Final

Source Water Assessment

for the

Stoney Chase / Rock Creek Mobile Home Parks 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

Prepared by:

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May 2003

Project No. 61726.01

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May 2003

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LIST OF ACRONYMS AND ABBREVIATIONS

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
mrem	Millirem(s)
MTBE	Methyl-Tert-Butyl-Ether
PCB	Polychlorinated Biphenyls
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
USGS	U.S. Geological Survey
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 Stoney Chase / Rock Creek Mobile Home Park (MHP) water system in Cecil County, Maryland. This water system is identified as Public Water System Identification (PWSID) 0070233 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 Stoney Chase / Rock Creek MHP's water supply is the Cecil Volcanic Complex, which is an unconfined crystalline rock aquifer. The Source Water Protection Area (SWPA) for the three ground-water supply and seven backup wells was delineated using the watershed delineation method for fractured bedrock wells. The SWPA is based on land topography, nearby streams, and a calculation of the total ground-water contributing area during a drought. The SWPA is approximately 136 acres and is oval in shape.

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. Septic systems, a potential polychlorinated biphenyl (PCB) containing electricity transformers, and a nursery were observed within the SWPA. Croplands and residential areas account for a significant portion of the SWPA and can be considered a non-point source of contaminants. Well information and water quality data were also reviewed.

The susceptibility analysis for the Stoney Chase / Rock Creek 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 Stoney Chase / Rock Creek MHP water supply is moderately susceptible to volatile organic compounds, radon-222, and total coliform bacteria, and has a low susceptibility to synthetic organic compounds, other radionuclides, and inorganic compounds.

Recommendations to protect the ground-water supply include creating a SWPA protection team, resident awareness, and communication with county officials about future planning and land use.

1. INTRODUCTION

EA Engineering, Science, and Technology was tasked to perform a Source Water Assessment for the Stoney Chase/ Rock Creek 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 Stoney Chase/ Rock Creek MHPs water system serves the communities of Stoney Chase MHP and Rock Creek MHP in Cecil County. The water treatment plant and the supply wells for the system are located within the development. The Stoney Chase/ Rock Creek MHPs water system serves a population of 396 with 97 connections. The water is supplied by three active and seven 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 Stoney Chase Wells 5, 6, and Rock Creek Wells 1, 2, 3, 4, 5, and 6 were drilled in 1988, 1995, 1992, 1992, 1992, 1991, 2001, and 2001 respectively, in accordance with the State's current well construction standards, which were implemented in 1973.

According to site personnel and MDE Public Drinking Water Supply Inspection Reports, Stoney Chase wells 1, 2 and 5 have approximate pumping rates of 6, 6 and 12-15 gallons per minute (gpm) respectively. Stoney Chase Well 3 is no longer in use and has been abandoned and grouted according to Mr. Lawson. Stoney Chase Well 4 (CE731009) is not in use and has not been abandoned. Mr. Lawson indicated that due to the steep, treacherous road to the well along the streambank, a contractor has not been located to date that is willing to perform the well abandonment. This well was not observed during the site visit. Pumping rates are unknown for Stoney Chase Well 6, but are estimated to be between 8 and 10 gpm.

Rock Creek Wells 5 (CE944811) and 6 (CE944812) have approximate pumping rates of 7 and 30 gpm, respectively. The pumping rates of Rock Creek Well 1, 2, 3 and 4 are unknown.

Stoney Chase Wells 1, 2, and 5 were completed above grade. Each wellhead was secure and in good repair. Stoney Chase Wells 1 and 2 were protected and covered by concrete structures. Stoney Chase Well 6 was completed below grade in a subsurface pit. The well pit was covered by a wooden structure.

Each of the Rock Creek wells was completed above grade. Each of the wellheads was observed secure and in good repair. Rock Creek Wells 1 and 2 were protected by steel ballards.

The wells have a total average yield of 20,000 gallons per day (gpd). Table 1 below 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	Stoney Chase Well 1 (back-up)	CE690326	207	20	Cecil Volcanic Complex
09	Stoney Chase Well 2 (back-up)	CE700253	168	20	Cecil Volcanic Complex
06	Stoney Chase Well 5 (back-up)	CE813647	380	40	Cecil Volcanic Complex
07	Stoney Chase Well 6 (back-up)	CE940976	380	20	Cecil Volcanic Complex
11	Rock Creek Well 1 (back-up)	CE882370	400	17	Cecil Volcanic Complex
12	Rock Creek Well 2 (back-up)	CE882379	400	17	Cecil Volcanic Complex
13	Rock Creek Well 3 (back-up)	CE882380	450	19	Cecil Volcanic Complex
14	Rock Creek Well 4	CE882155	400	65	Cecil Volcanic Complex
15	Rock Creek Well 5	CE944811	500	40	Cecil Volcanic Complex
16	Rock Creek Well 6	CE944812	520	60	Cecil Volcanic Complex

According to the MDE Public Water Supply Inspection Report for the water system dated March 2001 and April 2002, the operators of the water system are Bob Lawson and William Kilroy of Management Services. Mr. Kilroy is the regional manager, and Bob Lawson is the local operations manager of the system.

Currently, the raw ground water is treated with sodium hypochlorite (bleach) for disinfection. In addition, iron removal is achieved with Harmsco cartridge filters. The finished water is stored in seven 80-gal bladder tanks and one 16,000-gal above ground storage tank.

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 are 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 Stoney Chase/ Rock Creek MHPs is from production wells drilled into the Volcanic Complex of Cecil County. The Volcanic Complex is described as "metamorphosed andesitic and dacitic volcanic rocks (greenstone, greenschist, quartz amphibolite, and schistose felsite); amygdules and volcano-clastic textures locally preserved" [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 58 wells in the Volcanic Complex of Cecil County ranges from 3 to 200 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 37 wells range from less than 0.1 to 20 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, a 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 Stoney Chase/ Rock Creek MHPs, the current Water Appropriation Permit issued by the MDE Water Rights Division is for an average of 20,000 gpd for the total of the ten 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 50 acres. The delineated WHPA is approximately 136 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 6 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

The Turtle Hill Farm Nursery is present northwest of the mobile home park on the west side of Bouchelle Road. Nurseries are potential sources of fertilizers, pesticides, herbicides, and fungicides. Improper management of these chemicals can result in agricultural chemical impacts to the underlying ground-water aquifer.

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.

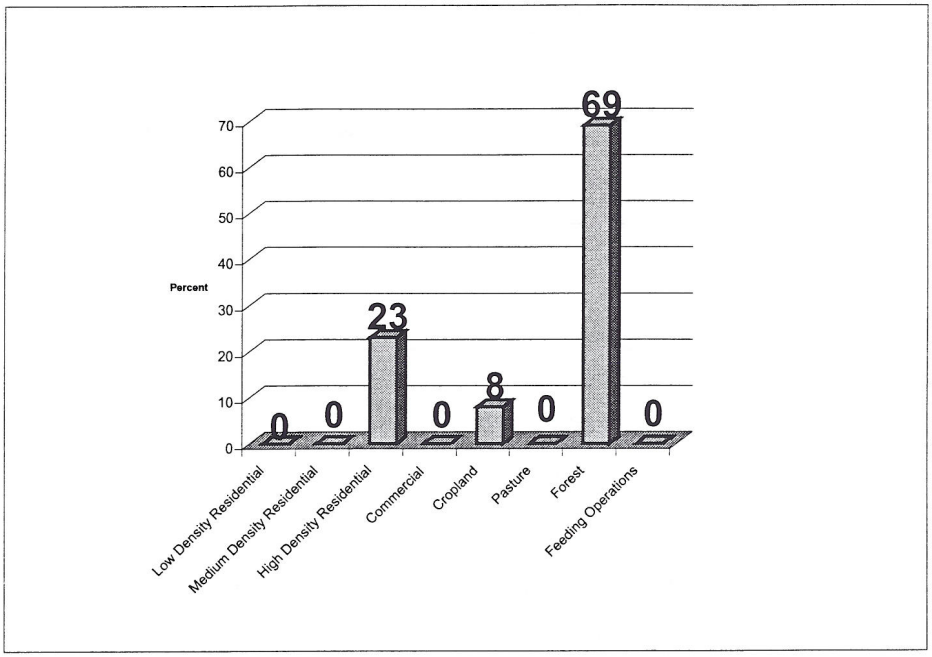
Gilpins Substation #329 is located northwest of the SWPA. Prior to 1977, many transformers and electrical equipment contained polychlorinated biphenyls (PCB) as an insulator. It is possible that the equipment could contain PCB. If the equipment leaks, the PCB oil could eventually leach through the soil overburden into the ground-water aquifer.

Stoney Chase Well 4 is a well that is not in use and has not been grouted. This well is located along a stream bank and therefore subject to flooding. This improperly abandoned well has the potential to be a pathway for contaminants to enter the ground-water aquifer if not maintained.

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



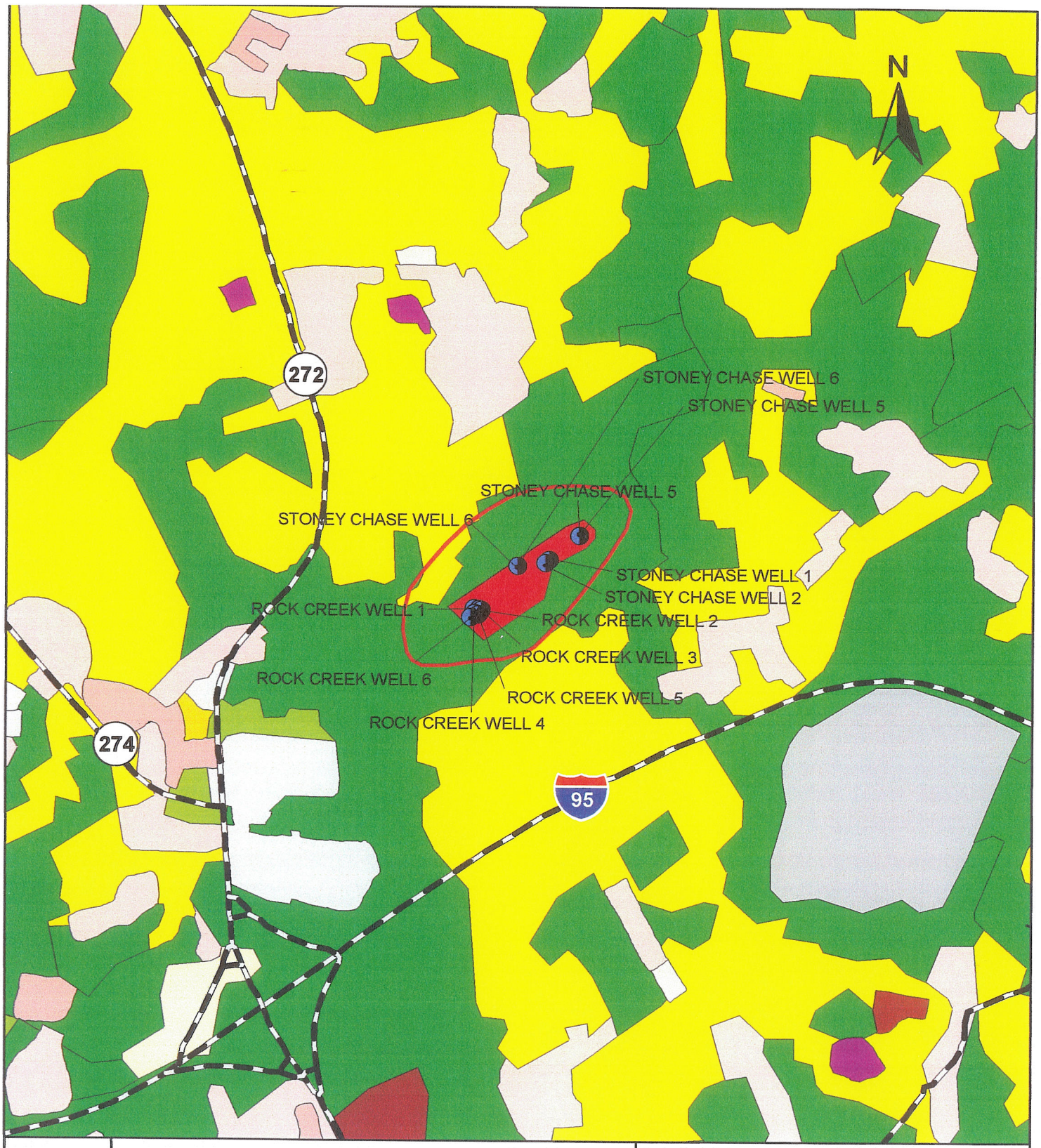


Figure 3. Stoney Chase/Rock Creek MHP Land Use Map of the Source Water Protection Area

Source Water Assessment Program
2003

Scale: 1000 0 1000 2000 Feet

Source: Maryland Office of Planning, 2000.

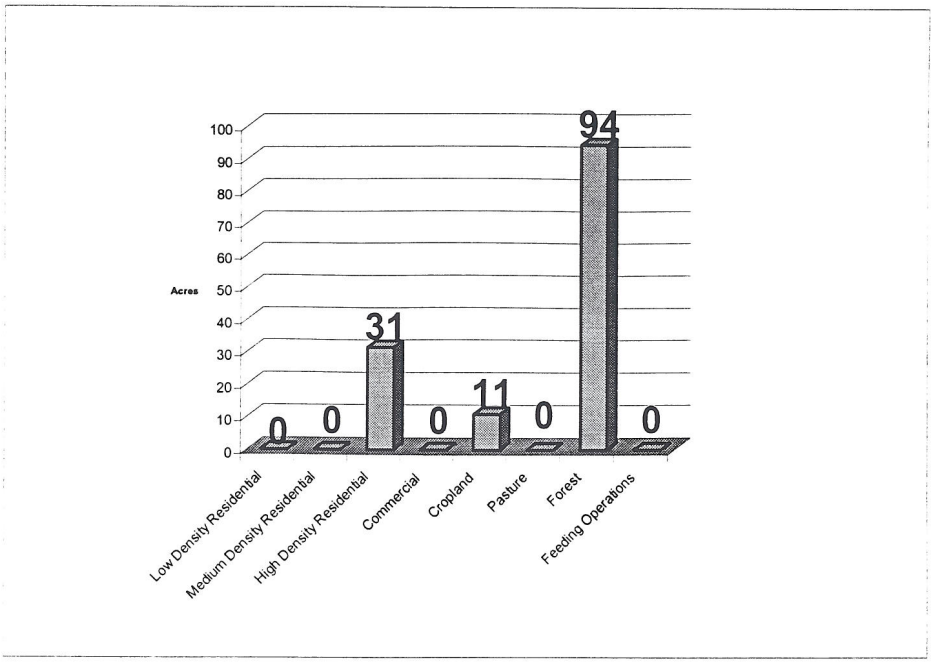
Legend:

- MHP Wells
- SWPA Boundary
- Major Roads

Land Use

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Commercial
- Industrial
- Extractive
- Cropland
- Pasture
- Orchards
- Forest
- Feeding Operations
- Barren Land

ACREAGE OF EACH LAND USE TYPE



From an interpretation of the graphs above, forest (94 acres) and cropland (11 acres) accounts for the majority of the SWPA (136 acres). The only non-point source of pollution generally associated with forests is from logging activities. The use of fertilizers and pesticides in croplands are 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 over the sewerage coverage layer in ArcView GIS, it was determined that approximately 92 percent of the SWPA does not have public sewer service nor is planned for service for at least 10 years. The other 8 percent of the SWPA has existing sewer service or is currently under construction.

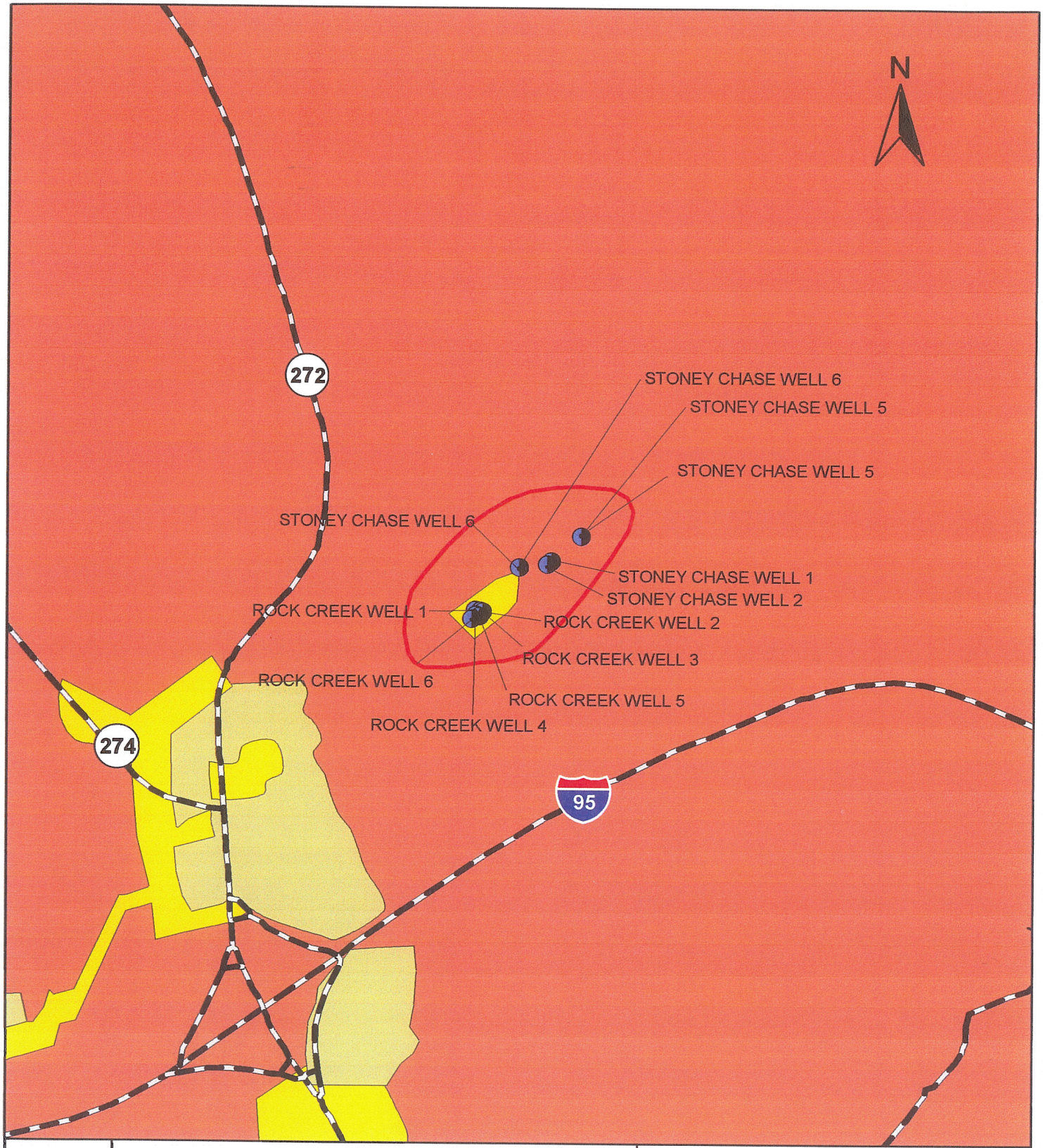


Figure 4. Stoney Chase/Rock Creek MHP Sewer Service Map of the Source Water Protection Area

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

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 1992 to 2002 has been performed for Stoney Chase / Rock Creek 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 USEPA MCL.

4.2 VOLATILE ORGANIC COMPOUNDS

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

However, low levels of 1,1,1-trichloroethane (0.6 µg/L) and trichloroethylene (0.8 µg/L) were reported in ground-water samples. Trichloroethylene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA) are commonly used as a dry cleaner, parts cleaner, and industrial solvent.

The disinfection by-products bromodichloromethane, bromoform, dichloromethane, and chloroform (commonly known as trihalomethanes) were reported in the water samples ranging from 0.5 to 21.9 µg/L. Trihalomethanes are formed as a reaction of chlorine to organic matter during water disinfection. Effective 1 January 2004, the MCL for total trihalomethanes will be 80 µg/L.

Methyl-tert-butyl-ether (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 was detected in the ground-water samples at concentrations ranging from 0.5 to 1.0 µg/L and is used as an additive to gasoline.

p-Dichlorobenzene was detected in ground-water samples at concentrations ranging from 0.9 to 0.6 µg/L. p-Dichlorobenzene is a chemical used in moth and insect control and has a USEPA Primary Drinking Water Standard MCL of 75 µg/L.

4.3 SYNTHETIC ORGANIC COMPOUNDS

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

Di(2-ethylhexyl)phthlate, generally associated with laboratory cross contamination and with plasticizers, was also reported in the October 1998 water sample (0.6 µg/L). The MCL for di(2-ethylhexyl)phthlate is 6 µg/L.

4.4 INORGANIC COMPOUNDS

No inorganic compounds (IOCs) were reported in the ground-water samples above 50 percent of the USEPA MCL.

However, low levels of nitrate were reported in ground-water samples, which ranged from 0.18 to 3.3 mg/L. Low levels of nitrite were also reported in ground-water samples, which ranged from 0.002 to 0.011 mg/L. Nitrate and nitrite are USEPA primary drinking water standard parameters with a USEPA MCL of 10 and 1 mg/L respectively. Elevated levels may occur due to the influx of agricultural animal waste, agricultural chemicals or fertilizers, and/or septic system effluent into the drinking water.

Also, low levels of sulfate were reported in ground-water samples, which ranged from 21.3 to 31.3 mg/L, but are below the SDWR standard of 250 mg/L. SDWR parameters are non-enforceable federal guidelines regarding cosmetic effects, such as tooth or skin discoloration, or aesthetic effects, such as taste, odor, or color.

4.5 MICROBIOLOGICAL CONTAMINANTS

Monthly ground-water sampling and analysis is performed for total and fecal coliform bacteria. Coliform bacteria are a primary drinking water standard parameter.

Three routine water samples submitted for analysis in April, May, and December 2001 were reported to contain total coliform bacteria. No samples were reported to contain fecal coliform. However, four repeat ground-water samples collected and analyzed from each month did not contain total or fecal coliform.

Another routine water sample submitted for analysis in August 1997 was also reported to contain total coliform bacteria. No fecal coliform was reported in this sample. However, all four of the repeat samples collected and submitted for analysis were reported to contain total coliform bacteria.

No other samples collected monthly since January 1997 through August 2002 were reported to contain coliform bacteria.

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. However, no ground-water sample data has been collected for any of the wells in this community.

4.6 RADIONUCLIDES

Radon-222 was reported at concentrations greater than the more conservative proposed MCL. 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 contaminant (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. A summary of the results for Radon-222 is shown in Table 2.

TABLE 2. SUMMARY OF RADON-222 ANALYSIS

Plant ID	Sample Date	Contaminant Name	Result	Unit
01	20-Mar-00	Radon-222	**1315**	pCi/L

ND = Not Detected.
Shaded value is greater than the more conservative proposed MCL.

Gross alpha and beta particles were also reported at concentrations ranging from 1 to 4.3 pCi/L and 2 to 9.6 pCi/L, respectively. The current MCL for gross alpha particles is 15 pCi/L. The current MCL for gross beta particles is 50 pCi/L.

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 Stoney Chase / Rock Creek 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

No VOCs were reported above 50 percent of the MCL.

The trihalomethanes reported in the water samples are likely by-products of the chlorination process to kill waterborne bacteria. Effective 1 January 2004, the MCL for total trihalomethanes will be 80 µg/L. The reported concentrations were well below this MCL total.

Low levels of MTBE were reported in ground-water samples collected in October 1998 and March 2000 and ranged from 0.5 to 1.0 µg/L. MTBE is commonly found in gasoline as an oxygenate additive and has a USEPA advisory level of 20 to 40 µg/L. While no point sources of gasoline were identified within the SWPA, there are a number of UST sites within one mile of the supply wells. As MTBE travels faster in ground water than other gasoline constituents such as benzene, these reported detections may be the leading edge of a contaminant plume.

A low concentration (0.8 µg/L) of TCE was reported in the water sample collected in March 1997. No TCE has been reported in any of the water samples since 1997. Another chlorinated compound, 1,1,1-TCA, was reported in the water sample from September 1994. No 1,1,1-TCA has been reported in any of the water samples since 1994. No point sources of solvents were

observed or reported within the SWPA. These anomalous detections may be the result of isolated solvent spills or improper disposal.

Based on the water quality data reviewed and the chemical characteristics of MTBE, the water supply at Stoney Chase / Rock Creek MHP is moderately susceptible to VOCs.

5.2 SYNTHETIC ORGANIC COMPOUNDS

No SOC concentrations were reported above 50 percent of the MCL.

Low levels of di(2-ethylhexyl)phthalate and decachlorobiphenyl were reported in water samples. Di(2-ethylhexyl)phthalate was reported in one water sample (October 1998) at a level well below the MCL and is most likely the result of laboratory cross-contamination.

The possible use of herbicides and pesticides on croplands, which accounts for approximately 8 percent of the SWPA, can be considered a potential minor non-point source for SOCs. However, no SOC pesticides and herbicides have been reported in any of the water samples submitted for analysis. Most SOCs also have a high affinity to sorb to soil particles and are not likely to infiltrate into the ground-water aquifer. From the well information, it appears that the soil overburden is approximately 15 to 40 ft thick above the bedrock aquifer and should help to inhibit the downward migration of SOCs into the aquifer.

Based on the water quality data reviewed, and the absence of point sources of SOCs, the water supply at Stoney Chase / Rock Creek MHP has a low susceptibility to SOCs.

5.3 INORGANIC COMPOUNDS

No IOC concentrations were reported above 50 percent of the MCL in any of the water samples analyzed.

Approximately 92 percent of the SWPA is not served by public sanitary sewer systems. Septic systems were observed on-site and are a possible source of nitrate in ground water. However, no concentrations of nitrate have been reported above 4 mg/L. No trends in the reported nitrate concentrations in the water samples have been observed over time.

Based on the water quality data reviewed and the lack of point sources of IOCs, the water supply at Stoney Chase / Rock Creek MHP has a low susceptibility to IOCs.

5.4 RADIONUCLIDES

Radon-222 was reported above the more conservative proposed MCL of 300 pCi/L in the water sample collected in March 2000.

Gross alpha and beta particles were also reported at levels below their respective MCLs.

Concentrations of radionuclides in the ground water in the Piedmont region of Maryland are generally from naturally occurring mineral decay (Bolton 1996). However, due to significant reported concentrations of radon-222, the water supply at Stoney Chase / Rock Creek MHP is moderately susceptible to radionuclides.

5.5 MICROBIOLOGICAL CONTAMINANTS

Total coliform bacteria were reported in the water samples during the routine and repeat water sampling event in August 1997.

Total coliforms are a group of closely related bacteria that are generally harmless. They are natural and common inhabitants of soil and surface water bodies. However, there are not generally found in ground water that is free of surface water or fecal contaminants (USEPA 2001). Therefore, if total coliforms are reported in water samples, there may be a direct pathway between surface water and the ground water.

Fecal coliforms are a subset of total coliforms and are a good indicator of surface water contamination, and of the potential presence of waterborne pathogens associated with fecal contamination (USEPA 2001). No fecal coliform bacteria were reported in any of the water samples.

No GWUDI data is available to date to determine whether the ground-water supply for Stoney Chase / Rock Creek MHP is under the direct influence of surface water.

According to a review of the PDWIS database, there are four unused wells on the property. Inactive wells can become a pathway for surface water with naturally occurring total coliforms to enter the ground-water aquifer if not maintained.

From documentation reviewed, eight of the ten supply wells were constructed after 1973, the year that current well construction standards were required. All the wellheads were observed to be in good repair.

Based on the available water quality review and the presence of unused wells on-site, the water supply at Stoney Chase / Rock Creek MHP is moderately susceptible to total coliform bacteria.

6. RECOMMENDATIONS FOR PROTECTING THE WATER SUPPLY

With the information contained in this report, Rock Creek and Stoney Chase MHPs have a basis for better understanding of the risks to the 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.

The management of the mobile home park should also contact the owner of the electricity transformers observed on-site to assess whether they contain PCB oil.

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 an example that 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.

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 on each of the production wells to assess whether the sources are under the direct influence of surface water.

Additional sampling for radiological contaminants (specifically radon-222) should be performed to monitor and document levels until the EPA determines how to regulate the radionuclides in public water supplies.

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.

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 pp.

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

4. Otton, E. G, R. E Willey, R. A McGregor, G. Achmad, S. N. Hiortdahl, J.M. Gerhart. 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., T.H. Slaughter, and A.E Hulme, 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 – 1992 Bay View, Maryland Quad

Appendix A

Detected Compounds in Ground-Water Samples

SUMMARY OF DETECTED COMPOUNDS IN STONY CHASE/ROCK CREEK WATER SAMPLES				
Plant ID	**Sample Date**	**Contaminant Name**	**Result**	**Unit**
Volatile Organic Compounds				
01	14-Sep-94	1,1,1-TRICHLOROETHANE	0.6	ug/L
01	02-Jul-96	BROMODICHLOROMETHANE	0.7	ug/L
01	04-Mar-97	BROMODICHLOROMETHANE	1.1	ug/L
01	04-Mar-97	BROMODICHLOROMETHANE	0.6	ug/L
01	27-Oct-98	BROMODICHLOROMETHANE	1.3	ug/L
01	10-Apr-01	BROMODICHLOROMETHANE	17.9	ug/L
01	16-Jul-02	BROMODICHLOROMETHANE	1.7	ug/L
01	27-Oct-98	BROMOFORM	0.6	ug/L
01	10-Apr-01	BROMOFORM	0.7	ug/L
01	16-Jul-02	BROMOFORM	1.4	ug/L
01	02-Jul-96	CHLOROFORM	4	ug/L
01	02-Jul-96	CHLOROFORM	5	ug/L
01	04-Mar-97	CHLOROFORM	0.7	ug/L
01	04-Mar-97	CHLOROFORM	1.5	ug/L
01	27-Oct-98	CHLOROFORM	0.5	ug/L
01	10-Apr-01	CHLOROFORM	21.9	ug/L
01	16-Jul-02	CHLOROFORM	0.8	ug/L
01	02-Jul-96	DIBROMOCHLOROMETHANE	0.9	ug/L
01	02-Jul-96	DIBROMOCHLOROMETHANE	1	ug/L
01	04-Mar-97	DIBROMOCHLOROMETHANE	2.1	ug/L
01	27-Oct-98	DIBROMOCHLOROMETHANE	2.1	ug/L
01	10-Apr-01	DIBROMOCHLOROMETHANE	8.3	ug/L
01	16-Jul-02	DIBROMOCHLOROMETHANE	2.8	ug/L
01	27-Oct-98	METHYL-TERT-BUTYL-ETHER	1	ug/L
01	20-Mar-00	METHYL-TERT-BUTYL-ETHER	0.5	ug/L
01	27-Oct-98	p-DICHLOROBENZENE	0.9	ug/L
01	20-Mar-00	p-DICHLOROBENZENE	0.6	ug/L
01	04-Mar-97	TRICHLOROETHYLENE	0.8	ug/L
Synthetic Organic Compounds				
01	27-Oct-98	DI(2-ETHYLHEXYL) PHTHALATE	0.6	ug/L
Inorganic Compounds				
01	02-Feb-93	NITRATE	3.3	mg/L
01	25-Jan-94	NITRATE	3.41	mg/L
01	14-Sep-94	NITRATE	0.18	mg/L
01	14-Sep-94	NITRATE	2.06	mg/L
01	11-Jan-95	NITRATE	3.25	mg/L
01	16-Jan-96	NITRATE	2.74	mg/L
01	26-Nov-96	NITRATE	1.7	mg/L
01	13-Jan-97	NITRATE	3.29	mg/L
01	14-Jan-98	NITRATE	2.49	mg/L
01	13-Jan-99	NITRATE	2.4	mg/L
01	03-Jan-00	NITRATE	1.7	mg/L

SUMMARY OF DETECTED COMPOUNDS IN STONY CHASE/ROCK CREEK WATER SAMPLES				
Plant ID	**Sample Date**	**Contaminant Name**	**Result**	**Unit**
Inorganic Compounds				
01	20-Mar-00	NITRATE	2.1	mg/L
01	22-Jan-01	NITRATE	1.6	mg/L
01	05-Jun-01	NITRATE	0.208	mg/L
01	02-Jan-02	NITRATE	1	mg/L
01	26-Nov-96	NITRITE	0.011	mg/L
01	26-Nov-96	NITRITE	0.003	mg/L
01	20-Mar-00	NITRITE	0.002	mg/L
01	26-Nov-96	SODIUM	18.6	mg/L
01	26-Nov-96	SODIUM	99.5	mg/L
01	20-Mar-00	SODIUM	14.2	mg/L
01	20-Mar-00	SODIUM	15.6	mg/L
01	14-Sep-94	SULFATE	31	mg/L
01	26-Nov-96	SULFATE	24.2	mg/L
01	26-Nov-96	SULFATE	31.3	mg/L
01	20-Mar-00	SULFATE	21.3	mg/L
01	20-Mar-00	SULFATE	24.9	mg/L
General Water Quality Parameters				
01	26-Nov-96	pH	6.9	s.u.
01	26-Nov-96	pH	7.1	s.u.
Radionuclides				
00	02-Jul-88	GROSS ALPHA	4	pCi/L
00	17-Nov-92	GROSS ALPHA	1	pCi/L
00	11-Feb-97	GROSS ALPHA	2	pCi/L
01	10-Apr-01	GROSS ALPHA	4.3	pCi/L
01	10-Apr-01	GROSS ALPHA	4	pCi/L
00	11-Feb-97	GROSS BETA	2	pCi/L
00	11-Feb-97	GROSS BETA	4	pCi/L
01	10-Apr-01	GROSS BETA	4	pCi/L
01	10-Apr-01	GROSS BETA	9.6	pCi/L
01	20-Mar-00	RADON-222	1315	pCi/L
Microbiological Contaminants				
NA	1-Aug-97	TOTAL COLIFORM (ROUTINE)	Positive	
NA	1-Aug-97	TOTAL COLIFORM (REPEAT)	Positive	
NA	1-Aug-97	TOTAL COLIFORM (REPEAT)	Positive	
NA	1-Aug-97	TOTAL COLIFORM (REPEAT)	Positive	
NA	1-Aug-97	TOTAL COLIFORM (REPEAT)	Positive	
NA	1-Apr-01	TOTAL COLIFORM (ROUTINE)	Positive	
NA	1-May-01	TOTAL COLIFORM (ROUTINE)	Positive	
NA	1-Dec-01	TOTAL COLIFORM (ROUTINE)	Positive	