CE71 G003

Final

Source Water Assessment

for the

Conowingo Mobile Home Park Water System

Cecil County, Maryland

Prepared for:

Maryland Department of the Environment
Water Management Administration
Water Supply Program
1800 Washington Boulevard, Suite 625
Baltimore, Maryland 21230-1719

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May 2003

Project No. 61726.01

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LIST OF ACRONYMS AND ABBREVIATIONS

AST	Above Ground Storage Tank
CCL	Contaminant Candidate List
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CHS	Controlled Hazardous Substances
COMAR	Code of Maryland Regulations
DWEL	Drinking Water Equivalent Level
ft	Foot/Feet
gal	Gallon(s)
gpd	Gallon(s) Per Day
gpm	Gallon(s) Per Minute
GPS	Global Positioning System
GWUDI	Ground Water Under Direct Influence
IOC	Inorganic Compound
L	Liter(s)
LUST	Leaking Underground Storage Tank
MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
mg	Milligram(s)
MGS	Maryland Geological Survey
MHP	Mobile Home Park
MTBE	Methyl-Tert-Butyl-Ether
pCi	Picocurie(s)
PWSID	Public Water System Identification
SDWA	Safe Drinking Water Act
SDWR	Secondary Drinking Water Regulations
SOC	Synthetic Organic Compound
SWAP	Source Water Assessment Plan
SWPA	Source Water Protection Area
µg	Microgram(s)
USEPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

VOC	Volatile Organic Compound
WHPA	Wellhead Protection Area

EXECUTIVE SUMMARY

EA Engineering, Science, and Technology was tasked to perform a Source Water Assessment for the Conowingo Mobile Home Park (MHP) water system in Cecil County, Maryland. This water system is identified as Public Water System Identification (PWSID) 0070214 by the Maryland Department of the Environment (MDE). EA has performed this study under Purchase Order No. U00P3200205, as authorized by the 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 Conowingo MHP's water supply is the Baltimore Gabbro Complex, which is an unconfined crystalline rock aquifer. The Source Water Protection Area (SWPA) for the four ground-water supply wells and two backup wells was delineated using the watershed delineation method for fractured bedrock wells. The area of the SWPA is based on land topography, the Susquehanna River, nearby streams, and a calculation of the total ground-water contributing area during a drought. The SWPA is approximately 111 acres in area.

Potential point and non-point sources of contamination within the assessment area were identified based on site visits, a review of MDE's databases, and a review of sewer service area and land use maps. Heating oil tanks and septic systems were observed on site. In addition, a Ground-Water Discharge Permit is issue for an upgradient community. Residential areas account for a significant portion of the SWPA. Overuse of nitrogen-based fertilizers in residential areas can be considered a non-point source of contamination. Well information and water quality data were also reviewed.

The susceptibility analysis for the Conowingo MHP 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 Conowingo MHP water supply is moderately susceptible to nitrate and radon-222 and has a low susceptibility to volatile organic compounds, synthetic organic compounds, other regulated inorganic compounds, other radionuclides, and microbiological contaminants (for Wells 4 and 5 only). An assessment of the susceptibility of Wells 1 and 6 to surface water needs to be performed as required by MDE.

1. INTRODUCTION

EA Engineering, Science, and Technology was tasked to perform a Source Water Assessment for the Conowingo Mobile Home Park (MHP) water system in Cecil County, Maryland. EA has performed this study under Purchase Order No. U00P3200205, as authorized by the Maryland Department of the Environment (MDE).

The Conowingo MHP water system serves the Conowingo MHP community of Cecil County. The water treatment plant and the supply wells for the system are located within the development. The Conowingo MHP water system is owned and operated by Bernard Brown and serves a population of 300 people with 120 connections. The water is supplied by four active and two backup wells (Figure 1).

1.1 GROUND-WATER SUPPLY SYSTEM INFORMATION

A review of the well data and sanitary surveys of the system indicates that well number 5 was drilled in 1991, in accordance with the State's current well construction standards, which were implemented in 1973. The wells have a total average yield of 28,000 gallons per day (gpd). Wells 1, 4, 5, and 6 have pumping rates of 14, 10, 14, and 14 gallons per minute (gpm) respectively. The pumping rates, permit numbers, and depths of Wells 2 and 3 are unknown. A well installed previously has been abandoned (CE811338). Table 1 contains a summary of the well construction data.

TABLE 1. WELL INFORMATION

Source ID	Source Name	Permit No.	Total Depth (ft)	Casing Depth (ft)	Aquifer
01	Conowingo MHP 1	CE710029	117	25	Balto. Gabbro Complex
02	Conowingo MHP 4	CE710046	120	30	Balto. Gabbro Complex
03	Conowingo MHP 5	CE732978	136	45	Balto. Gabbro Complex
04	Conowingo MHP 6	CE710047	90	55	Balto. Gabbro Complex
05	Conowingo MHP 2 (Backup)	Unknown	Unknown	Unknown	Balto. Gabbro Complex
06	Conowingo MHP 3 (Backup)	Unknown	Unknown	Unknown	Balto. Gabbro Complex

Wells 1 and 2 were observed within subsurface pits. No standing water was observed in either pit. Well 3 was observed with a damaged cap. With the exception of Well 3, each well was observed secure and in good repair.

According to the MDE Public Water Supply Inspection Report for the water system dated March 2002, the operator of the water system is Bernard Brown.

Currently, the raw ground water is treated with sodium hypochlorite (bleach) for disinfection. The finished water is stored in three approximately 2,000-gal hydropneumatic tanks and three 82-gal bladder tanks prior to distribution.

1.2 HYDROGEOLOGY

Cecil County has two distinct physiographic provinces, the Piedmont and the Atlantic Coastal Plain, divided by the Fall Line. In the northern third of the county, Precambrian to early Paleozoic crystalline igneous and metamorphic rock of the Piedmont province is exposed at the surface. In the southern two-thirds of the county, the crystalline rocks are overlain by Coastal Plain deposits consisting largely of unconsolidated pebbly sand, sand, sandy clay, and clay. The deposits form a wedge-shaped mass of materials that range in thickness from inches along the Fall Line to as much as 1,600 ft in the southeastern corner of the County (Overbeck et al. 1958).

The ground water used by the Conowingo MHP is from production wells drilled into the Gabbro Complex Formation. The Baltimore Gabbro Complex Formation is described as "hypersthene gabbro with subordinate amounts of olivine gabbro, norite, anorthositic gabbro, and pyroxenite with igneous minerals and textures well preserved in some rocks, other rocks exhibit varying degrees of alteration and recrystallization, and still others are completely recrystallized with a new metamorphic mineral assemblage" [Maryland Geological Survey (MGS) 1968].

The source of the ground water in Cecil County is from precipitation in the form of rainfall or snow melt. The water table in the aquifer generally mimics the surface topography. The availability of ground water in the crystalline rock of the area depends on the nature and distribution of secondary openings resulting from fracturing and weathering. The yield of a well in crystalline rock depends primarily on the amount of fracture openings penetrated by the well. The well yield range of 35 wells in the Gabbro Complex ranges from 3 to 100 gallons per minute (gpm) with 30 percent of the wells having well yields greater than 10 gpm. The range of specific capacity, which relates well yield to drawdown, of 27 wells range from less than 0.1 to 17 gallons per minute per foot of drawdown (Otton et al. 1988).

2. DELINEATION OF THE AREA CONTRIBUTING WATER TO SOURCE

For ground-water systems, a Wellhead Protection Area (WHPA) is considered to be the source water assessment and protection area for the system. Consistent with the recommended delineation in the Maryland SWAP (MDE 1999), the watershed drainage area that contributes ground water to the supply wells methodology was used.

This original delineation shape was then modified by accounting for surface water bodies, topography, significant land features, and by using a conservative calculation of total ground-water recharge during a drought. For conservative purposes, drought condition recharge value of 400 gpd per acre (or approximately 5.4 inches per year) was used to estimate the total ground-water contribution area required to supply the wells.

For Conowingo MHP, the current Water Appropriation Permit issued by the MDE Water Rights Division is for an average of 28,000 gpd for the total of the four active wells. To determine the total ground-water contribution area during a drought, the following equation was used:

Recharge Area (acre) = Average Use (gpd)/Drought Condition Recharge (gpd/acre)

From the equation above, the total ground-water contributing area during a drought is approximately 70 acres. The delineated WHPA is approximately 111 acres (Figure 2), and is therefore adequate to meet the average daily ground-water usage during a drought.

3. INVENTORY OF POTENTIAL CONTAMINANTS WITHIN THE DELINEATED AREA

A field survey was performed on 4 November 2002 to confirm potential sources of contamination identified in MDE databases near the ground-water wells. These 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 Tanks, and Controlled Hazard Substances (CHS) generator sites.

During the field survey, other sources of potential contamination not in the MDE databases were noted and the location was surveyed using a Global Positioning System (GPS) receiver for mapping purposes (Figure 2).

3.1 POINT SOURCES

Several 275-gal above ground residential heating oil tanks (AST) were observed throughout the development. Failure of an AST may impact the ground water with petroleum hydrocarbons.

Septic system drain fields were observed on-site. Septic system discharge could contain contaminants if there is insufficient treatment of biological contaminants such as coliforms and inorganic compounds such as nitrogen. Septic system discharge could also contain contaminants that the systems were not designed to treat, such as solvents and fuels.

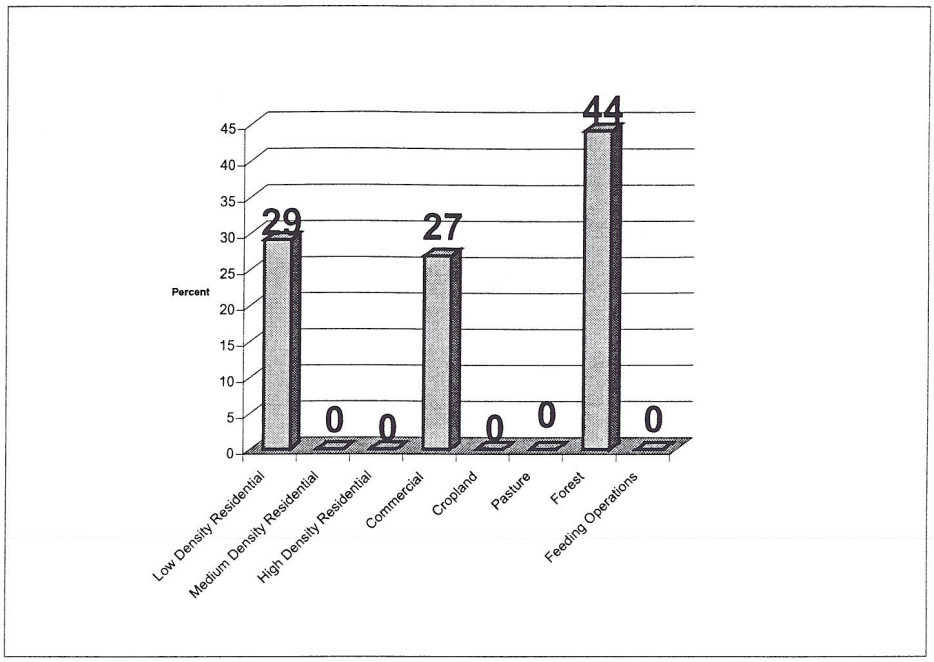
A Ground-water Discharge Permit was issued to Maybelle Manor Mobile Home Park, which is a newly built community upgradient of Conowingo MHP. If there is insufficient treatment of the domestic wastewater prior to discharge, biological contaminants such as coliforms and inorganic compounds such as nitrogen could impact the ground water.

Well 3 has a damaged cap that should be replaced to prevent the infiltration of rain water into the well head. Infiltration of rain or surface water could introduce contaminants into the ground-water aquifer.

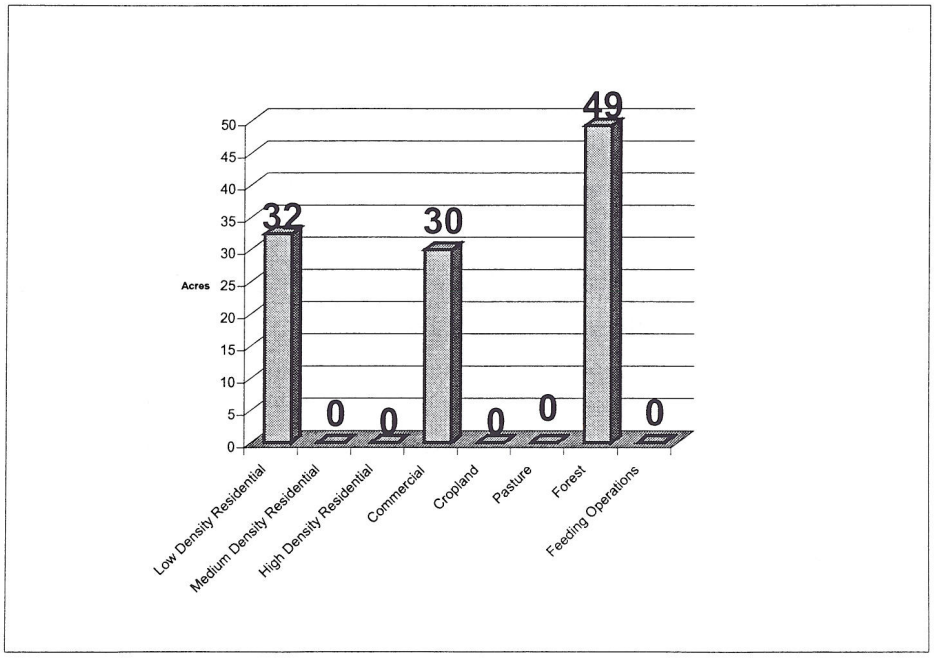
3.2 NON-POINT SOURCES

Using the Maryland Office of Planning's 2000 Land Use/Land Cover map for Cecil County, potential non-point sources within the source water protection area (SWPA) were also evaluated by land use designation (Figure 3). A summary of the percent and acreage of each type of land use is presented in the graphs below:

PERCENTAGE OF EACH LAND USE TYPE



ACREAGE OF EACH LAND USE TYPE



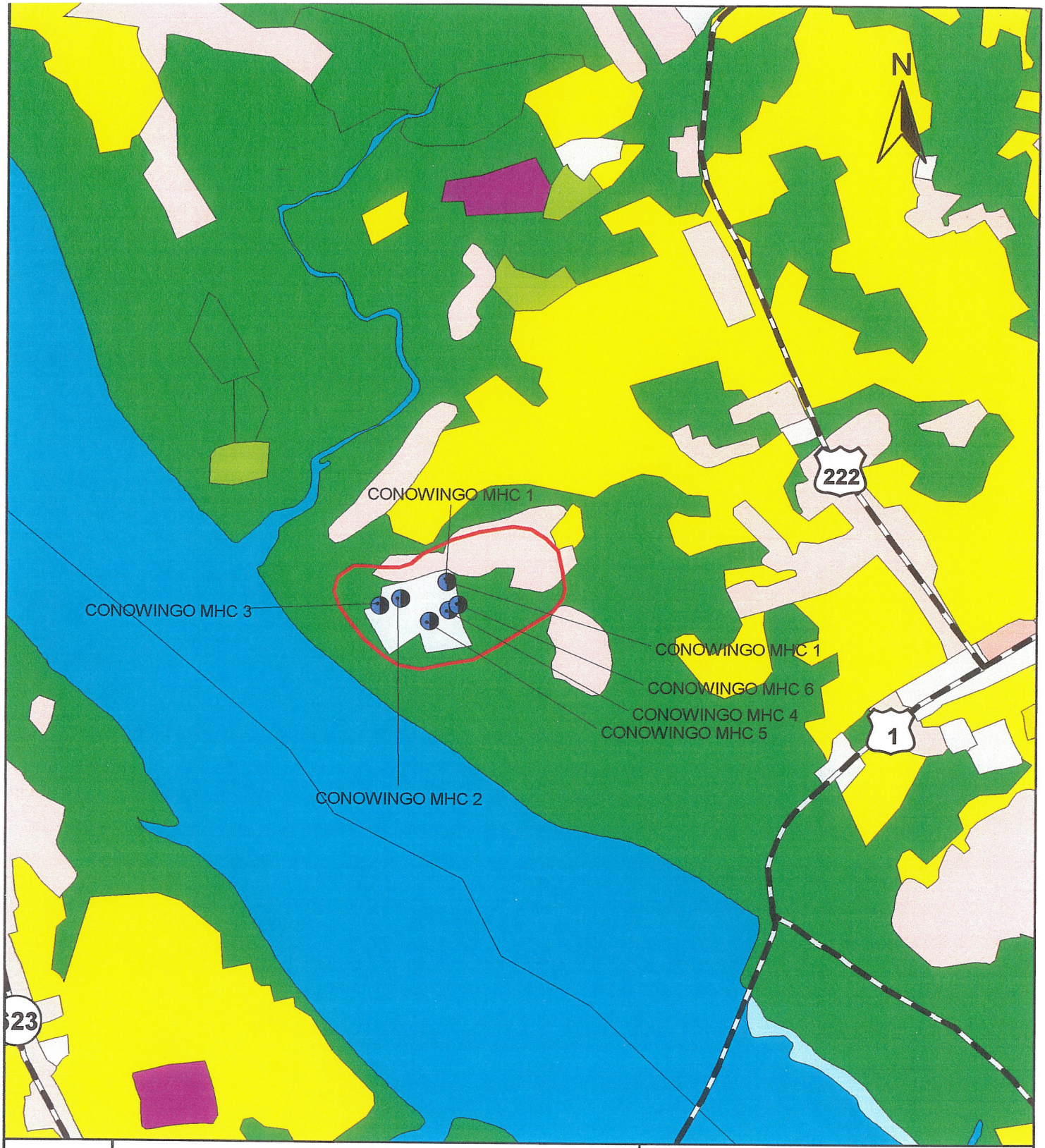


Figure 3. Conowingo MHP Land Use Map of the Source Water Protection Area

Source Water Assessment Program
2003

Scale: 1000 0 1000 2000 Feet

Source: Maryland Office of Planning, 2000.

Legend:

- MHP Wells
- SWPA Boundary
- Major Roads

Land Use

- Low Density Residential
- Commercial
- Cropland
- Pasture
- Forest
- Water
- Wetlands
- Feeding Operations

From an interpretation of the graphs above, forest (49 acres) accounts for nearly one half of the SWPA (111 acres). The only non-point source of pollution generally associated with forests is from logging activities. Residential areas (32 acres) account for a significant portion of the total SWPA area. The use of fertilizers and pesticides on residential area lawns is common. Therefore, there is little potential for the migration of potential contaminants into the ground water.

Using the 1993 Maryland Office of Planning's Cecil County sewerage coverage, potential non-point sources from other septic system users in the SWPA were assessed (Figure 4). By overlaying the SWPA on the sewerage coverage layer in ArcView GIS, it was determined that approximately 48 percent of the SWPA does not have public sewer service, 36 percent is either on public sewer service or is under construction, and 16 percent is programmed for service within 5 years.

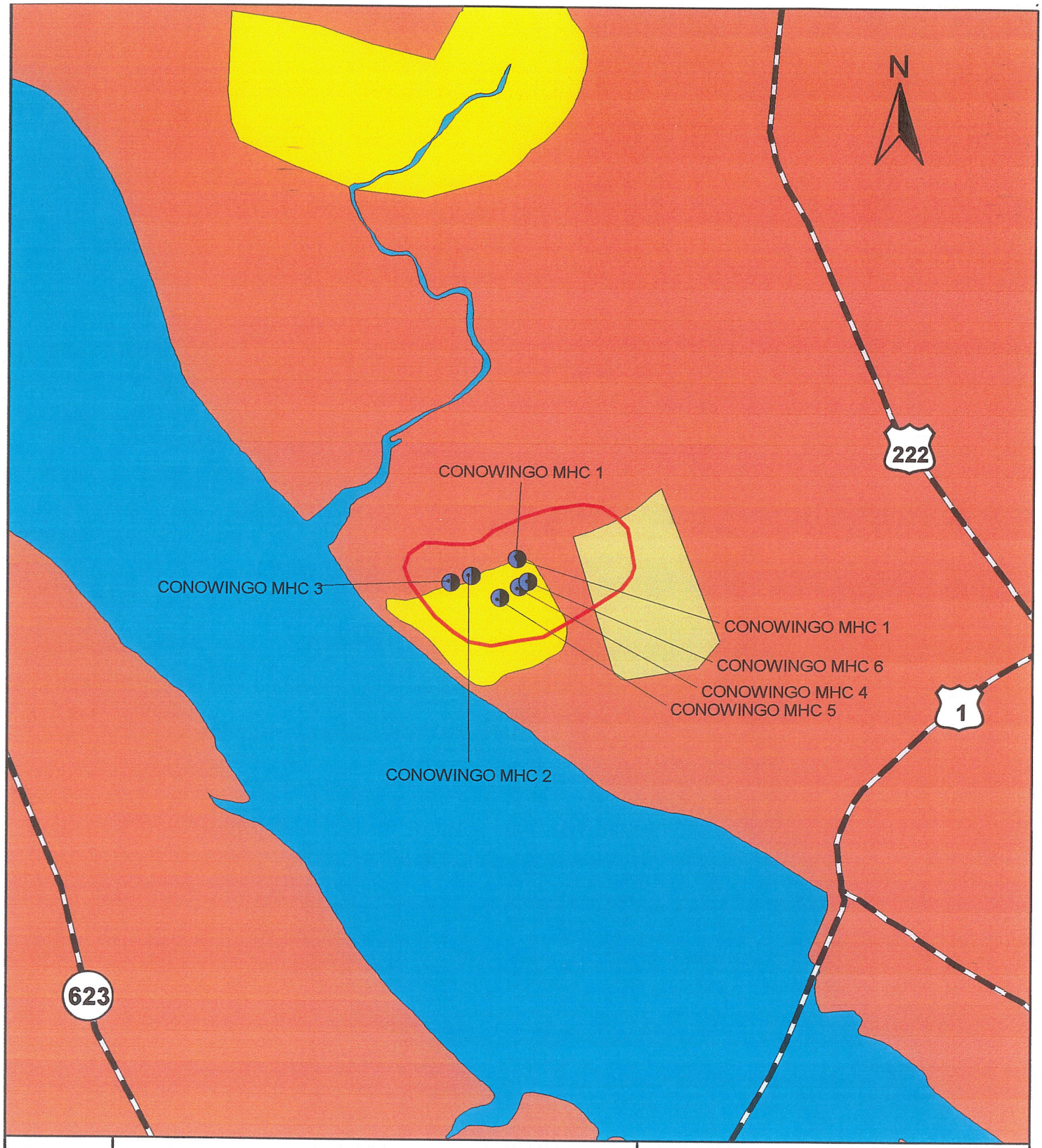


Figure 4. Conowingo MHP Sewer Service Map of the Source Water Protection Area

Source Water Assessment Program
2003

Legend:

MHP Wells
SWPA Boundary
Major Roads

Sewer
No planned service area
Existing service area
Area programmed for service within 5 years
Water

Source: Maryland Office of Planning, 1993.

Scale: 1000 0 1000 2000 Feet

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 noted).

A review of the water quality data from 1991 to 2002 has been performed for Conowingo MHP's finished water samples. All detected compounds from ground-water samples collected are shown in Appendix A.

Ground-water analytical results were compared to 50 percent of the United States Environmental Protection Agency (USEPA) Maximum Contaminant Levels (MCLs) or the USEPA Secondary Drinking Water Regulations (SDWR). If no MCL or SDWR is available, the Drinking Water Equivalent Level (DWEL) was substituted as recommended by the USEPA Office of Water.

4.1 GENERAL WATER QUALITY PARAMETERS

No general water quality parameters were reported in the ground-water samples above 50 percent of the comparison criteria. Two ground-water samples analyzed for pH were reported at 6.5 and 7.0 units.

4.2 VOLATILE ORGANIC COMPOUNDS

No volatile organic compounds (VOCs) were reported in the ground-water samples above 50 percent of the USEPA MCL.

Low levels of methyl-tert-butyl-ether (MTBE) was reported in ground-water samples collected in June 1999 and ranged from 0.8 to 1.1 µg/L. MTBE is presently on the USEPA Contaminant Candidate List (CCL) for evaluation of whether placement on the Primary Drinking Water Standards list is warranted. Due to its presence on the CCL, MTBE currently has no MCL, however, the USEPA has an advisory level of 20 to 40 µg/L for the compound. MTBE is commonly found in gasoline as an oxygenate additive.

No other VOCs have been detected in the ground-water samples collected.

4.3 SYNTHETIC ORGANIC COMPOUNDS

No SOCs have been reported in any of the ground-water samples collected and analyzed.

4.4 INORGANIC COMPOUNDS

Only one inorganic compound, nitrate, was reported above 50 percent of the MCL of 10 mg/L in two of the ground-water samples collected. A summary of all detected nitrate concentrations in the ground-water samples collected is shown in Table 2.

TABLE 2. SUMMARY OF NITRATE ANALYSIS

Plant ID	Sample Date	Contaminant	Result	Units
01	04-Feb-93	Nitrate	4.5	mg/L
01	24-Jan-94	Nitrate	3.02	mg/L
01	04-Jan-95	Nitrate	3.61	mg/L
01	01-Apr-96	Nitrate	4.7	mg/L
01	19-Sep-96	Nitrate	2.2	mg/L
02	19-Sep-96	Nitrate	4.3	mg/L
01	05-Nov-96	Nitrate	**5.86**	mg/L
01	20-Jan-97	Nitrate	**6.2**	mg/L
01	02-Apr-97	Nitrate	3.11	mg/L
01	02-Jul-97	Nitrate	2.36	mg/L
02	10-Dec-97	Nitrate	4.13	mg/L
01	13-Jan-98	Nitrate	ND	mg/L
01	13-Jan-98	Nitrate	ND	mg/L
02	13-Jan-98	Nitrate	ND	mg/L
01	12-Jan-99	Nitrate	2.1	mg/L
01	16-Mar-99	Nitrate	3.4	mg/L
01	15-Jun-99	Nitrate	1.9	mg/L
02	15-Jun-99	Nitrate	3.6	mg/L
01	03-Jan-00	Nitrate	1.9	mg/L
01	15-Jan-01	Nitrate	2.2	mg/L
01	09-Jan-02	Nitrate	2.2	mg/L
02	13-Feb-02	Nitrate	2.2	mg/L

ND = Not Detected.
Shaded values are greater than 50 percent of the MCL.

Nitrate is a primary drinking water standard parameter with a USEPA MCL of 10 mg/L. Elevated levels of nitrates may occur due to the influx of agricultural animal waste, agricultural chemicals or fertilizers, and/or septic system effluent into the drinking water.

Arsenic was also reported in two samples collected in June 2002 at concentrations of 0.0078 mg/L (Plant 1) and 0.0034 (Plant 2). No arsenic was reported in either plant water sample in August 2002. The current MCL is 0.050 mg/L.

4.5 MICROBIOLOGICAL CONTAMINANTS

No total or fecal coliform has been detected in ground-water samples of the water system's finished water from January 1997 to August 2002.

To assess the potential of Ground Water Under the Direct Influence (GWUDI) of surface water, ground-water sampling records (during dry and storm conditions) in MDE databases were assessed and information from Public Water Supply Inspection Reports were reviewed.

Surface water that directly recharges the aquifer through major fractures in rock does not pass through the soil overburden that both filters and contains beneficial microorganisms that break down potential contaminants. If significant variances in the ground-water results from dry and storm conditions are observed, it is possible that the ground water is under the direct influence of surface water.

From an assessment of the ground-water sampling results from Wells 4 and 5 by MDE, the ground water at these wells is not under the direct influence of surface water. A determination could not be made for Wells 1 and 6 due to the absence of the required GWUDI sampling data.

4.6 RADIONUCLIDES

Only one radionuclide, radon-222, was reported above 50 percent of the more conservative proposed MCL in two of the ground-water samples collected. A summary of all radon-222 concentrations in the ground-water samples collected is shown in Table 3.

TABLE 3. SUMMARY OF RADON-222 ANALYSIS

Plant ID	Sample Date	Contaminant	Result	Units
01	10-Jan-01	Radon-222	**205**	pCi/L
02	10-Jan-01	Radon-222	**190**	pCi/L

ND = Not Detected.
Shaded values are greater than 50 percent of the MCL.

Radionuclides are primary drinking water standard parameters. The MCL used for comparing detections of radon-222 was 300 picocuries per liter (pCi/L). This MCL is a proposed MCL established by USEPA since there is no current MCL for this compound (USEPA 1999). However, if a state has a program to address the more significant risk from radon in indoor air, then 4,000 pCi/L can be used as an alternate MCL. For the purpose of this investigation, the more conservative number was utilized.

Gross alpha particles were reported in a October 1992 water sample at concentration (3 piC/L) below the MCL (15 piC/L). No gross alpha particles have been reported in subsequent water samples.

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 SWPA
3. aquifer characteristics
4. well integrity
5. the likelihood of change to the natural conditions

The aquifer that supplies Coniwingo MHP's drinking water is an unconfined aquifer.

For the Susceptibility Analysis in this report, rankings of "high," "moderate," and "low" susceptibility to contamination were utilized after a review of current information. However, other SWAP reports for the State of Maryland also utilized rankings of "is," "may be," and "is not" susceptible to contamination. For consistency between the ranking systems, the following details their equivalence. The ranking of "highly susceptible" is equivalent to "is susceptible," "moderately susceptible" is equivalent to "may be susceptible," and "low susceptibility" is equivalent to "is not susceptible."

5.1 VOLATILE ORGANIC COMPOUNDS

MTBE, a gasoline additive used for cleaner air emissions, was reported in the water samples collected. Each reported concentration was reported below 50 percent of the USEPA advisory level of 20 to 40 µg/L. However, no sources of VOC were identified within the SWPA. While no point sources of gasoline were identified within the SWPA, there is a heating oil or diesel UST within one mile of the supply wells and is not likely the source of the MTBE. Unknown or unreported gasoline tanks spills could also be the cause of the low-level concentrations.

Based on the water quality data reviewed and the lack of potential point sources of VOCs in the SWPA, the water supply at Conowingo MHP has a low susceptibility to VOCs.

5.2 SYNTHETIC ORGANIC COMPOUNDS

The only point sources that may impact the ground water with SOCs within the SWPA are from heating oil tanks. No SOCs have been reported in any of the water samples submitted for analysis.

In addition, from the well information, there is approximately 25 to 55 ft of soil overburden above the bedrock aquifer. Most SOCs have a high affinity to sorb to soil particles and with the

significant soil overburden thickness reported, surface spills from heating oil tanks or application of pesticides and herbicides on croplands and residential areas are not likely to infiltrate into the ground-water aquifer.

Based on the water quality data reviewed and the absence of observed or reported facilities that may cause significant SOC contamination in the SWPA, the water supply at Conowingo MHP has a low susceptibility to SOCs.

5.3 INORGANIC COMPOUNDS

Nitrate concentrations were reported above 50 percent of the MCL of 10 mg/L in the water samples from November 1996 and January 1997. No nitrate concentration in the ground-water samples collected since 1997 have been reported greater than 5 mg/L.

On-site septic fields and an upgradient mobile home park discharge of domestic wastewater, which contains nitrate, into the subsurface were observed. Almost one-half of the SWPA is covered with forests. Nitrate ground-water contamination is generally not associated with forests.

Therefore, it appears that the nitrate concentrations are due to the domestic septic system discharge. However, nitrate was reported above one-half of the MCL in only two of the water samples and the nitrate concentrations in the 2002 water samples have been reported around 2.0 mg/L. It appears from the water quality review that actions may have been taken to reduce nitrate concentrations in the ground water.

Arsenic is a naturally occurring element that is present in aquifer material. Prior to the June 2002 water sample results (0.0078 and 0.0034 mg/L), no arsenic has been reported in prior water samples. On 22 February 2002, USEPA lowered the MCL for arsenic from 0.050 mg/L to 0.010 mg/L. Existing water systems must meet the new MCL by 23 January 2006. The arsenic results from the June 2002 would be below the future MCL.

Based on the water quality data reviewed and the current nitrate concentrations, the water supply at Conowingo MHP is moderately susceptible to impacts from nitrate and has a low susceptibility to other regulated inorganic compounds (IOCs).

5.4 RADIONUCLIDES

Radon-222 was reported above the 50 percent of the more conservative proposed MCL of 300 pCi/L in two water samples collected in January 2001. Based on the natural occurrence of

radionuclides in the ground water in the Piedmont region of Maryland (Bolton 1996) and the water quality data, the water supply at Conowingo MHP is moderately susceptible to radon-222 and has a low susceptibility to other radionuclides.

5.5 MICROBIOLOGICAL CONTAMINANTS

No coliform bacterium has been detected in the water samples since 1997.

From an assessment of GWUDI ground-water results by MDE, Wells 4 and 5 are not under the direct influence of surface water. No GWUDI data is available for Wells 1 and 6 to date to determine their susceptibility to surface water influence.

Only one of the supply wells was reportedly constructed after 1973, the year that current well construction standards were required.

Based on the water quality review and the condition and construction of the wells, the water supply at Conowingo MHP has a low susceptibility to microbiological contaminants.

6. RECOMMENDATIONS FOR PROTECTING THE WATER SUPPLY

With the information contained in this report, Conowingo MHP has a basis for better understanding of the risks to its drinking water supply. Being aware of the SWPA, 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 mobile home park owner and its residents. Specific management recommendations for consideration are listed below.

6.1 PROTECTION TEAM

The management of the mobile home park should be aware of the SWPA limits and evaluate the possible effects to the quality of the ground water prior to building or making any changes.

6.2 PUBLIC AWARENESS AND OUTREACH

The management of the mobile home park should consider discussing with property owners and businesses located within the SWPA of the activities that may have impacts to the ground water and its quality.

The management of the mobile home park should also consider sending pamphlets, flyers, or bill stuffers to its residents to educate them about the SWPA. An example pamphlet, "Gardening in a Wellhead Protection Area," is available from MDE. The residents should also be encouraged to notify the mobile home park management of any significant spills from gasoline or any other potentially hazardous substances.

Placing signs at the SWPA 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.

The Executive Summary of this report should also be listed in the Consumer Confidence Report for the water system, and should also indicate that the report is available to the general public by contacting the MHP owner, the local library, or MDE.

6.3 PLANNING/NEW DEVELOPMENT

The mobile home park should also inform the Cecil County Health and Planning Departments of any concerns to future development or zoning changes of properties that are within the SWPA.

6.4 MONITORING

The management of the mobile home park should continue to monitor the ground water for all SWDA contaminants as required by MDE. Due to the reported nitrate concentrations that were reported above 5 mg/L (one-half of the MCL), the management of the mobile home park should closely monitor the nitrate concentrations.

Annual raw water sampling for microbiological contaminants is a good way to check the integrity of the well.

The management of the mobile home park is required to conduct GWUDI sampling for Wells 1 and 6 to assess whether the ground water is under the direct influence of surface water.

6.5 CONTINGENCY 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 USES

The management of the mobile home park 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 SWPA.

6.7 CONTAMINANT SOURCE INVENTORY UPDATES/INSPECTIONS

The management of the mobile home park should conduct its own survey of the SWPA to ensure that there are no additional potential sources of contamination.

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.

Unused wells that are no longer connected to the distribution system should be abandoned and sealed as per COMAR 26.04.04.11. Unused wells can provide a pathway for contaminants to the aquifer. Wells 2 and 3 have been identified as backup wells for emergency use. If there are no plans to use these wells in the future, they should be abandoned as soon as possible.

The management of the mobile home park should consider extending the well casing above ground for wellheads that are currently below surface including Wells 1 and 2. While the wellheads are protected and no standing water was observed in the pit, extending the casing above ground surface is a better way to prevent surface water infiltration into the well.

Depressions around the wellheads should be filled and graded to prevent surface water ponding that may occur during rain events. This will help to prevent surface water infiltration into the well.

7. REFERENCES

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

1. 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.

2. Maryland Department of the Environment, Water Supply Program, 1999, Maryland's Source Water Assessment Plan, 36. p.

3. Maryland Geologic Survey 1968. *Cecil County Geologic Map adapted from Maryland Geological Survey's Geologic Map of Maryland.*

4. Otton, E. G, Willey, R. E., McGregor, R. A., Achmad, G., Hiortdahl, S. N., Gerhart, J.M. 1988. *Water Resources and Estimated Effects of Ground-Water Development, Cecil County, Maryland.* United States Department of the Interior, Geologic Survey. Bulletin 34.

5. Overbeck, R.M., Slaughter, T.H., and Hulme, A.E., 1958. *Water Resources of Cecil, Kent, and Queen Annes Counties*: Maryland Department of Geology, Mines and Water Resources Bulletin No. 21.

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 2000 Cecil County Land Use Map
Maryland Office of Planning 1993 Cecil County Land Use Map
USGS Topographic 7.5 minute Quadrangle Map – 1953 (1985) Conowingo Dam, Maryland Quad

Appendix A

Detected Compounds in Ground-Water Samples

SUMMARY OF DETECTED COMPOUNDS IN CONOWINGO WATER SAMPLES				
Plant ID	**Sample Date**	**Contaminant Name**	**Result**	**Unit**
Volatile Organic Compounds				
01	15-Jun-99	METHYL-TERT-BUTYL-ETHER	1.1	ug/L
02	15-Jun-99	METHYL-TERT-BUTYL-ETHER	0.8	ug/L
Inorganic Compounds				
01	17-Jun-02	ARSENIC	0.0078	mg/L
02	17-Jun-02	ARSENIC	0.0034	mg/L
01	04-Feb-93	NITRATE	4.5	mg/L
01	24-Jan-94	NITRATE	3.02	mg/L
01	04-Jan-95	NITRATE	3.61	mg/L
01	01-Apr-96	NITRATE	4.7	mg/L
01	19-Sep-96	NITRATE	2.2	mg/L
02	19-Sep-96	NITRATE	4.3	mg/L
01	05-Nov-96	NITRATE	5.86	mg/L
01	20-Jan-97	NITRATE	6.2	mg/L
01	02-Apr-97	NITRATE	3.11	mg/L
01	02-Jul-97	NITRATE	2.36	mg/L
02	10-Dec-97	NITRATE	4.13	mg/L
01	12-Jan-99	NITRATE	2.1	mg/L
01	16-Mar-99	NITRATE	3.4	mg/L
01	15-Jun-99	NITRATE	1.9	mg/L
02	15-Jun-99	NITRATE	3.6	mg/L
01	03-Jan-00	NITRATE	1.9	mg/L
01	15-Jan-01	NITRATE	2.2	mg/L
01	09-Jan-02	NITRATE	2.2	mg/L
02	13-Feb-02	NITRATE	2.2	mg/L
01	19-Sep-96	NITRITE	0.002	mg/L
02	19-Sep-96	NITRITE	0.003	mg/L
01	19-Sep-96	SODIUM	6.5	mg/L
02	19-Sep-96	SODIUM	4	mg/L
01	15-Jun-99	SODIUM	7.18	mg/L
02	15-Jun-99	SODIUM	4.48	mg/L
01	19-Sep-96	SULFATE	21.9	mg/L
02	19-Sep-96	SULFATE	19.4	mg/L
01	15-Jun-99	SULFATE	17	mg/L
02	15-Jun-99	SULFATE	19	mg/L
General Water Quality Parameters				
01	19-Sep-96	pH	7	s.u.
02	19-Sep-96	pH	6.5	s.u.
Radionuclides				
00	01-Oct-92	GROSS ALPHA	3	pCi/L
01	10-Jan-01	RADON-222	205	pCi/L
02	10-Jan-01	RADON-222	190	pCi/L

s.u. – standard units.