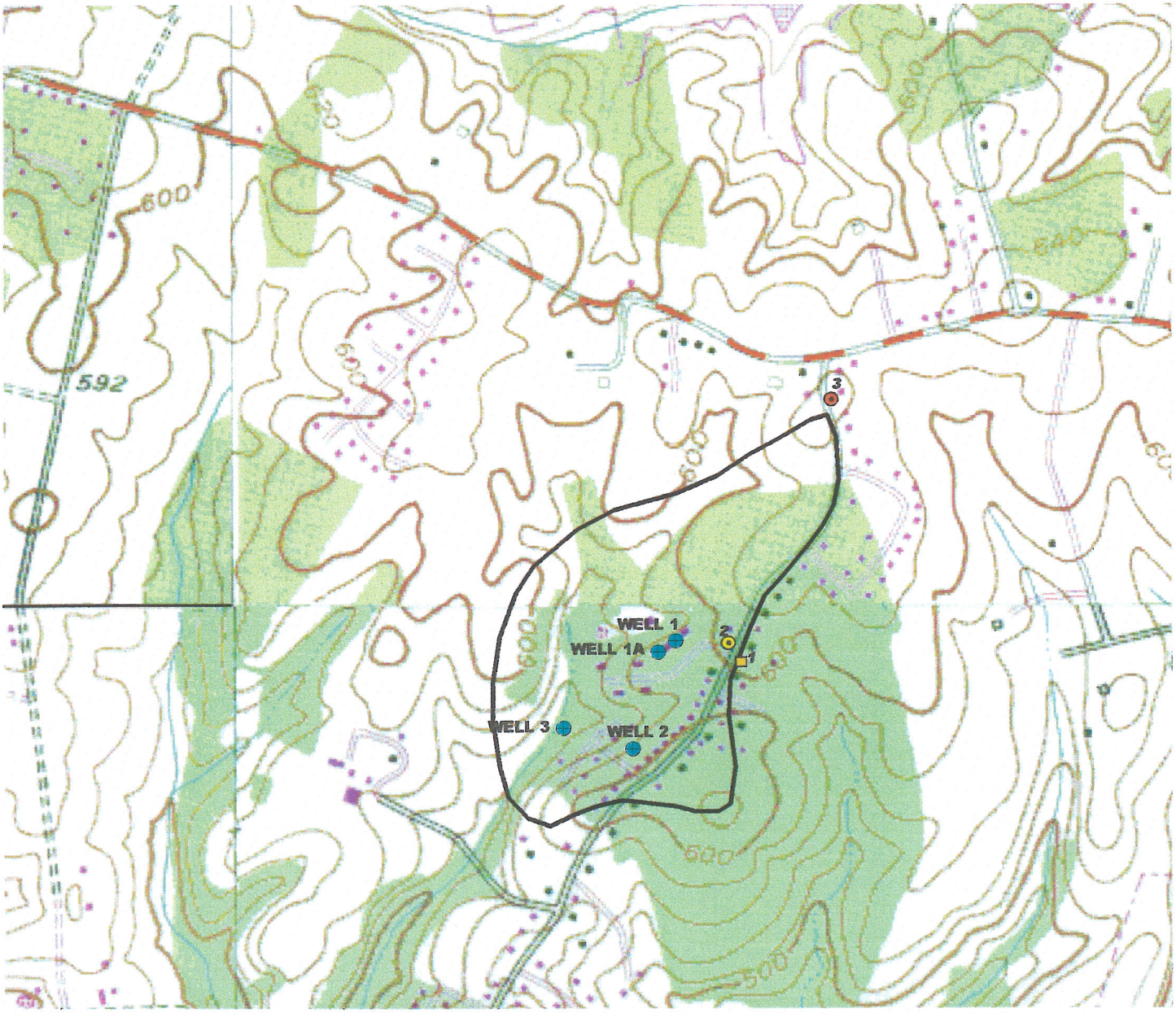


Figure 2. Gaither Manor Apartments Wellhead Protection Area with Potential Contaminant Sources

LEGEND

- Supply Well
- Wellhead Protection Area
- Junkyard
- Underground Storage Tank (UST)
- Former Leaking UST

1000 0 1000 Feet

N

Base Map: Digitized USGS 7.5 Minute Winfield Quadrangle

Figure 3. Land Use Map of the Gaither Manor Apartments Wellhead Protection Area

LEGEND

Land Use Categories

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Commercial
- Open Urban Land
- Cropland
- Pasture
- Forest
- Wellhead Protection Area
- Supply Well

N

1000 0 1000 Feet

Base Map: Maryland Office of Planning Carroll County 2000 Land Use Map