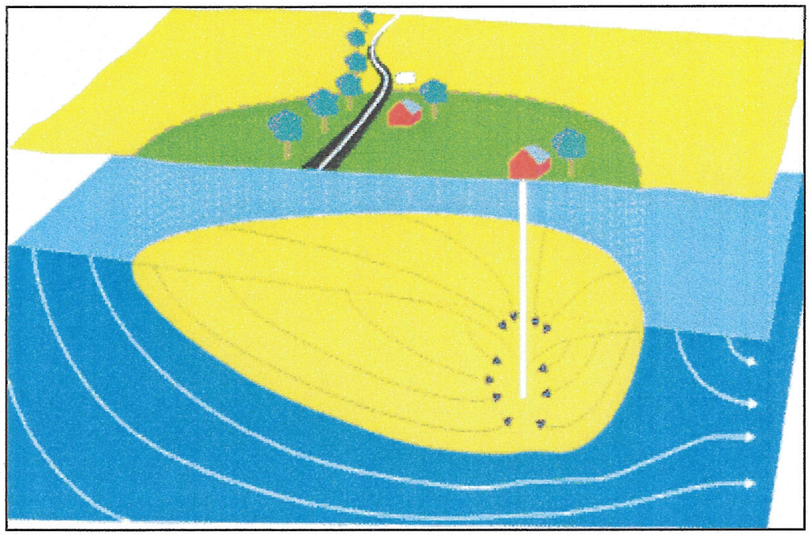
SOURCE WATER ASSESSMENT

FOR BOWLING BROOK PREPARATORY SCHOOL/MIDDLEBURG CARROLL COUNTY, MD



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MDE

CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

The Maryland Department of Environment's Water Supply Program (WSP) has performed a Source Water Assessment for the Bowling Brook Preparatory School water system in Carroll County, Maryland. This water system is identified as Public Water System Identification (PWSID) 0060018 by the Maryland Department of the Environment (MDE). The required components of this report as described in Maryland's Source Water Assessment Plan (SWAP) are:

- Delineation of the area that contributes water to the source
- Identification of potential sources of contamination
- Determination of the susceptibility of the water supply to contamination
- Recommendations for protecting the drinking water supply

The source of the Bowling Brook water supply is the New Oxford Formation, which is an unconfined Sedimentary rock of Triassic age. The Source Water Protection Area (SWPA) for the three ground-water supply wells was delineated using the watershed delineation method for fractured bedrock wells. The area of the SWPA is based on land topography, and a calculation of the total ground-water contributing area during a drought. The SWPA is approximately 186 acres in area.

There was only one potential non-point source of contamination within the assessment area based on site visits, a review of MDE's databases, and a review of land use maps. Because cropland and some forest account for a significant portion of the SWPA, overuse of nitrogen-based fertilizers in farm fields can be considered a non-point source of contamination. Well information and water quality data for the system were also reviewed.

The susceptibility analysis for the Bowling Brook Preparatory school 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 the Bowling Brook water supply is susceptible to nitrate and may be susceptible to radon-222 and bacteria. It was determined that the water supply is not susceptible to volatile organic compounds, other radionuclides, microbiological contaminants and other inorganic and synthetic organic compounds.

1. INTRODUCTION

The Water Supply Program has conducted a Source Water Assessment for the Bowling Brook Preparatory School (BBPS) water system in Carroll County, Maryland.

The school is located in western Carroll County approximately 1 mile northeast of Middleburg on the east side of Crouse Road.

The water treatment plant and the supply wells for the system are located on the northern end of the 120 acre property. The Bowling Brook Preparatory School water system is owned by Walden Real Estate, Inc. and is operated by Maryland Environmental Service (MES). It serves a current population of 161 people. The average daily flow in 2004 was 9,300 gallons per day. The water is supplied by three wells (Figure 1).

1.1 GROUND-WATER SUPPLY SYSTEM INFORMATION

A review of the well data and sanitary surveys of the system indicates that one of the wells was drilled in 1987 and the other two were drilled in 1995. Table 1 contains a summary of the wells construction data.

TABLE 1. WELL INFORMATION - PWSID # 060018

Source ID	Source Name	Permit No.	Total Depth (ft)	Casing Depth (ft)	Aquifer
01	Bowling Brook Preparatory School	CL815051	**300**	**20**	New Oxford Formation
02	Bowling Brook Preparatory School	CL930410	**405**	**53**	New Oxford Formation
03	Bowling Brook Preparatory School	CL930411	**205**	**55**	New Oxford Formation

All the wells are located within 1000 feet of the administrative building on the campus. All three wells have casing heights of two or more feet. The wells are pumped simultaneously to the treatment plant and then to a 22,000 -gallon above ground storage tank and from there to a 3500-gallon hydropneumatic tank before it is distributed to the system. The finished water is a mixture from all three wells. The plant employs ion exchange for removal of iron and manganese and chlorination for disinfection.

1.2 HYDROGEOLOGY

The Bowling Brook site is located on the western edge of Carroll County within the Piedmont Physiographic Province and the wells are drilled in the New Oxford Formation, a Triassic Sedimentary rock consisting of interbedded layers and lenses of sandstone, siltstone, and shale that dip to the west in the Frederick Valley. In the Taneytown area, the rock formation has a northeast to southwest strike. (R.E. Wright, 1988).

The sandstones and siltstones, where fractured and jointed, are highly transmissive. Where shales are interbedded in the sandstone and siltstone, they act as confining layers with very low transmissivities.

A geologic base map is presented in Figure 3. The source of the ground water is from precipitation in the form of rainfall or snow melt. The water table in the aquifer generally mimics the surface topography. Most of the ground water available to a well exists in the weathered rock zone and in the overlying saprolite. The fracture openings penetrated by the well also contribute ground water to the well.

2. SOURCE WATER ASSESSMENT AREA DELINEATION

For ground-water systems, a Wellhead Protection Area (WHPA) is considered to be the source water assessment and protection area for the system. As defined in Maryland's SWAP, the source water assessment area for public water systems permitted to use an average of more than 10,000 gallons per day (gpd), in unconfined fractured-rock aquifers is hydrogeologic mapping of the watershed drainage area that contributes to the well. For Bowling Brook Preparatory School, the current Water Appropriation Permit issued by the MDE Source Protection and Appropriation Division is for an average of 12,000 gpd for the three wells. The watershed drainage area is more than enough to support the allotted withdrawal from the three wells.

3. INVENTORY OF POTENTIAL CONTAMINANTS WITHIN THE DELINEATED AREA

MDE Water Supply Program staff conducted a field survey on April 20, 2005 to check for potential sources of contamination within and near the area surrounding the BBPS. Previously, the MDE database was queried for contaminant sources within and near the school. The contaminant databases include the Comprehensive Environmental Response, Compensation, and

Liability Act Information System (CERCLIS), which includes National Priority List (Superfund) sites, Maryland Registered Underground Storage Tank (UST) sites, Maryland Leaking Underground Storage Tank (LUST) sites, landfills, pesticide dealers, ground-water discharge permits, Colonial Pipeline, and Controlled Hazard Substances (CHS) generator sites.

None of the above mentioned potential contaminant sites were within the delineated wellhead protection area.

3.1 POINT SOURCES

The area is surrounded by farmland with some forest and no point sources of contamination have been identified in MDE's database for the site.

3.2 NON-POINT SOURCES

The Maryland Department of Planning's (MDOP) 2002 Land Use/Land Cover map for Carroll County was used to determine potential non-point sources within the wellhead protection area (WHPA). The evaluation was based on land use designation (Figure 4). A summary of the percent and acreage of each type of land use, using the 2002 map is presented in the table below:

Table 2. 2002 PERCENTAGE OF EACH LAND USE TYPE WITHIN WHPA

Forest (acre)	40.8
Forest (%)	22.0
Cropland (acre)	145.4
Cropland (%)	78.0
TOTAL ACRE	186.2
TOTAL %	100.0

The MDOP erroneously classified the BBPS ground as cropland. There is about 7 acres of buildings representing 3 to 4% of the total WHPA.

Agricultural and forested areas account for a significant portion of the total WHPA area. The use of fertilizers and pesticides are potential sources of pollution generally associated with agricultural land uses.

The septic system drain field serving the school is located down gradient of the wells on the north end of the property about 400 feet north of well 1. The down gradient location reduces the potential that the septic system discharge is affecting the supply wells.

4. REVIEW OF WATER QUALITY DATA

Water quality data was obtained from the MDE Water Supply Program database of Safe Drinking Water Act (SDWA) contaminants. The results reported are for finished (treated) ground water (unless otherwise noted). Currently, the raw ground water is treated with sodium hypochlorite (bleach) for disinfection and ion exchange to lower high iron levels. The finished water is stored in one 22,000-gal above ground tank and a 3,500-gal hydropneumatic buried tank prior to entering the distribution system.

A review of the water quality data from Bowling Brook covers the period 1993 onward through 2004. The school has been operating since 1991 but MDE's database only contains information from 1993. All detected compounds from ground water samples collected are shown in the tables. Ground-water analytical results were evaluated to establish susceptibility to contaminants.

4.1 VOLATILE ORGANIC COMPOUNDS (VOCs)

No volatile organic compounds (VOCs) were reported in the ground-water samples above 50 percent of the USEPA MCL. Table 3 lists all detection of volatile organic compounds. The presence of chloroform, bromoform, bromodichloromethane, and dibromochloromethane are due to the reaction of chlorine from the water treatment plant with naturally occurring organic compounds. The concentrations observed are well below the maximum allowable level of 80 parts per billion. No other VOCs have been detected in the ground-water samples collected.

TABLE 3. VOCs DETECTS

PWSID	Plant ID	Raw (R) or Finished (F)	Contaminant Name	MCL (ppb)	Sample Date	Results (ppb)
60018	1	R (well 2)	TOLUENE	1000	31-Jul-96	0.5
60018	1	R (well 2)	NAPHTHALENE	N/A	31-Jul-96	1.2
60018	1	F	BROMODICHLOROMETHANE	80	15-Dec-98	2.3
60018	1	F	BROMOFORM	80	15-Dec-98	1.4
60018	1	F	CHLOROFORM	80	15-Dec-98	1.7
60018	1	F	DIBROMOCHLOROMETHANE	80	15-Dec-98	2.5
60018	1	F	BROMODICHLOROMETHANE	80	29-Jan-01	1.8
60018	1	F	CHLOROFORM	80	29-Jan-01	2.1
60018	1	F	DIBROMOCHLOROMETHANE	80	29-Jan-01	1.6
60018	1	F	BROMOFORM	80	29-Jan-01	0.9
60018	1	F	BROMODICHLOROMETHANE	80	21-Jan-04	1.8
60018	1	F	DIBROMOCHLOROMETHANE	80	21-Jan-04	2.1
60018	1	F	CHLOROFORM	80	21-Jan-04	1.9
60018	1	F	BROMOFORM	80	21-Jan-04	0.8

4.2 SYNTHETIC ORGANIC COMPOUNDS (SOCs)

Pentachlorophenol was detected in the finished water on one occasion as shown in Table 4 below. This contaminant is used in preserving wood and has been known to cause liver and kidney problems along with increased risk of cancer. The result is less than 10% of the MCL. This compound was not detected in four other samples taken from this plant over the period of record.

TABLE 4. SOCS DETECTS DATA

PWSID	Plant ID	Contaminant ID	Contaminant Name	MCL (ppb)	Sample Date	Result (ppb)
060018	1	2326	PENTACHLOROPHENOL	1	07/24/1997	0.08

4.3 INORGANIC COMPOUNDS (IOCs)

Nitrate has consistently been detected for water samples tested from the wells since 1993. The highest measured value was 5.46 parts per million (ppm) while the lowest was 1.07 ppm. Of the 41 nitrate results in the table below 4 were greater than 50% of the MCL or 5 ppm. A summary of all detected IOCs concentrations in the ground-water samples collected is shown in Table 5. Some of the results are listed as raw water results from samples taken from individual wells in 1996 and 1997. The raw water results from well 3 show elevated Manganese. All the wells have moderately hard water, which had been reduced through ion exchange to remove the iron and manganese. As a consequence the treated sodium levels are approximately 10 times greater (approximately 90 ppm) than the value measured when the wells were drilled (8-13 ppm). EPA recommends 20 ppm for people on sodium restricted diet.

TABLE 5. SUMMARY OF IOC DETECTS

PWSID	Plant	Contaminant Name	MCL	Sample Date	Result (ppm)	Well #
60018	1	ALKALINITY, TOTAL		31-Jul-96	105	2
60018	1	ALKALINITY, TOTAL		31-Jul-96	98	3
60018	1	ALKALINITY, TOTAL		24-Jul-97	131	1
60018	1	ARSENIC	0.01	22-Nov-04	0.002	
60018	1	BARIUM	2	11-Jul-96	0.041	1
60018	1	BARIUM	2	31-Jul-96	0.03	2
60018	1	BARIUM	2	31-Jul-96	0.042	3
60018	1	CALCIUM		24-Jul-97	38	2
60018	1	CALCIUM		24-Jul-97	57	3

60018	1	CHLORIDE		24-Jul-97	19	3
60018	1	CHLORIDE		24-Jul-97	8	2
60018	1	COPPER	1.3	11-Jul-96	0.004	1
60018	1	COPPER	1.3	31-Jul-96	0.005	3
60018	1	COPPER	1.3	31-Jul-96	0.012	2
60018	1	FLUORIDE	4	31-Jul-96	1.7	3
60018	1	HARDNESS, TOTAL (AS CAC03)		31-Jul-96	170	2
60018	1	HARDNESS, TOTAL (AS CAC03)		31-Jul-96	150	2
60018	1	HARDNESS, TOTAL (AS CAC03)		24-Jul-97	182	1
60018	1	HARDNESS, TOTAL (AS CAC03)		24-Jul-97	186	3
60018	1	HARDNESS, TOTAL (AS CAC03)		24-Jul-97	140	2
60018	1	IRON	.3	31-Jul-96	0.599	3
60018	1	IRON	.3	31-Jul-96	2.16	2
60018	1	LEAD	0.015	31-Jul-96	0.003	3
60018	1	LEAD	0.015	31-Jul-96	0.005	2
60018	1	MANGANESE	.05	31-Jul-96	0.074	3
60018	1	MANGANESE	.05	31-Jul-96	0.033	2
60018	1	NITRATE	10	11-Feb-93	4.5	
60018	1	NITRATE	10	10-Jan-94	5.16	
60018	1	NITRATE	10	9-May-94	5.28	
60018	1	NITRATE	10	14-Dec-94	4.37	
60018	1	NITRATE	10	13-Feb-95	5.46	
60018	1	NITRATE	10	16-May-95	4.05	
60018	1	NITRATE	10	17-Aug-95	4.14	
60018	1	NITRATE	10	6-Nov-95	4.91	
60018	1	NITRATE	10	21-Dec-95	3.4	
60018	1	NITRATE	10	22-Jan-96	4.89	
60018	1	NITRATE	10	11-Jul-96	4.6	1
60018	1	NITRATE	10	31-Jul-96	3.1	3
60018	1	NITRATE	10	31-Jul-96	4.82	2
60018	1	NITRATE	10	7-Feb-97	4.91	
60018	1	NITRATE	10	16-Jan-98	3.67	
60018	1	NITRATE	10	4-Aug-98	4	
60018	1	NITRATE	10	9-Mar-99	4.06	
60018	1	NITRATE	10	30-May-00	4.99	
60018	1	NITRATE	10	29-Jan-01	4.3	
60018	1	NITRATE	10	6-Mar-01	3.53	
60018	1	NITRATE	10	5-Jun-01	5.01	
60018	1	NITRATE	10	24-Jul-01	1.07	
60018	1	NITRATE	10	18-Sep-01	3.87	
60018	1	NITRATE	10	15-Jan-02	3.53	
60018	1	NITRATE	10	18-Jun-02	4.02	
60018	1	NITRATE	10	2-Jul-02	3.5	
60018	1	NITRATE	10	27-Aug-02	3.35	
60018	1	NITRATE	10	27-Aug-02	3.56	
60018	1	NITRATE	10	27-Aug-02	3.36	

60018	1	NITRATE	10	12-Nov-02	3.6	
60018	1	NITRATE	10	14-Jan-03	3.62	
60018	1	NITRATE	10	23-Apr-03	3.89	
60018	1	NITRATE	10	9-Sep-03	3.87	
60018	1	NITRATE	10	7-Oct-03	3.89	
60018	1	NITRATE	10	20-Jan-04	3.81	
60018	1	NITRATE	10	13-Apr-04	3.88	
60018	1	NITRATE	10	3-Aug-04	4.13	
60018	1	NITRATE	10	25-Aug-04	4.14	
60018	1	NITRATE	10	9-Nov-04	4.12	
60018	1	NITRATE	10	22-Nov-04	4.3	
60018	1	NITRATE	10	18-Jan-05	3.98	
60018	1	pH		24-Jul-97	8	3
60018	1	pH		24-Jul-97	7.5	2
60018	1	pH		24-Jul-97	7.8	1
60018	1	SODIUM		11-Jul-96	12.7	1
60018	1	SODIUM		31-Jul-96	8.36	2
60018	1	SODIUM		31-Jul-96	12.9	3
60018	1	SODIUM		4-Aug-98	86.9	
60018	1	SODIUM		29-Jan-01	98	
60018	1	SODIUM		25-Aug-04	108	
60018	1	SODIUM		22-Nov-04	98.4	
60018	1	SULFATE		21-Dec-95	10.4	
60018	1	SULFATE		11-Jul-96	25.5	1
60018	1	SULFATE		31-Jul-96	28.1	3
60018	1	SULFATE		31-Jul-96	22.4	2
60018	1	SULFATE		29-Jan-01	19.4	
60018	1	TOTAL DISSOLVED SOLIDS (TDS)		11-Jul-96	200	1
60018	1	TOTAL DISSOLVED SOLIDS (TDS)		31-Jul-96	160	3
60018	1	TOTAL DISSOLVED SOLIDS (TDS)		31-Jul-96	170	2
60018	1	ZINC		31-Jul-96	0.048	2
60018	1	ZINC		31-Jul-96	0.071	3

4.4 MICROBIOLOGICAL CONTAMINANTS

To assess the potential of Ground Water Under the Direct Influence (GWUDI) of surface water, ground-water sampling records were reviewed. Ground water supplies are tested for surface water influence to determine their susceptibility to surface water microorganisms such as giardia and cryptosporidium. These microorganisms are resistant to simple disinfection treatment. Water samples from wells 1, and 2 were negative for all coliform bacteria. A water sample taken from well 3 in 1998 (see table 6) tested positive for total coliform but negative for fecal coliform. Inspection reports for the water system carried out by MDE staff indicate that well 3 has an unsecured cap. Repeated attempts to get the problem corrected has been unsuccessful up to this time. The negative fecal concentrations suggests that the wells are not susceptible to surface water microorganisms.

If surface water directly recharges an aquifer through major fractures in rock and do not pass through the soil overburden, then the aquifer is likely to have elevated levels of coliform bacteria. These values would be particularly high following a significant rainfall event. Sampling carried out following such events is used to determine the potential for a water supply well to be under the direct influence of surface water. Given the positive total coliform results under dry weather conditions, it is recommended that additional raw water samples be collected following chlorination of the well and inspection of the caps.

TABLE 6. GWUDI TEST RESULTS

Rainfall				**Field Test**			**Lab Results**		
	Date	Rain Amount (in)	Location	Sampling tap location	Temp (°C)	pH	Turbidity (NTU)	Total Coliform (concentration)	Fecal Coliform
1	7-Oct-1998	0	Bowling Brook	Raw Tap	16.5	7.4	0.3	-1.1 MPN/100mL	<1.1
2	7-Oct-1998	0	Bowling Brook	Raw Tap	16.3	7.5	0.03	-1.1 MPN/100mL	<1.1
3	7-Oct-1998	0	Bowling Brook	Raw Tap	15.4	7.8	0.7	12 MPN/100mL	<1.1

4.5 RADIONUCLIDES

Radon-222 was detected at 2130 Pico curies per liter (pCi/L) in the finished water sample in March 1997 (table 7). 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.

Other radionuclides do have primary drinking water standard parameters. Gross alpha particles and Radium 226 & 228 were detected at levels of about half the MCL (see Table 7). The occurrence of these radionuclides is due to the decay of uranium and thorium in the aquifer sediments. The data does not indicate an increasing trend over the last 4 years.

TABLE 7 RADIONUCLIDES DETECTS

PWSID	PL	CONTAMINANT NAME	MCL	SAMPLE DATE	RESULT
60018	1	COMBINED RADIUM (226 & 228)	5	30-May-00	2.8279
60018	1	GROSS ALPHA	15	30-May-00	7
60018	1	GROSS ALPHA	15	9-Feb-04	5
60018	1	GROSS ALPHA	15	14-Apr-04	7
60018	1	GROSS ALPHA	15	27-Jul-04	8
60018	1	GROSS ALPHA	15	22-Nov-04	9
60018	1	RADON-222	N/A	25-Mar-97	2130
60018	1	RADIUM-228	5	30-May-00	2.74
60018	1	RADIUM-226	5	30-May-00	0.0879
60018	1	URANIUM-234		30-May-00	4.69
60018	1	URANIUM-238		30-May-00	0.729
60018	1	URANIUM-235		30-May-00	0.162

5. SUSCEPTIBILITY ANALYSIS

To evaluate the susceptibility of the ground-water source to contamination, the following criteria were used:

1. Available water quality data
2. Presence of potential contaminant sources in the WHPA
3. Aquifer characteristics
4. Well integrity
5. The likelihood of change to the natural conditions

Wells drilled at the Bowling Brook Preparatory school withdraw water from an unconfined fractured rock aquifer. Wells using unconfined aquifers are in general more susceptible to contamination from surface activities. Table 7 summarizes the susceptibility of Bowling Brook Preparatory school water supply to the various classes of contaminants.

5.1 VOLATILE ORGANIC COMPOUNDS

No incidents of ground water contamination have been reported and no VOCs were identified within the WHPA.

Based on the water quality data reviewed, the location of the wells on the property, the water supply at Bowling Brook Preparatory School is not susceptible to VOCs.

5.2 SYNTHETIC ORGANIC COMPOUNDS

There were no identified point sources containing SOCs within the WHPA. The single detect of Pentachlorophenol out of five samples tested over the years is an anomaly and cannot be determined to pose a susceptibility problem for the water system. The level of detection (10% of the MCL) is also well below the 50% action level used to determine susceptibility.

Based on the water quality data reviewed, the water supply at Bowling Brook Preparatory School is not susceptible to SOCs.

5.3 INORGANIC COMPOUNDS

Water from the treatment plant have been tested on several occasions from 1993 to 2004 for the presence of IOCs. Nitrate has been detected at levels greater than 50% of the MCL in about 10% of the water samples since 1993. Cropland is noted as a significant use of land within the well head protection area and the most likely source of nitrate to the production wells.

Based on the water quality data reviewed and the consistence detection of nitrate in the water samples, the water supply at Bowling Brook Preparatory school is susceptible to nitrate contamination but not to other regulated inorganic compounds (IOCs).

5.4 RADIONUCLIDES

Radon-222 has been detected at a level higher than 50% of the higher proposed MCL. Radon is prevalent in ground water in Carroll County due to radioactive decay of uranium bearing minerals in the bedrock (Bolton, 1996).

Based on the water quality data, the water supply at Bowling Brook Preparatory School may be susceptible to radon-222 but not susceptible to other radionuclides.

5.5 MICROBIOLOGICAL CONTAMINANTS

Data available to MDE for wells 1,2 and 3 suggest that the sources are not under the direct influence of surface water.

Well 3 has tested positive for total coliform and there were problems with the well cap that has not been corrected up to now. However, this is a problem that when corrected will bring the well up to standard and prevent any further contamination problems.

Based on the water quality review and the condition of all the wells, the water supply at Bowling Brook Preparatory school is not susceptible to protozoan contaminants present on the surface such as Giardia & cryptosporidium. Previously identified deficiencies indicate that re-sampling of the well 3 is needed.

TABLE 8: SUSCEPTIBILITY LOGIC CHART

Contaminant Name	Are Contaminant Sources Present in WHPA?	Are Contaminants Detected in WQ Samples at Levels of Concern?	Is Well Integrity a Factor?	Is the Aquifer Vulnerable?	Is the System Susceptible?
VOC	NO	NO	NO	NO	NO
SOC	NO	NO	NO	NO	NO
IOC	YES (nitrate)	YES (nitrate)	NO	YES (nitrate)	YES (nitrate)
RADIONUCLIDES	YES (Radon-222)	MAYBE (Radon-222)	NO	YES (Radon-222)	MAYBE (Radon-222)
MICROBIOLOGICAL PATHOGENS	NO	YES	YES (well 3)	NO	NO-protozoa YES-bacteria

6. RECOMMENDATIONS FOR PROTECTING THE WATER SUPPLY

With the information contained in this report, Bowling Brook Preparatory School has a basis for better understanding of the risks to its drinking water supply. Being aware of the WHPA, knowing potential contaminant sources, evaluating current and future development, working with agricultural producers and soil conservation agencies, and effective outreach and education are examples of management practices that will help protect the water supply.

Recommendations for the protection of the ground-water supply are intended for the school owner and its residents. Specific management recommendations for consideration are listed below.

6.1 WELL INSPECTION AND REHABILATION

A regular inspection and maintenance program of the supply wells should be considered to prevent a failure in the well's integrity, which may provide a pathway for contaminants to the aquifer.

Inspection of the wells indicates opportunity for microbiological contaminants to enter well 3. Replacement or repair of the caps, chlorination, and re-sampling is recommended. If the resampling shows positive coliform than inspection of the well casing integrity is recommended.

6.2 PUBLIC AWARENESS AND OUTREACH

The summary of this assessment should be made available to the residents through the annual consumer confidence report. The importance of careful handling of gasoline and other chemicals should be emphasized to the school maintenance staff.

The management of the school should also consider sending pamphlets, flyers, or bill stuffers to its residents to educate them about the WHPA. The staff should also be encouraged to notify the school management of any significant spills from gasoline or any other potentially hazardous substances. Placing road signs at the WHPA boundaries is an effective way to make the public aware of protecting their source of water supply, and to help in the event of spill notification and response.

6.3 PLANNING/NEW DEVELOPMENT

The management of the school should be aware of the WHPA limits and evaluate the possible effects to the quality of the ground water prior to building or making any changes. The school should also inform the Carroll County Planning Department of any concerns to future development or zoning changes of properties that are within the WHPA.

6.4 MONITORING

The management of the school should continue to monitor the ground water for all SWDA contaminants as required by MDE.

Annual raw water sampling for microbiological contaminants is a good way to check the integrity of the wells. Previous sampling indicated positive total coliform results that should be followed up.

6.5 CONTIGENCY PLAN

As required by the Code of Maryland Regulations (COMAR) 26.04.01.22, all water system owners are required to prepare and submit for approval a plan to provide safe drinking water under emergency conditions.

6.6 CHANGES IN USE

The management of the school should inform the Water Supply Program at MDE of any changes to pumping rates and when a change in the number of wells used is anticipated. Any changes to the pumping rate and/or the number of supply wells will affect the size and shape of the WHPA.

6.7 CONTAMINANT SOURCE INVENTORY UPDATES/INSPECTIONS

The management of the school should conduct its own survey of the WHPA to ensure that there are no additional potential sources of contamination.

7. REFERENCES

The following sources of information were consulted as a part of this investigation:

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6. United States Environmental Protection Agency (USEPA). 1999. *Proposed Radon in Drinking Water Rule.* Office of Water. EPA 815-F-99-006. October.

7. United States Environmental Protection Agency (USEPA). 2001. *A Small Systems Guide to the Total Coliform Rule.* Office of Water. EPA 816-R-01-017A. June.

SOURCES OF DATA

Water Appropriation and Use Database
Public Water Supply Inspection Reports
Monitoring Reports
MDE Water Supply Program Oracle Database
MDE Waste Management Sites Database
Maryland Office of Planning 2002 Carroll County Land Use Map
USGS Topographic 7.5 minute Quadrangle Map – Union Bridge Quad

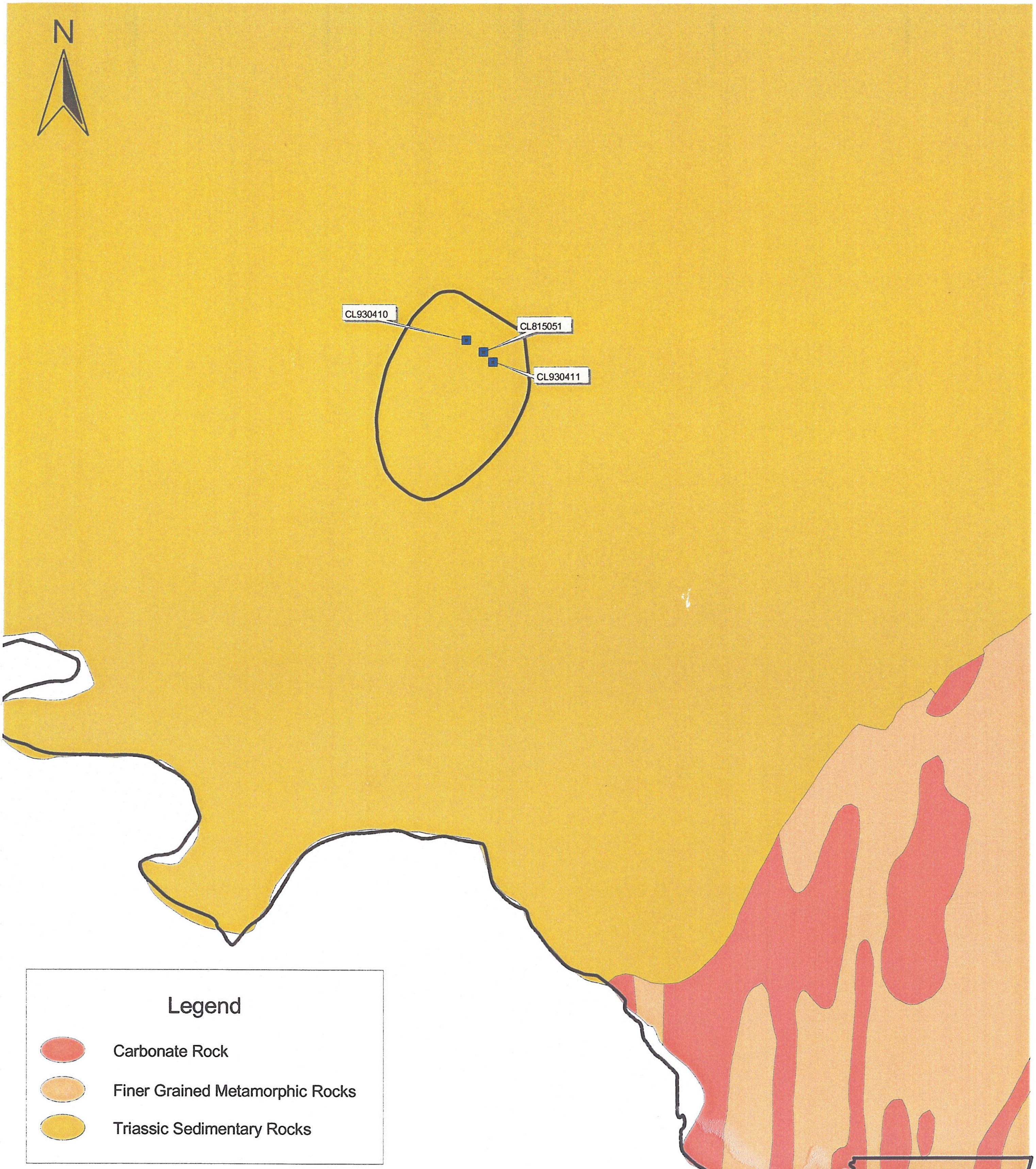
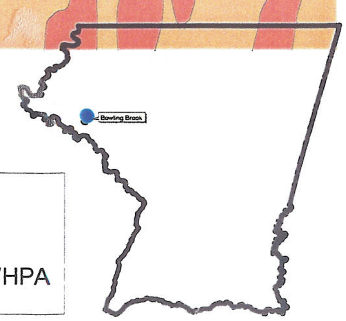


Figure 3: Geology Map of WHPA at Bowling Brook School



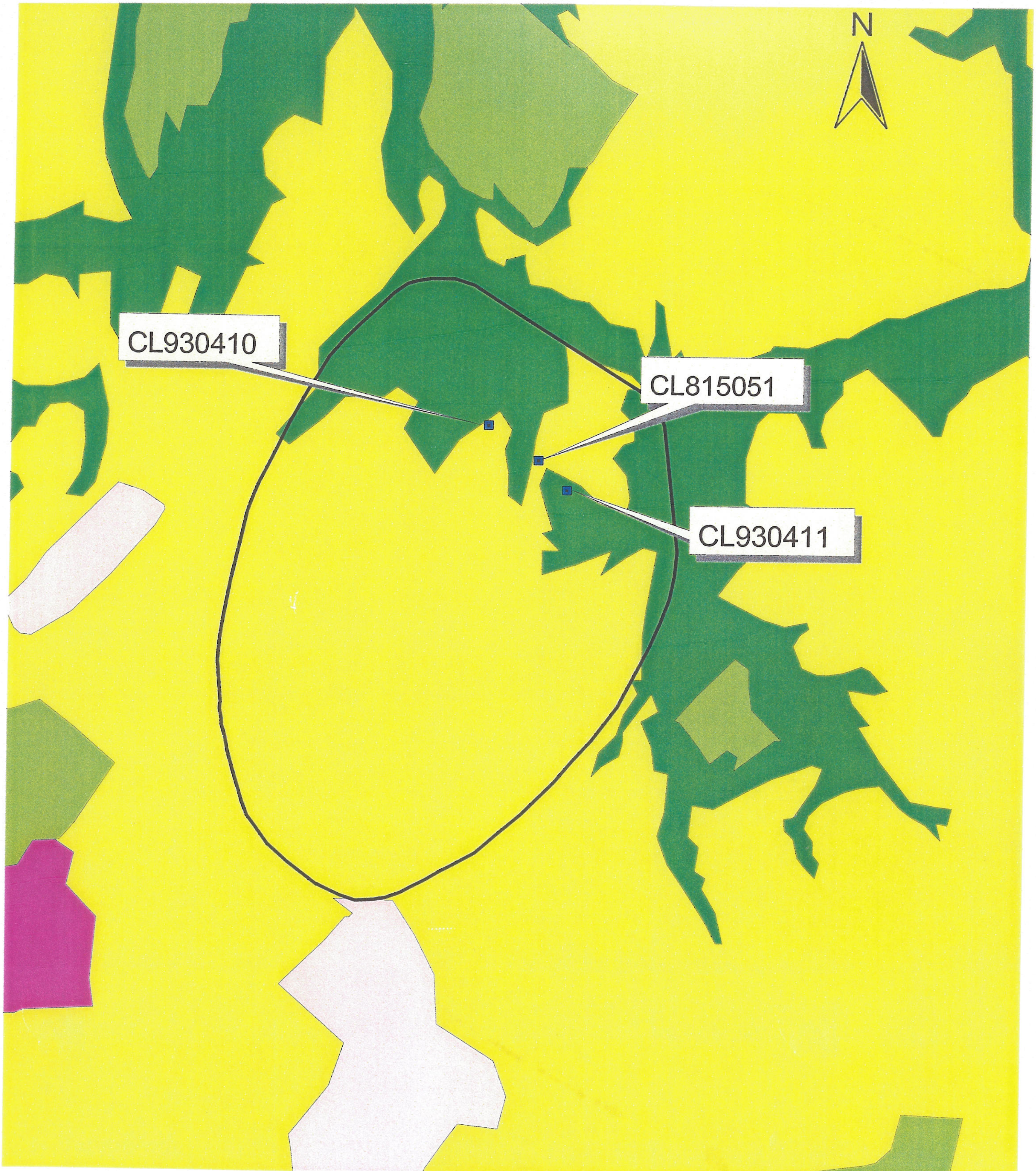


Figure 4: 2002 Carroll County Land Use Map of the WHPA