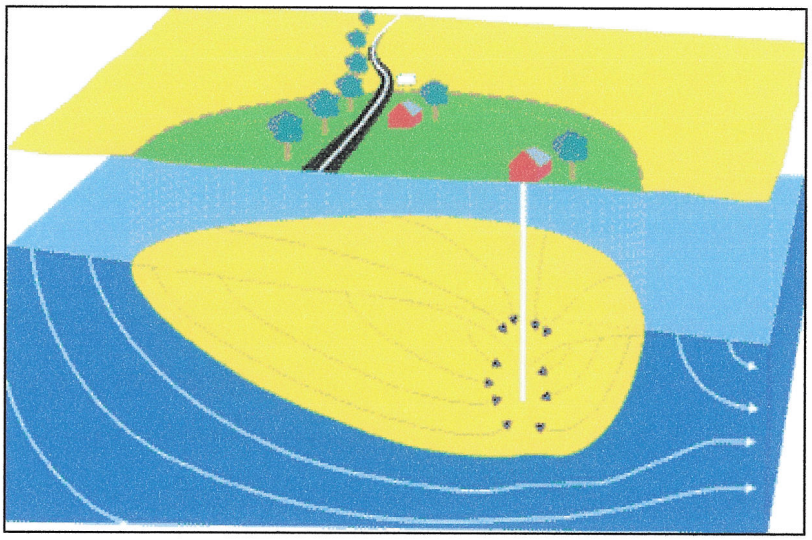
SOURCE WATER ASSESSMENT
for
FOUR GOLF COURSES IN
NORTHERN BALTIMORE COUNTY, MD



Prepared By
Water Management Administration
Water Supply Program
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MDE

Robert L. Ehrlich, Jr.
Governor

Michael S. Steele
Lt. Governor

Kendl P. Philbrick
Secretary

Jonas A. Jacobson
Deputy Secretary

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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for the non transient non community water systems at the Towson, Hillendale, Caves Valley, and Hayfields Golf Clubs. 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 the golf courses' water supplies are 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 identified within the assessment area from field inspections, contaminant inventory databases, and previous studies. The Maryland Office of Planning's 2002 digital land use map for Baltimore County was used to identify non-point sources of contamination. Well information and water quality data were also reviewed. Maps showing potential contaminants sources and land use within the Source Water Assessment areas are included in the report.

The susceptibility analysis is based on a review of the existing water quality data for the golf course water systems, the presence of potential sources of contamination in the WHPAs, well integrity, and the inherent vulnerability of the aquifers. As the golf courses obtain their water from water table fractured aquifers, they are vulnerable to contamination from various sources. There have been several contaminants above 50% of an MCL in the water supplies from possible sources in the wellhead protection areas (WHPAs). The primary contaminant of concern is nitrate.

INTRODUCTION

The Water Supply Program has conducted Source Water Assessments for the public water systems of the Towson, Hillendale, Caves Valley, and Hayfields golf clubs in Baltimore County. These four water systems are considered non transient non community (NTNC) water systems. A NTNC system is a water system that regularly serves twenty-five of the same people at least six months of the year. The Towson and Hillendale Golf Courses are located near Gunpowder Falls State Park, about seven miles north-northeast of Baltimore City, in fractured rock aquifers of the Gunpowder Falls basin. The Hayfields Golf Club is located near Hunt Valley, about 10 miles north of Baltimore City, also in a fractured rock aquifer of the Gunpowder Falls basin. The Caves Valley Golf Club is located about three miles northeast of Owings Mills and about six miles northwest of Baltimore City, in a fractured rock aquifer of the Jones Falls (Patapsco River) basin The systems serve populations between 30 and 75.

WELL INFORMATION

Well information was obtained from the Water Supply Program's database, site visits, well completion reports and sanitary survey inspection reports. The Towson, Hillendale, Caves Valley, and Hayfields golf clubs have four, one, four, and two potable supply wells, respectively. A review of the well completion reports and sanitary surveys indicates that all of the potable supply wells in use were installed after 1973, when the State's present well construction regulations went into effect, and should meet construction standards for grouting and casing. A summary of the well information is located in Table 1.

PLANT ID	SOURCE ID	USE CODE	WELL NAME	PERMIT	TOTAL DEPTH	CASING DEPTH	YEAR DRILLED
01	01	UNUSED		BA-71-0405	250	86	1971
01	02	UNUSED		BA-81-8651	95	80	1988
01	03	UNUSED		BA-70-0387	250	50	1970
01	04	UNUSED		BA-70-0383	300	52	1970
01	05	PRODUCTION	Clubhouse 1	BA-94-2481	500	105	1997
01	06	PRODUCTION	Clubhouse 2	BA-81-5574	200	35	1988
01	07	PRODUCTION	Comfort Station	BA-81-5575	550	50	1988
01	08	PRODUCTION	Maintenance Shop	BA-94-5671	440	25	2001

Table 1a. Towson Golf and Country Club Well Information (PWSID 1030059)

PLANT ID	SOURCE ID	USE CODE	WELL NAME	PERMIT	TOTAL DEPTH	CASING DEPTH	YEAR DRILLED
01	01	OTHER	Irrigation	BA-94-1239	300	40	1995
01	02	PRODUCTION	Potable well	BA-81-6955	150	37	1987
01	03	ABANDONED		NONE	N/A	N/A	N/A

Table 1b. Hillendale Country Club Well Information (PWSID 1030061)

PLANT ID	SOURCE ID	USE CODE	WELL NAME	PERMIT	TOTAL DEPTH	CASING DEPTH	YEAR DRILLED
01	01	PRODUCTION	Back-up well	BA-88-1831	500	105	1997
01	02	PRODUCTION	Maintenance (hole 14)	BA-88-1765	175	90	1989
01	03	PRODUCTION	Pumphouse well	BA-88-1828	550	50	1988
01	04	PRODUCTION	Guard Shack well	BA-88-1827	440	25	2001

Table 1c. Caves Valley Country Club Well Information (PWSID 1030065)

PLANT ID	SOURCE ID	USE CODE	WELL NAME	PERMIT	TOTAL DEPTH	CASING DEPTH	YEAR DRILLED
01	01	OTHER	Irrigation well	BA-94-0329	165	83	1995
01	02	PRODUCTION	Well 2	BA-94-0328	200	44	1994
01	03	PRODUCTION	Well 1	BA-94-3289	256	63	1998

Table 1d. Hayfields Country Club Well Information (PWSID 1030071)

HYDROGEOLOGY

The four golf courses in this study are located in the northern part of Baltimore County and within the Piedmont physiographic province. The underlying bedrock is composed of Paleozoic, crystalline, metamorphic and igneous rocks in unconfined, fractured rock aquifers. Fractures provide most of the generally limited permeability and porosity in these types of formations. Due to the low primary porosity, large production wells are not common in this formation unless significant, water-bearing fractures are encountered.

Ground water systems in crystalline rock tend to be localized and flow is within topographic divides towards the nearest perennial stream. The water table is generally in the weathered zone (saprolite + weathered bedrock), which is characterized by high porosity and thus, the amount of storage often depends on the thickness of this zone. 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. Wells located along fracture traces in stream valleys may be hydraulically connected to the stream.

Aquifers used by the golf courses include the Cockeysville Marble (Caves Valley and Towson Golf Clubs), the Baltimore Gneiss (Hayfields Golf Club), and the Loch Raven Schist (Hillendale Golf Club and the Cave Valley-Maintenance Well).

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 estimated potable uses for all the four golf courses are less than an annual average of 10,000 gallons per day (gpd). As defined in Maryland's SWAP, the wellhead protection areas for "small" public water systems using an average of less than 10,000 gpd, in unconfined, fractured-rock aquifers, is a fixed radius of 1,000 feet around each well. This radius is based on calculating the land area needed to provide a yield of 10,000 gpd, assuming a drought annual average recharge rate of 400 gpd avg per acre and a safety factor. The WHPAs for each of the four golf courses are shown in figures 1-4.

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 3 potential point sources of contamination within the WHPAs of the golf courses (Table 2 and maps 1, 2, and 4). One underground storage tank (UST) was identified at each of the Hillendale and Towson Golf Clubs, both of which were listed as permanently out of service. A Transcontinental Gas pipeline passes through the southern portion of the Hayfields WHPA. There are no point sources of contamination in the Caves Valley Golf Club WHPA.

PDWID	Name	Type	Facility Name	Address	Comments
1030059	Towson Golf Club	UST-perm out	Towson Golf Course	12801 Stone Hill Rd.	gasoline
1030061	Hillendale Golf Club	UST-perm out	Hillendale Golf Club	13700 Blenheim Rd.	gasoline
1030065	Caves Valley Golf Club	None			
1030071	Hayfields Golf Club	Discharger	Williams Gas Pipeline-Transco	P.O. Box 1396 Houston, TX 77251	Heating Oil tank

Table 2. Potential Contaminant Sources in Baltimore County Golf Course WHPAs

Underground Storage Tanks (UST's) and gas transmission pipelines are potential sources of volatile organic compounds from petroleum products, if they leak. Newer tanks are less likely to leak due to new construction standards; however, leaks may still be common in underground piping. Leaks often go undetected unless a water supply is impacted, because they are located in the subsurface.

Non-Point Sources

The Maryland Department of Planning's 2002 digital land use coverage of Baltimore County was used to determine the dominant types of land use in each WHPA (Figures 1-4). The land use summary is given in Tables 3a-d. Most of the WHPAs are made up of open urban area (golf course land), cropland, or forest. The remainders of the WHPAs are low density residential areas, with a total of 1.0 acre of pasture (Towson GC) and commercial areas (Hayfields GC).

Use Code	Land Use Type	Total Acres	% WHPA
11	Low Density Residential	8.9	4.8
18	Open Urban Land	92.4	50.2
21	Cropland	27.6	15.0
22	Pasture	1.0	0.5
41	Deciduous Forest	36.0	19.5
42	Evergreen Forest	2.8	1.5
43	Mixed Forest	15.5	8.4
	Total	184.2	100

Table 3a. Land Use Summary, Towson Golf Club

Use Code	Land Use Type	Total Acres	% WHPA
11	Low Density Residential	12.0	16.6
18	Open Urban Land	41.6	57.7
21	Cropland	18.5	25.7
	Total	72.1	100

Table 3b. Land Use Summary, Hillendale Golf Club

Use Code	Land Use Type	Total Acres	% WHPA
11	Low Density Residential	18.1	10.2
18	Open Urban Land	75.7	42.7
21	Cropland	42.3	23.9
41	Deciduous Forest	41.0	23.3
	Total	177.1	100

Table 3c. Land Use Summary, Caves Valley Golf Club

Use Code	Land Use Type	Total Acres	% WHPA
14	Commercial	0.0(2)	0.0
18/21	Open Urban Land/Cropland	79.3	99.1
41	Deciduous Forest	0.7	0.9
	Total	80.1	100

Table 3d. Land Use Summary, Hayfields Golf Club

Agricultural and golf course lands are commonly associated with nitrate loading of ground water. They also represent potential sources of SOCs depending on use of pesticides. Residential areas without sewer service may be a source of nitrate from septic systems. Additionally, residential areas may be a source of nitrate and SOCs if fertilizers, pesticides, and herbicides are not used carefully in lawns and gardens. Commercial areas are generally associated with facilities that may have point sources of contamination as described above.

The Maryland Department of Planning's 2002 digital sewer map of Baltimore County shows that all of the Towson, Caves Valley, and Hillendale Country Clubs' WHPAs have no planned sewer service, and that 94% of the Hayfields WHPA has no planned service (5 acres at the eastern boundary of that WHPA has a six-year planned 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 treatment methods for the golf course supplies are outlined in Table 4. Three of the courses, Towson, Caves Valley and Hayfields have no treatment listed. Also, MDE records indicate that the three courses do not provide bottled water to the population served.

SYSTEM	PWSID	PLANT ID	TREATMENT	PURPOSE
TOWSON	1030059	01	NO TREATMENT	
HILLENDALE	1030061	01	pH ADJUSTMENT	CORROSION CONTROL
HILLENDALE	1030061	01	HYPOCHLORITE	DISINFECTION
CAVES VALLEY	1030065	01	NO TREATMENT	
CAVES VALLEY	1030065	02	NO TREATMENT	
HAYFIELDS	1030071	01	NO TREATMENT	

Table 4. Treatment Methods in Baltimore County Golf Course Plants

A review of the monitoring data since 1993 was completed for the four golf courses in this study. The water quality sampling results are summarized in Tables 5a-d.

	Plant 01	
Contaminant Group	No. of Samples Collected	No. of Samples > 50% of an MCL
Inorganic Compounds	26	0
Radiological Contaminants	1	1
Volatile Organic Compounds	9	0
Synthetic Organic Compounds	4	0

Table 5a. Summary of Water Quality Samples for Towson Plant

	Plant 01	
Contaminant Group	No. of Samples Collected	No. of Samples > 50% of an MCL
Inorganic Compounds	21	5
Radiological Contaminants	1	1
Volatile Organic Compounds	8	0
Synthetic Organic Compounds	5	1

Table 5b. Summary of Water Quality Samples for Hillendale Plant

	Plant 01		Plant 02	
Contaminant Group	No. of Samples Collected	No. of Samples > 50% of an MCL	No. of Samples Collected	No. of Samples > 50% of an MCL
Inorganic Compounds	22	0	18	0
Radiological Contaminants	0	0	0	0
Volatile Organic Compounds	9	0	9	0
Synthetic Organic Compounds	4	0	4	1

Table 5c. Summary of Water Quality Samples for Caves Valley Plants

	Plant 01	
Contaminant Group	No. of Samples Collected	No. of Samples > 50% of an MCL
Inorganic Compounds	29	18
Radiological Contaminants	0	0
Volatile Organic Compounds	8	0
Synthetic Organic Compounds	2	0

Table 5d. Summary of Water Quality Samples for Hayfields Plant

Inorganic Compounds (IOCs)

Nitrate levels in the Hillendale and Hayfields water supplies have exceeded 50% of the MCL of 10 ppm. In addition the levels for Antimony and Thallium in one sample at the Hayfields course exceeded 50% of the MCLs of 0.006 and 0.002 ppm, respectively. The results of these analyses are shown in Tables 6a-b. No inorganic compounds were detected above 50% of an MCL at the Towson and Caves Valley Golf Clubs.

Contaminant Name	MCL(ppm)	Sample Date	Result (ppm)
NITRATE	10	30-JAN-96	5.2
NITRATE	10	14-MAY-96	5.5
NITRATE	10	30-JAN-97	6.5
NITRATE	10	8-JAN-98	5.1
NITRATE	10	23-JAN-01	8.5
NITRATE	10	8-JAN-02	6.7

Table 6a Inorganic Compound results above 50% of an MCL for Hillendale Golf Club

Contaminant Name	MCL(ppm)	Sample Date	Result (ppm)
NITRATE	10	27-OCT-98	5
ANTIMONY	0.006	27-OCT-98	0.005
THALLIUM	0.002	27-OCT-98	0.002
NITRATE	10	18-JAN-99	9.4
NITRATE	10	18-JAN-99	9.4
NITRATE	10	15-JUN-99	7
NITRATE	10	6-OCT-99	8.3
NITRATE	10	5-JAN-00	7.1
NITRATE	10	5-OCT-00	7
NITRATE	10	5-DEC-00	7.3
NITRATE	10	4-JAN-01	10
NITRATE	10	3-JUL-01	5.7
NITRATE	10	24-SEP-01	5.5
NITRATE	10	25-SEP-02	5.5
NITRATE	10	23-JUL-03	6.8
NITRATE	10	1-OCT-03	6.5
NITRATE	10	2-JAN-04	6.2
NITRATE	10	1-APR-04	5.8
NITRATE	10	11-OCT-04	7.7
NITRATE	10	10-JAN-05	8.7
NITRATE	10	7-APR-05	8

Table 6b. Inorganic Compound results above 50% of an MCL for Hayfields Golf Club

Radionuclides

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 results were 465 pCi/L for the Hillendale system and 2460 pCi/L for the Towson system, both exceeding the lower proposed MCL. No record of results for Radon-222 could be found in the MDE database for the Caves Valley and Hayfields golf courses.

Volatile Organic Compounds (VOCs)

A review of the data shows that VOCs have not been detected above 50% of an MCL. Of interest is that disinfection byproducts or Trihalomethanes, (Bromodichloromethane, Chloroform, and Dibromochloromethane) were detected only in the Hillendale system, which was, also, the only one with water treatment.

Synthetic Organic Compounds (SOCs)

The only SOC detected above 50% of an MCL was Di(2-Ehtylhexyl)Phthalate, which was found in the Towson and Hillendale systems, and plant02 of the Caves valley system. This contaminant is commonly found in laboratory blank samples and was reported in the blank samples for all three systems. The method for analyzing this contaminant was started in 1995 and had produced many false positive results.

Microbiological Contaminants

Raw water bacteriological data were reviewed for each of the systems for evaluation for ground water under the direct influence of surface water (GWUDI). All systems were free of fecal coliform bacteria (non-GWUDI). Wells in carbonate rocks, like those operated by Caves Valley and Towson Golf Club, require more testing for GWUDI analysis. Towson sources 5 & 6 (clubhouse wells 1 & 2) each had two dry and two wet sample sets, Hillendale source 1 (probably source 2) had one wet sample, Hayfields source 3 (well 1) had two dry and two wet sample sets, and Caves Valley sources 1 (back-up well), 3 (pumphouse well) and source 4 (guard shack well) had two dry and two wet sample sets, while source 2 (Maintenance shop well) had one wet sample. All of the systems' total coliform results were negative, except the dry samples for the back-up and pumphouse well at Caves Valley, shown in table 7. As the follow up wet samples produced negative results, the positive total coliform in the dry samples were not deemed significant.

Rain Date	Well	Remarks	Sample Date	Total Coliform	Fecal Coliform[1]
				(col./100 ml)	(col./100 ml)
	Back-up	Dry Sample	22-OCT-02	8	-1.1
	Pumphouse	Dry Sample	22-OCT-02	8	-1.1

Table 7. GWUDI from the Caves Valley Golf Club

[1]Negative symbol indicates less than the detection limit

SUSCEPTIBILITY ANALYSES

The wells serving the four golf courses draw water from unconfined fractured-rock aquifers. Wells in unconfined aquifers 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.

In the non-carbonate areas 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 for some contaminants. Properly constructed wells with no potential sources of contamination in their WHPA should, generally, be well protected from contamination. There are, however, dozens of cases in Maryland (such as Taneytown well 13, Poolesville well 2, Fountaindale well A and Oaks Landfill) where detailed studies were completed and the contamination that occurred could not be directly related to well construction. The susceptibilities of the four golf course water supplies to the various types of contaminants are summarized in
Tables 8a-d.

Inorganic Compounds

All results were less than 50% the MCL for all inorganic compound levels, except for the nitrate levels at the Hillendale and Hayfield golf courses. Sources of nitrate can generally be traced back to land use. Fertilization of agricultural fields, golf course playing areas and residential lawns, residential septic systems, and areas with high concentrations of livestock are common sources of nitrate loading in ground water. The residential areas within the WHPA that have existing or planned sewer service are limited to five acres at the eastern boundary of the Hayfields WHPA. There remaining residential areas (about 29 acres or 6%) are low-density housing with septic systems, for which there is no planned sewer service. Open urban areas, cropland, and forests make of 93% of the total area of the four WHPAs and present other sources of nitrate to the water supplies.

The levels of nitrates in the Hillendale and Hayfields water supplies indicate that those sources **are susceptible** to this contaminant. Levels of nitrate in the Caves Valley and Towson water supplies would suggest that those sources are **not** susceptible to this contaminant. However, due to the vulnerability of the aquifer to land activity, and the presence of nitrate sources in those WHPAs, the nitrate levels should be monitored closely to ensure that they do not rise.

The water supplies are **not** susceptible to inorganic compounds other than nitrate, based on water quality data and lack of potential contaminant sources within the WHPAs. On sample (in 1998) at the Hayfields golf club exceeded 50% of the MCLs for antimony and th allium, but was not repeated in subsequent samples. These chemicals are associated with discharges from petroleum refineries, electronics, glass, ceramic, and

drug factories, as well as fire retardants, solder, and leaching from ore-processing sites. There does not appear to be any past or present activities of these sorts in the vicinity of the wells.

Radionuclides

The water supplies are **not** presently susceptible to radionuclides. The Hillendale and Towson have Radon-222 levels exceeding the lower MCL (300 pCi/L) proposed by the EPA for that contaminant. The source of radionuclides in ground water is the natural occurrence of uranium in rocks.

Volatile Organic Compounds

The water supplies are **not** presently susceptible to contamination by VOC's, but there is the presence of contaminant sources in the Towson, Hillendale and Hayfields WHPAs. VOC's have not been detected at a level of concern. The proximity of the contaminant sources to the wells does present a possible threat and VOC's should be monitored regularly.

Synthetic Organic Compounds

The wells at each course are **not** presently susceptible to synthetic organic compounds. Potential sources of SOCs in the WHPAs may be pesticide or herbicide use in agricultural and residential areas or the golf course properties. The level of SOCs that were detected were significantly below MCLs and are not likely to rise due to long term trends of reduced herbicide usage.

Microbiological Contaminants

The data contained in MDE's database indicate that the wells at the four golf courses are not under the direct influence of surface water. Each system should be evaluated to determine if any additional GWUDI testing is required. All of the wells postdate the State's construction standards.

Contaminant Group	Are Contaminant Sources Present in WHPA?	Are Contaminants Detected Above 50% of MCL?	Is Well Integrity a Factor?	Is the Aquifer Vulnerable	Is the System Vulnerable
Nitrate	Yes	No	No	Yes	No
Inorganic Compounds (except nitrate)	No	No	No	Yes	No
Radiological Compounds	Yes	Yes	No	Yes	Yes
Volitile Organic Compounds	Yes	No	No	Yes	No
Synthetic Organic Compounds	No	Yes	No	Yes	No
Microbiological Contaminants	No	No	No	Yes	No

Table 8a. Susceptibility Analysis Summary for Towson Golf Club (marble)

Contaminant Group	Are Contaminant Sources Present in WHPA?	Are Contaminants Detected Above 50% of MCL?	Is Well Integrity a Factor?	Is the Aquifer Vulnerable	Is the System Vulnerable
Nitrate	Yes	Yes	No	No	Yes
Inorganic Compounds (except nitrate)	No	No	No	No	No
Radiological Compounds	Yes	Yes	No	Yes	Yes
Volitile Organic Compounds	Yes	No	No	No	No
Synthetic Organic Compounds	No	Yes	No	No	No
Microbiological Contaminants	No	No	No	No	NO

Table 8b. Susceptibility Analysis Summary for Hillendale Golf Club (schist)

Contaminant Group	Are Contaminant Sources Present in WHPA?	Are Contaminants Detected Above 50% of MCL?	Is Well Integrity a Factor?	Is the Aquifer Vulnerable	Is the System Vulnerable
Nitrate	Yes	No	No	Yes	No
Inorganic Compounds (except nitrate)	No	No	No	Yes	No
Radiological Compounds	Yes	N/R	No	Yes	N/R
Volitile Organic Compounds	No	No	No	Yes	No
Synthetic Organic Compounds	No	Yes	No	Yes	No
Microbiological Contaminants	No	No	No	Yes	No

Table 8c. Susceptibility Analysis Summary for Caves Valley Golf Club (marble)

Contaminant Group	Are Contaminant Sources Present in WHPA?	Are Contaminants Detected Above 50% of MCL?	Is Well Integrity a Factor?	Is the Aquifer Vulnerable	Is the System Vulnerable
Nitrate	Yes	Yes	No	No	Yes
Inorganic Compounds (except nitrate)	No	Yes	No	No	No
Radiological Compounds	Yes	N/R	No	Yes	N/R
Volitile Organic Compounds	Yes	No	No	No	No
Synthetic Organic Compounds	No	No	No	No	No
Microbiological Contaminants	No	No	No	No	No

Table 8d. Susceptibility Analysis Summary for Hayfields Golf Club (gneiss)

MANAGEMENT OF THE WHPA

Contaminant Source Inventory/Well Inspection

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

Cooperative Efforts with Other Agencies

- Work closely with Baltimore County Department of Environmental Protection and Resource Management to identify any unused wells in the WHPAs and to ensure that they are abandoned and sealed in compliance with the State's well construction standard
- Work with the local Soil Conservation District or Cooperative Extension to implement Best Management Practices for the golf courses maintenance.

Monitoring

- Continue to monitor for all Safe Drinking Water Act contaminants as required by MDE.
- Carefully monitoring the nitrate data to determine whether there is a change in levels over time.

Changes in Use

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

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OTHER SOURCES OF DATA

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MDE Water Supply Program Oracle® Database
MDE Waste Management Sites Database
USGS Topographic 7.5 Minute Quadrangles for Baltimore County
Maryland Office of Planning 2002 Baltimore County Digital Land Use Map
Maryland Office of Planning 2002 Baltimore County Digital Sewer Map