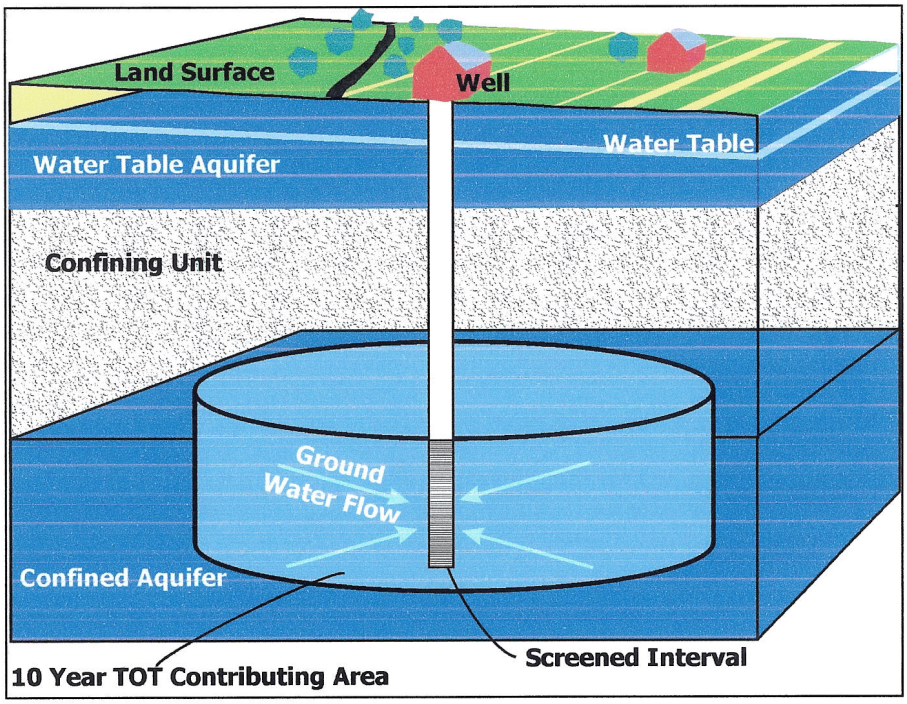
SOURCE WATER ASSESSMENT

FOR COMMUNITY WATER SYSTEMS

IN SOMERSET COUNTY, MD



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Water Supply Program
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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for eleven community water systems in Somerset County. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of these eleven community systems in Somerset County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The eleven community water systems included in this report are currently using twenty-eight wells that pump water from many different confined aquifers. The Source Water Assessment areas were delineated by the WSP using U.S. EPA approved methods specifically designed for sources in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. Maps and aerial photographs showing Source Water Assessment areas are included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the water systems are not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifer. One system may be susceptible to microbiological contaminants due to well construction issues. Two systems are susceptible to naturally occurring radiological contaminants and two systems are susceptible to naturally occurring flouride.

A. Introduction

The Water Supply Program has conducted a Source Water Assessment for eleven community water systems in Somerset County. Somerset County is located in the eastern shore of Maryland and is bounded by the Chesapeake Bay to the east, Wicomico County to the north, Virginia in the south and Worcester County to the west. Its total population, reported in 2003 is estimated to be 25,447 (U.S. Department of the Census, 2004). The eleven community systems serve a population of approximately 12,475 of the county residents. The community systems include the two incorporated municipalities of Princess Anne and the City of Crisfield, one run by Somerset County (Fairmount), one operated by the State, and seven individually owned and operated systems (table1). The community systems included in this report are shown in figure 1.

B. Well Information

Well information for each system was obtained from the Water Supply Program's database, site visits, well completion reports, sanitary survey inspection reports and published reports. A total of twenty-eight wells are currently in use or are backup wells for the eleven community water systems included in this report. Eighteen of these wells were drilled after 1973 and should comply with Maryland's well construction regulations. The remaining ten wells were drilled prior to 1973, when current regulations went into effect, and may not meet the current construction standards. Table 2 contains a summary of well information for each of the systems.

Based on site visits, most wells were in good condition and appeared to be regularly maintained, sealed and protected to insure integrity. Some of the older wells had a one-piece well cap, which may present a possible route of contamination (insects) through unscreened vents and electrical holes. This situation can be easily remedied with the installation of a new two-piece sanitary well cap to prevent contamination. Another common threat to wells observed during field inspections are unused wells in the same aquifer as the production wells. A few water systems have wells that are not in use due to screen problems, or were drilled as test wells during new well construction (table 2). As long as these wells are sealed with a tight cap, and the pumps are exercised regularly they pose little threat to the production wells. However, unused wells, with loose caps, no pumps or with no potential for use in the future should be rectified or permanently abandoned and sealed by a licensed well driller because they represent a pathway for contamination to the deep aquifer. Wells that are properly grouted and without pumps may be useful for long-term monitoring. Access to such wells should be restricted through locked caps and/or other security measures.

C. Hydrogeology

Ground water flows through pores between gravel, sand and silt grains in unconsolidated sedimentary rock aquifers such as those used by the community water systems in Somerset County. An aquifer is any formation that is capable of yielding a significant

amount of water. The transmissivity is a measure of the amount of water an aquifer is capable of producing and is related to the hydraulic conductivity and the thickness of the aquifer. A confining layer is generally composed of fine material such as clay and silt, which transmits relatively very little water. Confined aquifers are those formations that are overlain by a confining unit. Confined aquifers are recharged from the water stored in the confining unit above (vertical leakage), or from precipitation that infiltrates into the formation where it is exposed at the surface.

Somerset County lies within the Atlantic Coastal Plain physiographic province. This province, which in Maryland includes roughly the area east of Interstate 95, is underlain by unconsolidated clastic sediments of Lower Cretaceous to recent age, which thicken to the southeast so that they appear wedge-shaped. The thickness of these sediments is greater than 8,500 feet beneath the Atlantic shore. The eleven community water systems pump water from two confined aquifers known as the Manokin and Potomac (Patapsco) aquifer systems. The Manokin aquifer is confined under the Pocomoke aquifer and is the primary aquifer used for water supply in Somerset County. The Patapsco is the deepest and the oldest aquifer (see Appendix- table 1). These aquifers have been studied considerably and hydrologic, lithologic and geochemical data is available in several Maryland Geological Survey reports (1955, 1967, 1973, 1974, 1984, 1985 and 1993). The descriptive material below is summarized from these reports and the reader is referred to them for further information.

Manokin Aquifer

The Manokin aquifer is the primary aquifer used for water supply in Somerset County. It is in the Eastover Formation and consists principally of gray, fine- to medium-grained sand and contains some shell material. In the western part of the county, in the area encompassing Fairmount, Kingston, Janes Island State Park, and Smith Island, the unit becomes finer grained and is no longer recognizable as a distinct aquifer in geophysical logs. The Manokin aquifer subcrops beneath the Chesapeake Bay west of Deal Island and trends northeast through Dorchester and Wicomico Counties into Delaware near Seaford. The top of the aquifer ranges from about 75 feet below sea level at Deal Island to about 190 feet in the northeastern corner of the county. The aquifer serves the town of Princess Anne and the Eastern Correctional Institution (ECI). South of the town of Westover, however, chloride concentrations in the aquifer exceed the 250-mg/L SMCL of the U.S. Environmental Protection Agency (USEPA) (1986b), and the Manokin aquifer usually is not used as a source of potable water in this area (see Figure 5).The largest values of transmissivity may exceed 1,000 ft2/d and decreases to the south and east to about 200 ft2/d in the vicinity of Crisfield.

North of Crisfield, and encompassing the towns of Rumbley and Kingston, is an area where the sediments that are equivalent to the Manokin aquifer consist primarily of very fine sand and silt and no longer function as an aquifer. The Manokin aquifer is overlain by a confining unit consisting of silt, clay and fine-grained sand. The thickness ranges from less than 40 feet near Eden to more than 100 feet near Princess Ann. In the Crisfield area the lithology of the confining unit changes from predominantly silt and clay to one characterized by more interbeds of sand. Several of these interbeds are

tramsmissive enough to supply water. The change in character of the confining unit in the Crisfield area also may allow more water to more vertically between the Pocomoke and Manokin aquifers.

Potomac Aquifer System (Patapsco)

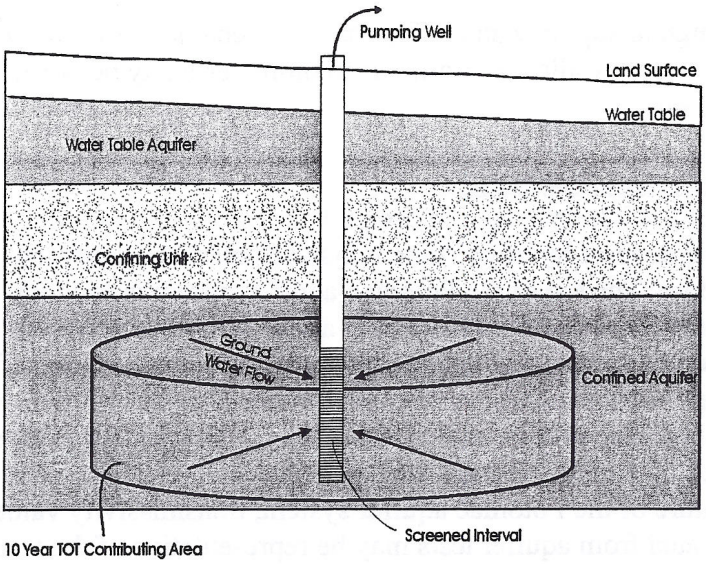
The upper sands of the Potomac aquifer are part of the Patapsco aquifer system. These sands are the deepest hydrogeologic units in Somerset County that produce water of acceptable quality. The top of the Potomac aquifer system is encountered at about 820 feet below land surface on Smith Island and at about 1,000 feet below land surface near Crisfield. The deepest aquifer yielding potable water occurs at a depth of 1,295 feet. The upper sands of the Potomac aquifer system are the most heavily used aquifer system for public water supply in the western part of the county. They produce water for municipal supplies at Crisfield, Rumbley, Frenchtown, Fairmount, Smith Island and ECI. Because of the complex nature of the Potomac aquifer system, transmissivity values and storage coefficients calculated from aquifer tests may be representative of the tested aquifer only in the vicinity of the test site.

D. Source Water Assessment Area Delineation

For ground water systems, a Wellhead Protection Area (WHPA) is considered to be the source water assessment area for the system. The WHPAs were delineated using the methodology described in Maryland's Source Water Assessment Plan (MDE, 1999) for confined aquifers in the Coastal Plain, often referred to as the "Florida Method". The area is a radial zone of transport within the aquifer and is based on a 10-yr time of travel (TOT), the pumping rate and the screened interval(s) of the well or wells included in the WHPA, and the porosity of the aquifer (see illustration below for conceptual model). The Florida Method is a modification of Darcy's Law for radial flow to a well and the WHPA's were calculated using the following volumetric equation:

$$r = \sqrt{\frac{Qt}{\pi n H}}$$

where r = calculated fixed radius (ft)
Q = pumping rate of well (ft^3/yr)
t = time of travel (yr.)
n = aquifer porosity (dimensionless)
H = length of well screen (ft)



Conceptual illustration of a zone of transport for a confined aquifer

Table 3 gives the values used and the calculated radius for each water system's WHPA. The pumping rate (Q) used is generally the permitted daily average. If a water system has more than one well, the wells usually alternate pumpage. Therefore, the total appropriated amount was used in the calculation for each well, since, in theory each well is producing a zone of transport based on the average pumping rate. In some cases, the permitted amount was split between wells that do not alternate and are a significant distance apart, thus the permitted amount was divided amongst the wells based on pumping records for the last year.

A conservative estimate of porosity (n) of 25% was used for each of the aquifers based on published reports. The lengths of the well screens (H) were obtained from well completion reports. In the instance that there were multiple screens, the sum of the individual screen lengths was used. Using these parameters the radius was calculated with the above equation for the WHPA delineation (table 3). Circles around each of the wells with the appropriate calculated radius represents the WHPA and are shown in figures 2a-2f. The circles represent the aquifer zone of transport in the subsurface as illustrated above.

E. Potential Sources of Contamination

In confined aquifer settings, sources of contamination at land surface are generally not a threat unless there is a pathway for direct injection into the deeper aquifer such as through unused wells or along well casings that are not intact or have no grout seal.

Potential sources of contamination are classified as either point or non-point sources. Examples of point sources of contamination are leaking underground storage tanks, landfills, discharge permits, large-scale feeding operations, and CERCLA sites. Non-point sources of contamination are associated with certain land use practices that may

lead to ground water contamination over a larger area. All potential sources of contamination are identified at the land surface and therefore have the potential to impact the shallow water table aquifer. As long as there is no potential for direct injection into the deeper confined aquifers, the water supply used by the community systems should be well protected from ground water contamination.

Potential point sources of contamination are identified if they fall within the WHPA for awareness and to ensure that the deep aquifer does not become affected by unused wells or poorly constructed wells in the water supply aquifer. Table 4 lists the facilities identified from MDE databases and field surveys as potential sources of contamination and their locations are shown in Figure 2a-2f. Underground storage tanks (USTs) sites are facilities that store petroleum/heating oil on site in underground tanks registered with MDE's Waste Management Administration. Controlled Hazardous Substance Generators (CHS) are facilities that may use or store any hazardous substance on site. Ground Water Discharge Permits (GWD) are issued by MDE's Water Management Administration for discharge of wastewater to ground water.

The contaminants associated with the types of facilities are based on generalized categories and often the potential contaminant depends on the specific chemicals and processes being used at the individual facility. The potential contaminants for an activity may not be limited to those listed in Table 4. Potential contaminants are grouped as Volatile Organic Compounds (VOC), Synthetic Organic Compounds (SOC), Heavy Metals (HM), Nitrates (N) and Microbiological Pathogens (MP).

F. Water Quality Data

Water Quality data was reviewed from the Water Supply Program's database for Safe Drinking Water Act (SDWA) contaminants. All data reported is from the finished (treated) water unless otherwise noted. The State's SWAP defines a threshold for reporting water quality data as 50% of the Maximum Contaminant Level (MCL). If the monitoring results for a contaminant is greater than 50% of the MCL in at least 10% of the samples, this report will describe the sources of such a contaminant and, if possible, locate the specific sources that are the cause of the elevated contaminant level. Table 5 summarizes the various treatment methods used at the water treatment plants for each of the eleven community water systems.

A review of the monitoring data for the eleven systems indicates that currently the water supplies meet the drinking water standards. Table 6 summarizes the water quality results for each of the water systems by contaminant group.

Inorganic Compounds (IOCs)

A review of the data shows that fluoride was detected more than one time above 50% of the MCL in five different water systems (table 7). Fluoride is naturally occurring in the Patapsco aquifer. All but three of the reported values of fluoride levels are below the maximum contaminant level. Fluoride levels from plant 4 of the Fairmount water system exceeded 4 mg/l. This plant is inactive and no longer provides water to the Fairmount

water system. The fluoride levels above 4 mg/l were from plant 4 in the Crisfield system. Two wells in the Crisfield system provide water to plant 4, the Maryland Avenue and Jacksonville wells. Fluoride levels in the Maryland Avenue well are above 4 mg/l, but when combined with the Jacksonville well, the results are below the maximum contaminant level.

Two different wells from the Town of Crisfield system were reported to have lead (James Island well and Jacksonville well) in excess of the action level from samples collected in 1996. In all subsequent tests the lead levels were less than half the action level, therefore, these earlier samples are not believed to be representative of the actual levels in the well.

Table 7 indicates that Arsenic was detected one time above 50% of the MCL in one of the plants supplying Crisfield's water supply. Results from the same plant at many other times showed no arsenic.

One system, Eastern Correctional Institute uses a reverse osmosis system to remove alkalinity and sodium ions from solution. Sodium levels in the well water were measured to be above 300 mg/l. The treatment protects individuals on sodium restricted diets and protects against scaling in the facility's power plant and cooling systems. Reverse osmosis is used to remove unwanted soluble ions from solution.

Radionuclides

Radon-222 was reported above 150 pCi/L at two community water systems (table 7). There is currently no MCL for radon-222, however EPA has proposed an MCL of 300 pCi/L or an alternate of 4000 pCi/L for community water systems if the State has a program to address the more significant risk from radon in indoor air. The results from these wells are below the lower proposed limit, therefore, of little known health risk.

Volatile Organic Compounds (VOCs)

A review of the data shows that there were no VOCs present greater than 50% of MCL standards.

Synthetic Organic Compounds (SOCs)

A review of the data shows that there were no SOCs detected above 50% of the MCL standard. A few systems had one time very low level detections of 2, 4-D and dalapon. Subsequent sampling showed no detects of these SOCs.

Microbiological Contaminants

Routine bacteriological monitoring is conducted in the finished water for each water system on a monthly basis and measures total coliform bacteria. Since five of the water systems disinfect their water at the treatment plant, the finished water data does not give much indication of the quality of raw water directly from the well. Total coliform bacteria are not pathogenic, but are used as an indicator organism for other disease-causing microorganisms. A major breach of the system or the aquifer would likely cause a positive total coliform result despite disinfection and would require followup total and

fecal coliform analysis. Eight water systems had positive total coliform in their routine bacteriological samples (table 8). Follow up samples for all of them showed an absence of total coliform.

G. Susceptibility Analysis

The wells serving the community water systems included in Somerset County pump water from confined aquifers. Confined aquifers are naturally well protected from activity on the land surface due to the confining layers that provide a barrier for water movement from the surface into the aquifer below. A properly constructed well with the casing extended to the confining layer above the aquifer and with sufficient grout should be well protected from contamination at the land surface. The only instance in which a contaminant at the surface would impact the water supply is through direct injection into the aquifer from within the WHPA. This could occur via poorly constructed wells, wells out of use that penetrate the aquifer and underground injection wells drilled into the aquifer.

Some contaminants like radionuclides and other chemical elements (e.g. flouride, arsenic and iron) are naturally occurring in the aquifer and in some instances can reach concentrations that pose a risk to the water supply. In the case of confined aquifers, this is generally more problematic than contaminants originating at the land surface.

The susceptibility of the source water to contamination is determined for each group of contaminants based on the following criteria: 1) the presence of natural and anthropogenic contaminant sources within the WHPA, 2) water quality data, 3) well integrity, and 4) the aquifer conditions. The susceptibility analysis is summarized for each water system in table 9.

Inorganic Compounds

Fluoride was detected more than once above 50% of the MCL in Fairmount, Crisfield, ECI, Rhodes Point South waterworks and Tylerton waterworks cooperative. Due to the natural occurrence of fluoride in the Patapsco (Potomac) aquifer, the above listed five systems are **susceptible** to fluoride.

Arsenic was detected one time above 50% of the MCL in Crisfield's water supply. The source of arsenic in these supplies is the natural occurrence and mobility of this contaminant in the aquifer material. Since only one time arsenic was detected, this system is **not susceptible** to arsenic.

Based on the natural occurrence of iron at certain locations within the aquifers and treatment for iron removal, four of the community systems (see table 5) are **susceptible** to iron.

Due to the naturally protected characteristics of the confined aquifers, the water quality data, and the lack of potential sources of contamination, the community water systems are considered **not susceptible** to inorganic compounds except for five systems susceptible to fluoride and four systems to iron.

Radionuclides
The source of radon in ground water can be traced back to the natural occurrence of uranium in rocks. Radionuclides are present in ground water due to radioactive decay of uranium bearing minerals in the sediment that makes up the aquifer material.

There is currently no MCL for radon-222, however EPA has proposed an MCL of 300 pCi/L or an alternate of 4000 pCi/L if the State has program to address the more significant risk from radon in indoor air.

Based on the natural occurrence of radon-222 in the aquifer and water quality data, Eastern Correctional Institute and Crisfield **may be susceptible** to radon-222, depending on the final mcl that is adopted for this contaminant.

Volatile Organic Compounds
Volatile organic compounds (VOCs) have not been detected at 50% of the MCL in any of the systems. The eleven community systems are **not susceptible** to contamination by VOCs.

Synthetic Organic Compounds
Synthetic organic compounds (SOCs) have not been detected in the water supplies. Based on lack of contaminant sources, water quality data and aquifer type, the water supplies are **not susceptible** to SOCs.

Microbiological Contaminants
Raw water monitoring for microbiological contaminants is not required of water systems in confined aquifers because they are considered naturally protected from sources of pathogens at the land surface. Eight systems had positive total coliform in an occasional routine bacteriological samples. Nine community systems are **not susceptible** to microbiological contaminants. Two of the Smith Island systems may be **susceptible** to flooding and subsequent microbiological contamination.

H. Management of the Source Water Assessment Area

With the information contained in this report, the individual community water systems in Somerset County are in a position to protect their water supplies by staying aware of the areas delineated for source water protection. Specific management recommendations for consideration are listed below:

Public Awareness and Outreach
The Consumer Confidence Report should list that this report is available to the general public through their county library, or by contacting the operator or MDE.

Monitoring
Continue to monitor for all required Safe Drinking Water Act contaminants Annual raw water bacteriological testing is a good check on well integrity.

Contaminant Source Inventory Updates

Conduct a survey of the WHPA and inventory any potential sources of contamination, including unused wells that may not have been included in this report. Keep records of new development within the WHPA and new potential sources of contamination that may be associated with the new use.

Well Inspections/Maintenance/Improvements

Work with the County Health Department to ensure that there are no unused wells within the WHPA. An improperly abandoned well can be a potential source of contamination to the aquifer.

Water operation personnel should have a program for periodic inspections and maintenance of the supply wells and backup wells to ensure their integrity and protect the aquifer from contamination.

Hill Waterworks Cooperative and Ewell Waterworks Cooperative systems on Smith Island are above ground and should be 2 feet above high tide level and have water tight caps to prevent contamination to the water during storm events.

Changes in Use

Water system owners are required to notify the MDE Water Supply Program if new wells are to be added or if they wish to increase their water useage. An increase in use or the addition of new wells may require revisions to the WHPA.

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Slaughter, T. H., and Otton, E. G., 1968, Availability of ground water in Somerset County, Maryland: Maryland Geological Survey Bulletin 30, 100 p.

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U.S. Environmental Protection Agency, 1991, Wellhead Protection Strategies for Confined-Aquifer Settings: Office of Ground Water and Drinking Water, EPA/570/9-91-008, 168 p.

OTHER SOURCES OF DATA

Water Appropriation and Use Permits
Public Water Supply Sanitary Survey Inspection Reports
MDE Water Supply Program Oracle® Database
MDE Waste Management Sites Database
Department of Natural Resources Digital Orthophoto Quarter Quadrangles
USGS Topographic 7.5 Minute Quadrangles for Somerset County
Maryland Office of Planning 2000 Somerset County Land Use Map
Maryland Office of Planning 1995 Somerset County Sewer Map

TABLES

Public Water System ID (PWSID)	System Name	Owner/Operator Type	Population Served
0190001	CRISFIELD	Local Government	4500
0190002	PRINCESS ANNE	Local Government	3040
0190004	EWELL WATERWORKS COOPERATIVE	Investor/Trust/Water Assoc.	75
0190006	MIDTOWN WATERWORKS COOPERATIVE	Investor/Trust/Water Assoc.	34
0190007	HILL WATERWORKS COOPERATIVE	Investor/Trust/Water Assoc.	100
0190008	FIELD WATERWORKS COOPERATIVE	Investor/Trust/Water Assoc.	76
0190009	RHODES POINT SOUTH WATERWORKS	Investor/Trust/Water Assoc.	100
0190011	TYLERTON WATERWORK COOPERATIVE	Investor/Trust/Water Assoc.	100
0190012	FAIRMOUNT	Local Government	700
0190013	EASTERN CORRECTIONAL INSTITUTE	State	3500
0190205	EDEN MOBILE HOME PARK	Investor/Trust/Water Assoc.	250

Table 1. Community Water Systems in Somerset County

PWSID	System Name	Plant ID	Source ID	Use Code	Well Name	Well Permit #	Well Depth	Casing Depth	Screened Depth(s)	Year Drilled	Aquifer
0190205	EDEN MOBILE HOME PARK	01	01	p	Eden TP 1 Benjamin Ln East	SO-81-0302	255	235	235-245	1983	Manokin
		02	02	P	Eden TP 2 Sandy Ln	SO-810324	255	235	235-255	1991	Manokin
		03	03	P	Edem TP 3 Benjamin Ln West	SO-88-0045	255	235	235-255	1988	Manokin
190002	PRINCESS ANNE	04	03	P	Well 3 Rest Stop	SO-81-0558	240	165	165-240	1985	Manokin
		01	04	P	Well 4 Irving Ave	SO-01-1924	214	163	163-214	1953	Manokin
		06	05	P	Well 5 Crisfield Lane	SO-67-0126	250	160	160-205	1967	Manokin
		02	06	P	Well 6 Abbeylane	SO-73-0645	195	151	151-191	1976	Manokin
		03	07	P	Well 7 Industrial Park	SO-81-0471	255	190	190-250	1985	Manokin
		05	08	P	Well 8 Ridge Road	SO-88-0394	191	146	146-186	1994	Manokin
0190013	Eastern Correctional Institute	02	01	S	Perry rd 1	SO-81-0556	245	190	190-240	1985	Manokin
		03	02	S	Detention 2	SO-81-0557	235	190	190-230	1985	Manokin
		01	03	P	RO Plant 4	SO-81-1656	1515	762	365-865	1989	Patapsco
		01	04	P	RO Pland 5	SO-88-0058	1270	1186	1186-1246	1991	Patapsco
0190012	Fairmont	01	01	P	Nevette Muir Well	SO-73-1425	1145	1110	1110-1145	1979	Patapsco
		02	02	P	Upper Hill Well	SO-92-0199	1137	409	409-1132	1995	Patapsco
0190001	Crisfield	01	03	P	Jersey 3	n/a	1076	941	1042-1076		Patapsco
		02	06	P	Broadway 6	SO-72-0054	1216	1121	1121-1156	1972	Patapsco
		03	07	P	James Island 7	SO-71-0064	1200	1121	1116-1136	1970	Patapsco
		04	08	P	Jacksonville 8	SO-81-0413	1330	916	922-1269	1984	Patapsco
		06	09	P	Crisfield 9	SO-81-1483	1455	1150	1150	14132	Patapsco
		04	11	P	MD Ave. 5	SO-04-6301	1207	915	930-1090	1962	Patapsco
Smith Island Wells											
0190004	Ewell Waterworks Cooperative	01	03	P	Well 3	SO-94-0275	910	890	890-910	1998	Patapsco
0190006	Midtown Waterworks Cooperative	01	01	P	Well 1	SO-81-0112	937	906	906-927	1982	Patapsco
		01	02	P	Well 2	n/a					Patapsco
0190007	Hill Waterworks Cooperative	01	01	P	Well 1	SO-73-0192	929	909	909-929	1973	Patapsco
0190008	Field Waterworks Cooperative	01	01	P	Well 1	SO-00-0133	850	567	830-850	1946	Patapsco
0190009	Rhodes Point South Waterworks	01	01	P	Well 1	SO-00-2950	841	808	808-841	1948	Patapsco
0190011	Tylerton Waterwork Cooperative	01	01	P	Well 1	SO-70-0042	940	920	920-940	1970	Patapsco

Table 2. Well Information for Community Water Systems in Somerset County

Use Code P = Production
S = Standby
U = Unused

PWSID	System Name	Wells Included in WHPA	Aquifer	Discharge (Q) in gal/day	Screened Interval (H) in feet	Calculated Radius for WHPA in feet	Acreage of WHPA	Comment
190205	Eden Mobile Home Park	3 wells	Manokin	20000	20	455	15	2 Circles Overlap
0190002	Princess Anne	6 wells	Pocomoke	576000	20	543	21	
190013	Eastern Correctional Institute	2 wells	Patapsco	567000	20	2967	635	Circles overlapping
		2 wells	Manokin	10000	20	394	22	
190012	Fairmont	2 wells	Patapsco	60000	20	965	67	
190001	Crisfield	6 wells	Patapsco	600000	20	1931	269	Circles overlapping
	SMITH ISLAND							
190004	Ewell Waterwrks Coop	2 wells	Patapsco	15000	20	483	17	Circles overlapping
190006	Midtown Waterworks Coop	2 wells	Patapsco	3500	20	233	4	Circles overlapping
190007	Hill Waterworks Coop	1 well	Patapsco	2000	20	249	5	
190008	Field Waterworks Coop	1 well	Patapsco		20	845	51	
190009	Rhodes Point South	1 well	Patapsco	300	20	97	1	
190011	Tylerton Waterwork Coop	1 well	Patapsco	7500	20	483	17	

Table 3. Parameters used for WHPA delineations

ID	Type	Facility Name	Address	Reference* Location	WHPA System Name	No. of UST's/ Capacity/ Subatance/ Other Comments	Potential Contaminants
1	UST	J & J Video Sales, Inc.	328 W. Main St.	Figure 2e	Crisfield	1-500 gal Heating Oil	VOC
7	UST	Shore Stop # 47	63 Richardson Ave.	Figure 2e	Crisfield	1-1000 gal Kerosene, 1-1000 gal Diesel, 3-4000 gal Gasoline	VOC
8	UST	Fast Gas	35 Richardson Ave.	Figure 2e	Crisfield	2-12,000 gal Gasoline	VOC
9	UST	Somers Cove Marina	715 Broadway	Figure 2e	Crisfield	Unknown	VOC
10	UST	Tawes Bros. Oil	102 N. 10th St	Figure 2e	Crisfield	Unknown	VOC

Table 4. Potential Contaminant Point Sources within WHPAs

*see referenced figure for location

PWSID	System Name	Plant ID	Treatment Name	Purpose
0190205	EDEN MOBILE HOME PARK	01	HYPOCHLORINATION, POST	DISINFECTION, IRON REMOVAL
		02	HYPOCHLORINATION, POST	DISINFECTION, IRON REMOVAL
		03	HYPOCHLORINATION, POST	DISINFECTION, IRON REMOVAL
0190002	PRINCESS ANNE	01	HYPOCHLORINATION, POST	DISINFECTION, IRON REMOVAL
		02	HYPOCHLORINATION, POST	DISINFECTION, IRON REMOVAL
		03	HYPOCHLORINATION, POST	DISINFECTION, IRON REMOVAL
		03	SEQUESTRATION	IRON REMOVAL
		04	HYPOCHLORINATION, POST	DISINFECTION, IRON REMOVAL
		04	SEQUESTRATION	IRON REMOVAL
		05	HYPOCHLORINATION, POST	DISINFECTION, IRON REMOVAL
		05	SEQUESTRATION	IRON REMOVAL
		06	HYPOCHLORINATION, POST	DISINFECTION, IRON REMOVAL
0190013	EASTERN CORRECTIONAL INSTITUTE	01	GASEOUS CHLORINATION, POST	DISINFECTION, IRON REMOVAL
		01	RED. AGENT, SODIUM SULFITE	DECHLORIMATION
		01	FILTRATION, GREENSAND	IRON REMOVAL
		01	PERMANGANATE	IRON REMOVAL
		01	REVERSE OSMOSIS	INORGANIC REMOVAL
		01	MICROSREENING	INORGANIC REMOVAL
		02	GASEOUS CHLORINATION, POST	DISINFECTION, IRON REMOVAL
		03	GASEOUS CHLORINATION, POST	DISINFECTION, IRON REMOVAL
		04	NO TREATMENT	PLANT INACTIVE

Table 5. Treatment Methods **(continued next page)**

PWSID	System Name	Plant ID	Treatment Name	Purpose
0190012	FAIRMOUNT	01	HYPOCHLORINATION, POST	DISINFECTION, IRON REMOVAL
		02	HYPOCHLORINATION, POST	DISINFECTION, IRON REMOVAL
		03	NO TREATMENT	PLANT INACTIVE
		04	NO TREATMENT	PLANT INACTIVE
0190001	CITY OF CRISFIELD	01	HYPOCHLORINATION, POST	DISINFECTION
		02	HYPOCHLORINATION, POST	DISINFECTION
		03	HYPOCHLORINATION, POST	DISINFECTION
		04	HYPOCHLORINATION, POST	DISINFECTION
		05	NO TREATMENT	PLANT INACTIVE
		06	NO TREATMENT	PLANT INACTIVE
0190004	EWELL WATERWORKS COOPERATIVE	01	NO TREATMENT	
0190006	MIDTOWN WATERWORKS COOPERATIVE	01	NO TREATMENT	
0190007	HILL WATERWORKS COOPERATIVE	01	NO TREATMENT	
0190008	FIELD WATERWORKS COOPERATIVE	01	NO TREATMENT	
0190009	RHODES POINT SOUTH WATERWORKS	01	NO TREATMENT	
0190011	TYLERTON WATERWORK COOPERATIVE	01	NO TREATMENT	

Table 5 (Cont.). Treatment Methods

PWSID	System Name	Plant ID	IOCs		Radionuclides		VOCs		SOCs	
			No. of Samples Collected	No. of Samples > 50% MCL	No. of Samples Collected	No. of Samples > 50% MCL	No. of Samples Collected	No. of Samples > 50% MCL	No. of Samples Collected	No. of Samples > 50% MCL
0190205	EDEN MOBILE HOME PAR	01	89	0	2	2	7	0	2	0
		02	94	0	2	2	7	0	2	0
		03	85	0	3	3	7	0	2	0
0190002	PRINCESS ANNE	01	65	0	4	2	3	0	1	0
		02	68	0	4	4	4	0	1	0
		03	70	1	3	3	5	0	1	0
		04	70	0	3	3	6	0	1	0
		05	82	0	4	4	8	0	1	0
		06	73	0	3	3	5	0	2	0
0190013	EASTERN CORRECTIONA INSTITUTE	01	70	2	2	0	4	0	1	0
		02	128	0	2	1	4	0	1	0
		03	66	0	3	1	7	0	1	0
		04	89	0	0	0	7	0	1	0
0190012	FAIRMONT	01	166	87	4	0	3	0	1	0
		02	90	8	4	0	7	0	1	0
		04	6	2	1	0	1	0	1	0
0190001	CRISFIELD	01	171	6	4	0	6	0	1	0
		02	191	2	6	1	3	0	1	0
		03	162	2	4	1	5	0	2	0
		04	289	11	3	3	5	0	2	0
		06	0	0	0	0	2	0	0	0
0190004	EWELL WATERWORKDS COOPERATIVE	01	104	0	0	0	9	0	1	0
0190006	MIDTOWN WATERWORKDS COOPERATIVE	01	87	3	0	0	7	0	1	0
0190007	HILL WATERWORKDS COOPERATIVE	01	74	0	0	0	7	0	0	0
0190008	FIELD WATERWORKS COOPERATIVE	01	71	0	0	0	7	0	0	0
0190009	RHODES POINT SOUTH WATERWORKS	01	73	4	0	0	5	0	0	0
0190011	TYLERTON WATERWORK COOPERATIVE	01	85	3	0	0	7	0	0	0

Table 6. Summary of Water Quality Results

PWSID	System Name	Plant ID	Contaminant	MCL	Units	Sample Date	Result
0190002	Princess Anne	03	FLUORIDE	4	mg/L	04/30/2002	2.46
0190013	ECI	01	FLUORIDE	4	mg/L	09/10/2002	2.47
		01	FLUORIDE	4	mg/L	01/13/2004	2.09
		02	RADON-222	*300	pCi/L	09/26/2002	200
		03	RADON-222	*300	pCi/L	05/20/2002	225
0190012	FAIRMONT	01	FLUORIDE	4	mg/L	01/25/1994	2.64
		01	FLUORIDE	4	mg/L	04/26/1994	2.46
		01	FLUORIDE	4	mg/L	05/24/1994	2.5
		01	FLUORIDE	4	mg/L	06/12/1994	2.7
		01	FLUORIDE	4	mg/L	10/25/1994	2.46
		01	FLUORIDE	4	mg/L	11/22/1994	2.62
		01	FLUORIDE	4	mg/L	12/27/1994	2.8
		01	FLUORIDE	4	mg/L	01/24/1995	2.36
		01	FLUORIDE	4	mg/L	02/14/1995	3.14
		01	FLUORIDE	4	mg/L	03/14/1995	2.36
		01	FLUORIDE	4	mg/L	04/11/1995	2.66
		01	FLUORIDE	4	mg/L	05/09/1995	2.3
		01	FLUORIDE	4	mg/L	06/13/1995	2.58
		01	FLUORIDE	4	mg/L	07/11/1995	2.58
		01	FLUORIDE	4	mg/L	08/08/1995	2.6
		01	FLUORIDE	4	mg/L	10/10/1995	2.32
		01	FLUORIDE	4	mg/L	11/14/1995	2.6
		01	FLUORIDE	4	mg/L	12/12/1995	2.6
		01	FLUORIDE	4	mg/L	04/09/1996	3.1
		01	FLUORIDE	4	mg/L	06/11/1996	2.62
		01	FLUORIDE	4	mg/L	07/09/1996	2.52
		01	FLUORIDE	4	mg/L	08/13/1996	2.64
		01	FLUORIDE	4	mg/L	10/08/1996	2.76
		01	FLUORIDE	4	mg/L	11/12/1996	2.42
		01	FLUORIDE	4	mg/L	12/10/1996	2.3
		01	FLUORIDE	4	mg/L	01/14/1997	2.46
		01	FLUORIDE	4	mg/L	02/21/1997	2.54
		01	FLUORIDE	4	mg/L	03/11/1997	2.36
		01	FLUORIDE	4	mg/L	05/13/1997	2.56
		01	FLUORIDE	4	mg/L	06/10/1997	2.42
		01	FLUORIDE	4	mg/L	07/08/1997	2.5
		01	FLUORIDE	4	mg/L	08/12/1997	2.68

Table 7. Results of Inorganic Compounds and Radionuclides where detected at least once above 50% of their MCL. (continued next page)

* This value was proposed but not adopted by the USEPA

PWSID	System Name	Plant ID	Contaminant	MCL	Units	Sample Date	Result
0190012	FAIRMONT	01	FLUORIDE	4	mg/L	09/09/1997	2.78
		01	FLUORIDE	4	mg/L	11/18/1997	3.02
		01	FLUORIDE	4	mg/L	12/09/1997	3.52
		01	FLUORIDE	4	mg/L	01/20/1998	3.06
		01	FLUORIDE	4	mg/L	03/10/1998	2.24
		01	FLUORIDE	4	mg/L	04/19/1998	2.6
		01	FLUORIDE	4	mg/L	05/27/1998	2.74
		01	FLUORIDE	4	mg/L	06/09/1998	2.48
		01	FLUORIDE	4	mg/L	07/14/1998	2.76
		01	FLUORIDE	4	mg/L	08/11/1998	3
		01	FLUORIDE	4	mg/L	09/08/1998	2.6
		01	FLUORIDE	4	mg/L	10/13/1998	2.8
		01	FLUORIDE	4	mg/L	11/10/1998	3.52
		01	FLUORIDE	4	mg/L	12/08/1998	3.44
		01	FLUORIDE	4	mg/L	01/12/1999	2.54
		01	FLUORIDE	4	mg/L	02/09/1999	2.9
		01	FLUORIDE	4	mg/L	04/13/1999	2.68
		01	FLUORIDE	4	mg/L	06/08/1999	2.82
		01	FLUORIDE	4	mg/L	07/13/1999	2.98
		01	FLUORIDE	4	mg/L	08/10/1999	2.5
		01	FLUORIDE	4	mg/L	09/21/1999	2.94
		01	FLUORIDE	4	mg/L	10/25/1999	2.86
		01	FLUORIDE	4	mg/L	12/14/1999	2.9
		01	FLUORIDE	4	mg/L	01/31/2000	3.26
		01	FLUORIDE	4	mg/L	02/08/2000	2.1
		01	FLUORIDE	4	mg/L	03/14/2000	2.82
		01	FLUORIDE	4	mg/L	06/20/2000	3.01
		01	FLUORIDE	4	mg/L	07/11/2000	3.02
		01	FLUORIDE	4	mg/L	08/09/2000	2.83
		01	FLUORIDE	4	mg/L	09/12/2000	3.1
		01	FLUORIDE	4	mg/L	11/14/2000	2.96
		01	FLUORIDE	4	mg/L	01/09/2001	2.88
		01	FLUORIDE	4	mg/L	02/20/2001	2.96
		01	FLUORIDE	4	mg/L	03/08/2001	2.75
		01	FLUORIDE	4	mg/L	03/27/2001	3.05
		01	FLUORIDE	4	mg/L	04/24/2001	2.78
		01	FLUORIDE	4	mg/L	05/30/2001	2.97

Table 7. (continued) Results of Inorganic Compounds and Radionuclides where detected at least once above 50% of their MCL. (continued next page)

PWSID	System Name	Plant ID	Contaminant	MCL	Units	Sample Date	Result
0190012	FAIRMONT	01	FLUORIDE	4	mg/L	06/27/2001	3.06
		01	FLUORIDE	4	mg/L	08/28/2001	3.12
		01	FLUORIDE	4	mg/L	09/27/2001	3.05
		01	FLUORIDE	4	mg/L	10/09/2001	3.4
		01	FLUORIDE	4	mg/L	10/31/2001	3.07
		01	FLUORIDE	4	mg/L	12/31/2001	2.98
		01	FLUORIDE	4	mg/L	01/29/2002	3.04
		01	FLUORIDE	4	mg/L	02/19/2002	2.64
		01	FLUORIDE	4	mg/L	03/26/2002	2.9
		01	FLUORIDE	4	mg/L	04/30/2002	2.62
		01	FLUORIDE	4	mg/L	05/29/2002	2.87
		01	FLUORIDE	4	mg/L	08/28/2002	2.92
		01	FLUORIDE	4	mg/L	11/21/2002	2.77
		02	FLUORIDE	4	mg/L	08/12/1995	3.1
		02	FLUORIDE	4	mg/L	03/24/1998	2.62
		02	FLUORIDE	4	mg/L	10/28/1998	2.66
		02	FLUORIDE	4	mg/L	11/09/1999	2.88
		02	FLUORIDE	4	mg/L	03/08/2001	2.8
		02	FLUORIDE	4	mg/L	03/27/2001	2.31
		02	FLUORIDE	4	mg/L	10/09/2001	3.47
		02	THALLIUM	0.002	mg/L	03/24/1998	0.002
		04**	FLUORIDE	4	mg/L	01/25/1994	**4.96**
		04**	FLUORIDE	4	mg/L	06/21/1994	**4.16**
0190001	CRISFIELD (part 1)	01	ARSENIC	0.01	mg/L	05/23/2002	0.0054
		01	FLUORIDE	4	mg/L	05/23/1996	2.2
		01	FLUORIDE	4	mg/L	07/08/1998	2.21
		01	FLUORIDE	4	mg/L	03/29/2000	2.2
		01	FLUORIDE	4	mg/L	05/23/2002	2.02
		01	FLUORIDE	4	mg/L	04/10/2003	2.64
		02	FLUORIDE	4	mg/L	05/23/2002	3.7
		02	FLUORIDE	4	mg/L	04/10/2003	2.36
		02	RADON-222	*300	pCi/L	03/28/1994	160
		03	FLUORIDE	4	mg/L	04/10/2003	2.3
		03	LEAD	0.015	mg/L	05/23/1996	0.083
		03	RADON-222	*300	pCi/L	03/28/1994	155
		04	FLUORIDE	4	mg/L	06/02/1997	2.18
		04	FLUORIDE	4	mg/L	07/08/1998	2.17

Table 7. (continued) Results of Inorganic Compounds and Radionuclides where detected at least once above 50% of their MCL. (continued next page)

* This value was proposed but not adopted by the USEPA

** Plant Matter

PWSID	System Name	Plant ID	Contaminant	MCL	Units	Sample Date	Result
0190001	CRISFIELD	04	FLUORIDE	4	mg/L	03/29/2000	2.2
		04	FLUORIDE	4	mg/L	05/24/2001	4
		04	FLUORIDE	4	mg/L	05/24/2001	2.38
		04	FLUORIDE	4	mg/L	05/23/2002	3.7
		04	FLUORIDE	4	mg/L	05/23/2002	2.5
		04	FLUORIDE	4	mg/L	04/10/2003	**4.37**
		04	FLUORIDE	4	mg/L	04/10/2003	2.18
		04	FLUORIDE	4	mg/L	04/10/2003	2.78
		04	LEAD	0.015	mg/L	05/23/1996	0.016
		04	RADON-222	*300	pCi/L	03/28/1994	200
		04	RADON-222	*300	pCi/L	11/10/1997	205
		04	RADON-222	*300	pCi/L	11/10/1997	205
		04	TURBIDITY	5	NTU	07/28/1999	4.4
0190009	Rhodes	01	FLUORIDE	4	mg/L	06/01/1994	2.48
		01	FLUORIDE	4	mg/L	10/02/1996	2.26
		01	FLUORIDE	4	mg/L	11/01/1999	2.6
		01	FLUORIDE	4	mg/L	04/24/2002	2.6
0190011	Tylerton	01	FLUORIDE	4	mg/L	03/23/1993	2.02
		01	FLUORIDE	4	mg/L	11/01/1999	2.04
		01	FLUORIDE	4	mg/L	04/24/2002	2.08

Table 7. (continued) Results of Inorganic Compounds and Radionuclides where detected at least once above 50% of their MCL.

* This value was proposed but not adopted bu the USEPA

PWSID	PWS_NAME	No. of Samples Collected	No. of Positive Samples	Disinfection Treatment
0190205	EDEN MOBILE HOME PARK	91	0	Y
0190002	PRINCESS ANNE	90	1	Y
0190013	EASTERN CORRECTIONAL INSTITUTE	90	1	Y
0190012	FAIRMOUNT	88	0	Y
0190001	CRISFIELD	91	0	Y
0190004	EWELL WATERWORKS COOPERATIVE	79	3	N
0190006	MIDTOWN WATERWORKS COOPERATIVE	79	2	N
0190007	HILL WATERWORKDS COOPERATIVE	80	9	N
0190008	FIELD WATERWORKDS COOPERATIVE	77	4	N
0190009	RHODES POINT SOUTH WATERWORKS	78	3	N
0190011	TYLERTON WATERWORK COOPERATIVE	79	3	N

Table 8. Routine Bacteriological Monitoring Results from System Distribution
(Sample results are since 1995)

PWSID	SYSTEM NAME	Is the Water System Susceptible to....				
		Inorganic Compounds	Radionuclides	Volatile Organic Compounds	Synthetic Organic Compounds	Microbiological Contaminants
0190205	EDEN MOBILE HOME PARK	NO*	NO	NO	NO	NO
0190002	PRINCESS ANNE	NO*	NO	NO	NO	NO
0190013	EASTERN CORRECTIONAL INSTITUTE	YES*	YES	NO	NO	NO
0190012	FAIRMOUNT	YES*	NO	NO	NO	NO
0190001	CRISFIELD	YES	YES	NO	NO	YES
0190004	EWELL WATERWORKS COOPERATIVE	NO	NO	NO	NO	NO
0190006	MIDTOWN WATERWORKS COOPERATIVE	NO	NO	NO	NO	NO
0190007	HILL WATERWORKS COOPERATIVE	NO	NO	NO	NO	NO
0190008	FIELD WATERWORKS COOPERATIVE	NO	NO	NO	NO	NO
0190009	RHODES POINT SOUTH WATERWORKS	YES	NO	NO	NO	NO
0190011	TYLERTON WATERWORKS COOPERATIVE	YES	NO	NO	NO	NO

Table 9. Susceptibility Analysis

*System has treatment for iron removal, which suggests source water is susceptible to iron

APPENDIX

TABLE 1
GEOLOGIC AND HYDROGEOLOGIC UNITS IN SOMERSET COUNTY
[correlation of units shown in each column under previous investigations not implied]

System	Series	Previous investigations: Geologic units: Rasmussen and Slaughter (1955)	Previous investigations: Geologic units: Hansen (1978)	Previous investigations: Geologic units: Hansen (1981)	Previous investigations: Geologic units: Owens and Denny (1984)	Previous investigations: Geologic units: Mixon (1985) southern Somerset County	Previous investigations: Hydrogeologic units: Hansen (1967) Crisfield area	This report: Geologic units	This report: Hydrogeologic units
Quaternary	Holocene	Undifferentiated	Not studied	Shoreline Complex	Alluvium, swamp, and tidal marsh deposits	Estuarine marsh deposits	Undifferentiated	Alluvium, swamp, and tidal marsh deposits	Surficial aquifer system
	Pleistocene	Parsonsburg Sand Talbot and Pamlico Formations Walston Silt Beaverdam Sand	Not studied	? Beaverdam Sand	Parsonsburg Sand Kent Island Formation Omar Formation	Pocomoke River alluvium point-bar deposits Kent Island Formation		Parsonsburg Sand Kent Island Formation Omar Formation	
Tertiary	Pliocene	Brandywine, Bryn Mawr, and Beacon Hill gravels (Red Gravelly Sand)	Not studied	"Red Gravelly Sand" facies	Beaverdam Sand Yorktown Formation	Yorktown Formation	Not present	Beaverdam Sand --?-------?------ Yorktown Formation and	--?-----?--------- Confining unit Pocomoke aquifer
	Miocene	Yorktown and Cohansey Formations (?) — Upper aquiclude / Pocomoke aquifer / Lower aquiclude / Manokin aquifer St. Marys Formation Choptank Formation Calvert Formation	Undifferentiated	Upper Miocene aquifer complex St. Marys (?) Formation Not studied	Yorktown (?) and Cohansey (?) Formations Not studied	Eastover Formation Not studied	Confining unit Pocomoke aquifer Confining unit Manokin aquifer Confining unit Choptank aquifer Confining unit	--?-----?------ Eastover Formation (undifferentiated) St.Marys Formation Choptank Formation Calvert Formation	Miocene series undifferentiated — Confining unit / Manokin aquifer / Confining unit Choptank aquifer Confining unit
	Oligocene	Not present	Not present	Not studied	Not studied	Not studied	Not present	Not present	Not present
	Eocene	Chickahominy Formation Piney Point Formation Nanjemoy Formation Aquia Greensand	Piney Point Formation Nanjemoy Formation	Not studied	Not studied	Not studied	Piney Point aquifer	Piney Point Formation	Piney Point aquifer Confining unit
	Paleocene	Brightseat (?) Formation	Aquia Formation Brightseat Formation	Not studied	Not studied	Not studied	Confining unit "Paleocene" aquifer Confining unit	Undifferentiated	Paleocene aquifer system Confining unit
Cretaceous	Upper Cretaceous	Monmouth Formation Matawan Formation Magothy Formation Raritan Formation Patapsco and Arundel Formations	Not present Potomac Group (undifferentiated)	Not studied Not studied	Not studied Not studied	Not studied Not studied	Confining unit Magothy aquifer Confining unit "Upper Raritan" aquifer Confining unit Not studied	Not present Potomac Group (undifferentiated)	Not present Potomac aquifer system
	Lower Cretaceous	Patuxent Formation		Not studied	Not studied	Not studied	Not studied		

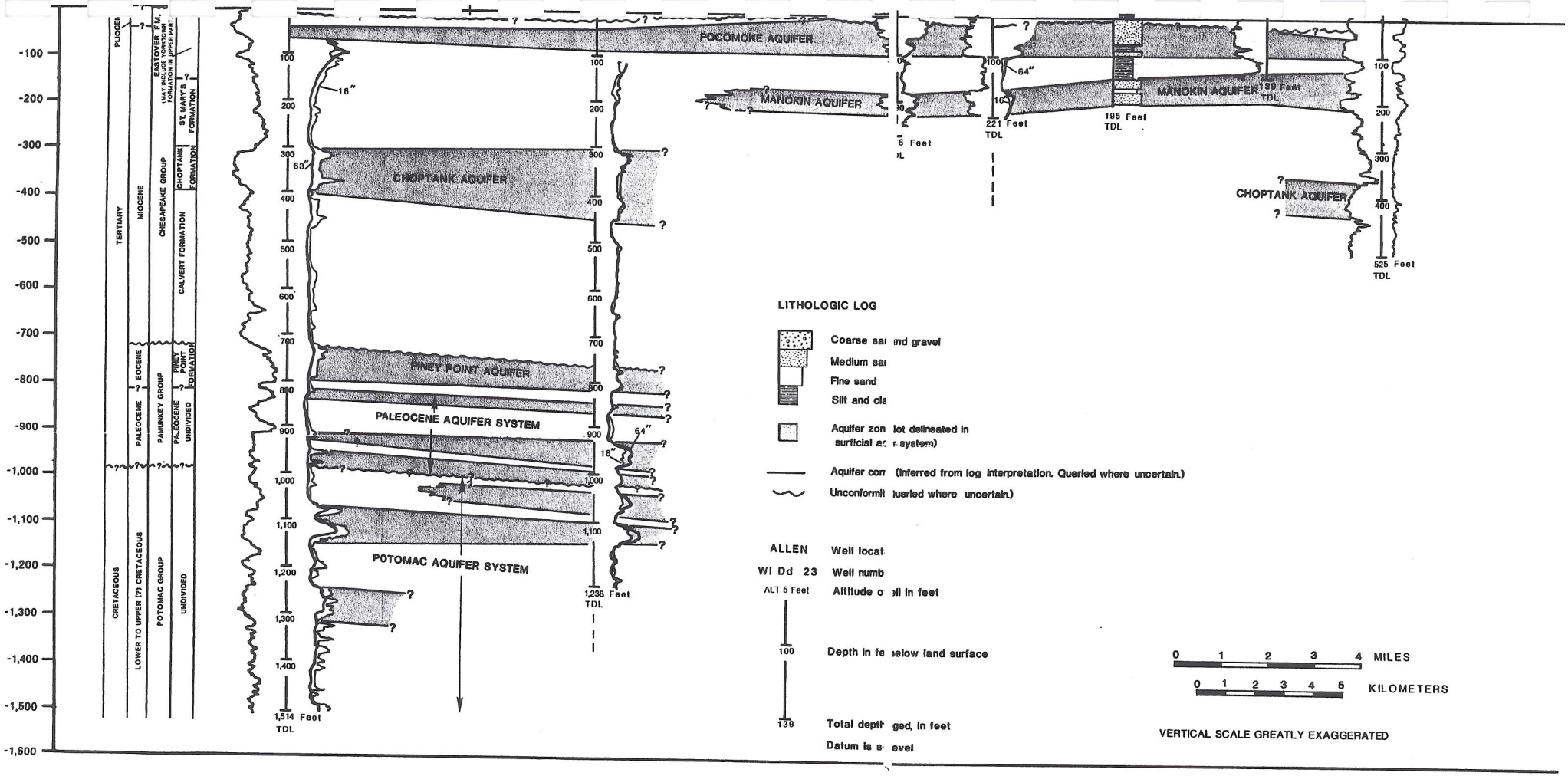
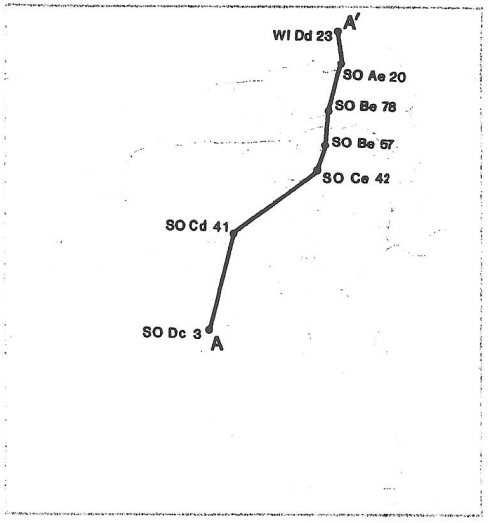
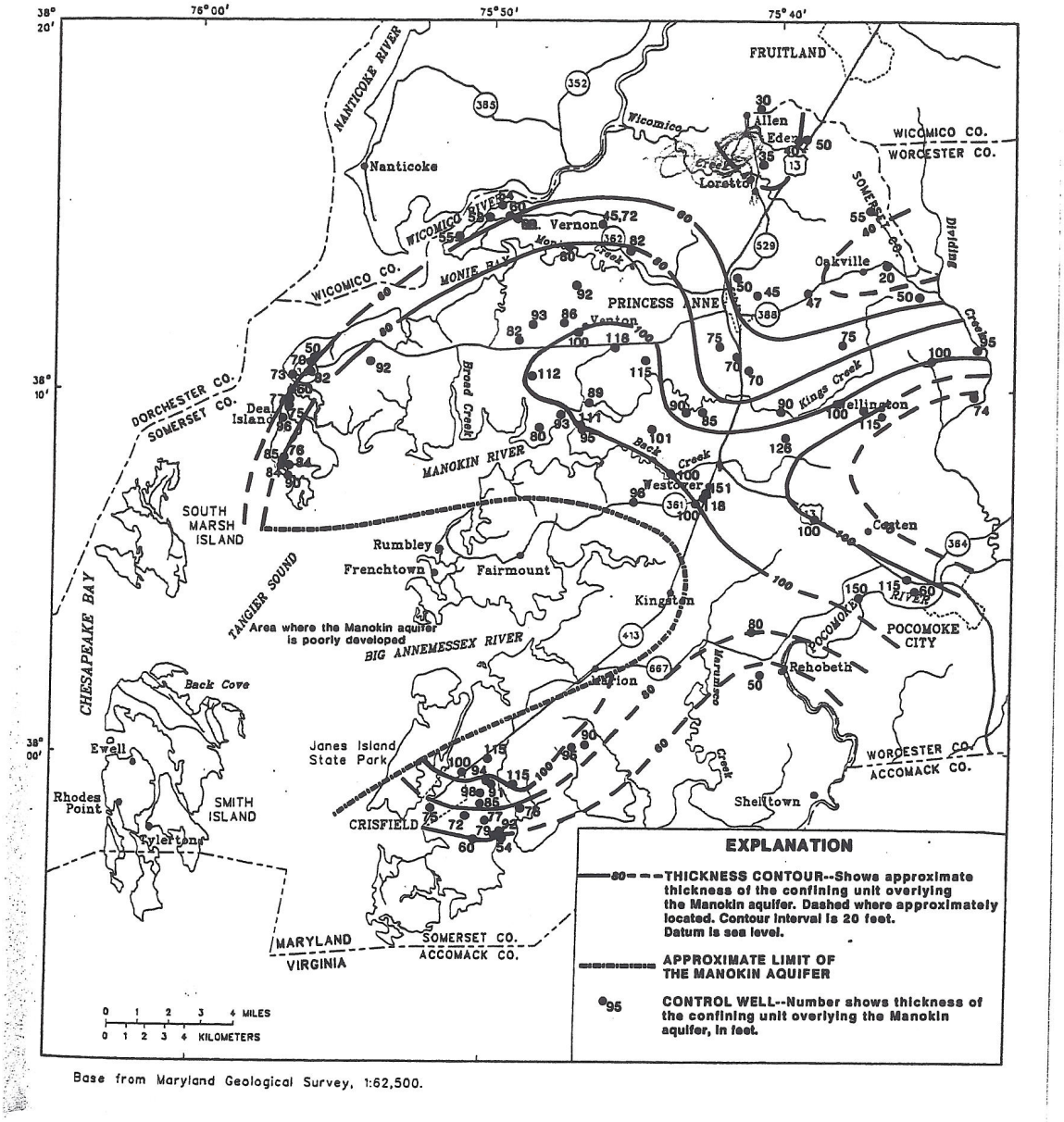


Plate 1. Hydrogeologic Section A-A'

MGS BUL 35





Base from Maryland Geological Survey, 1:62,500.

Figure 3. Thickness of the confining unit overlying the Manokin aquifer

MGS BUL 35

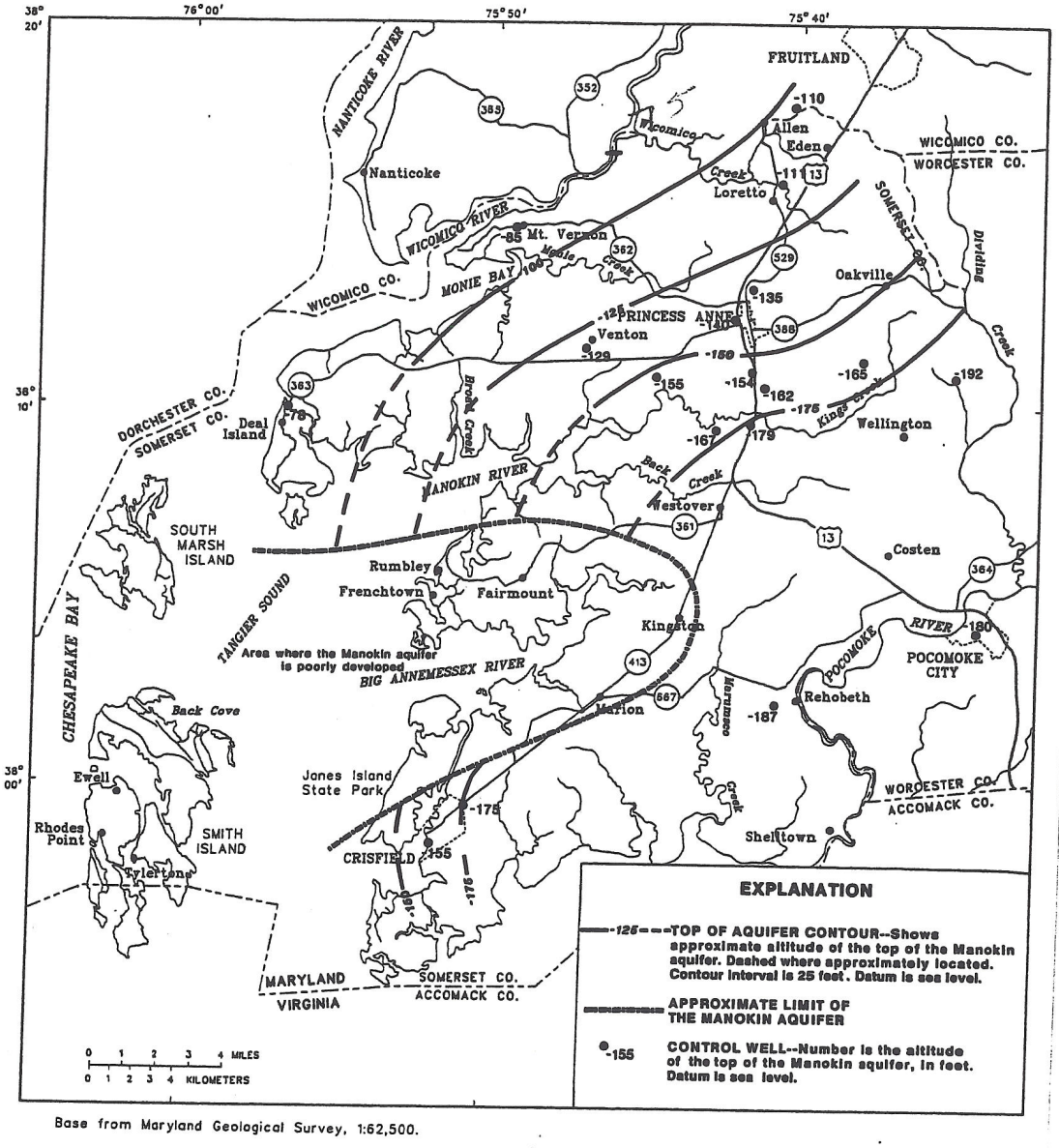
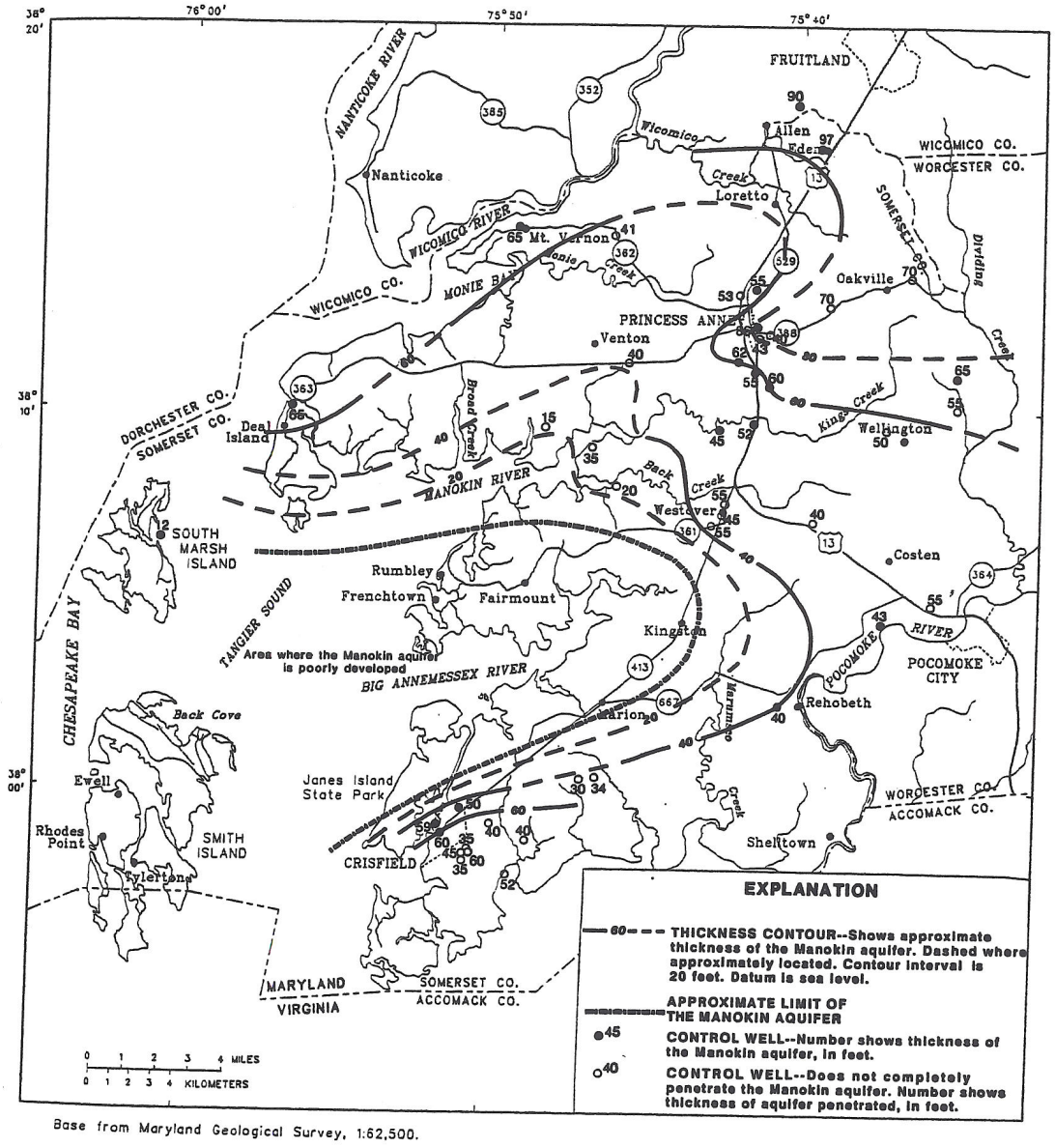


Figure 4. Altitude of the top of the Manokin aquifer

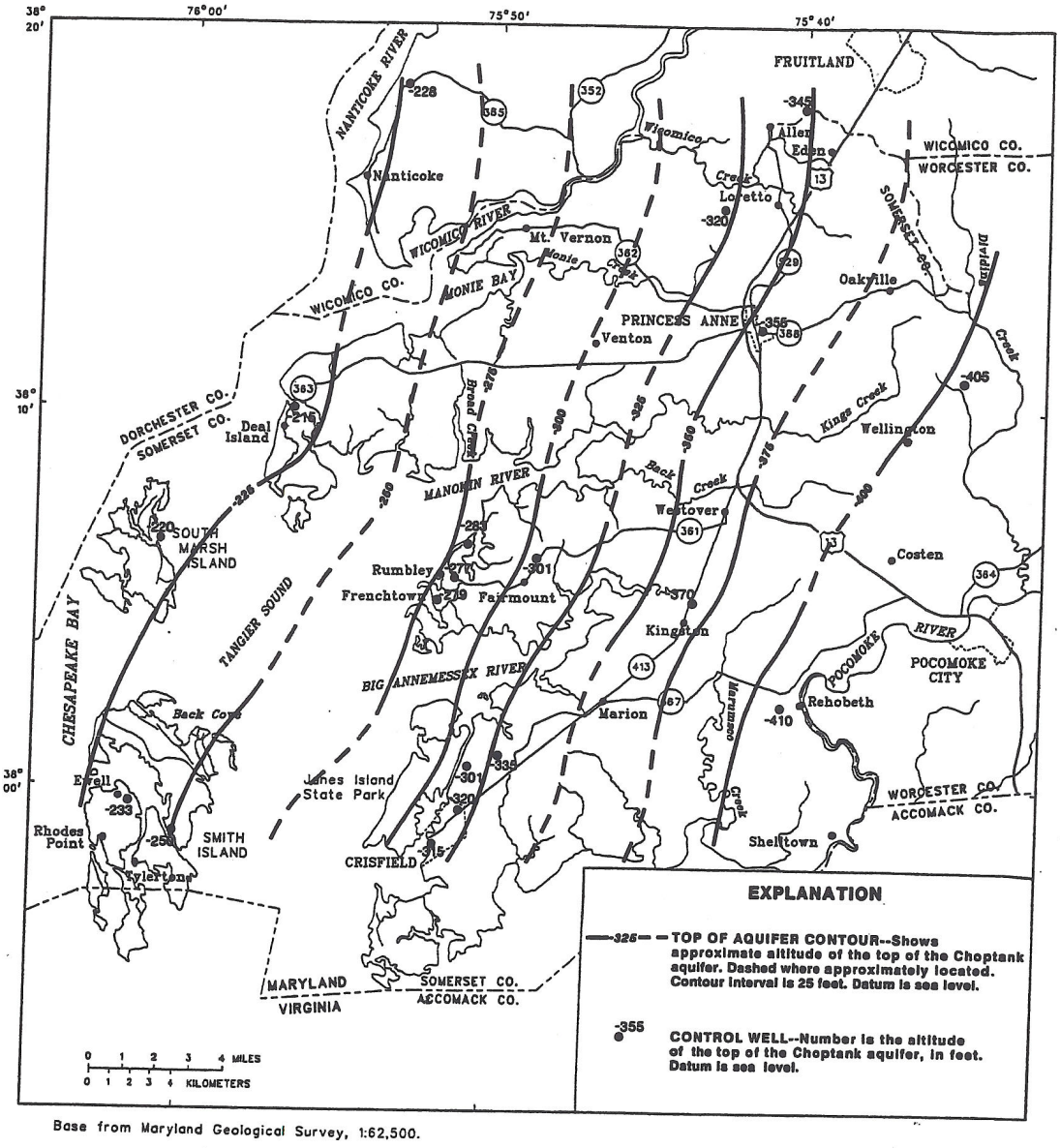
MGS BUL 35



Base from Maryland Geological Survey, 1:62,500.

Figure 5. Thickness of the Manokin aquifer

MGS BUL 35



Base from Maryland Geological Survey, 1:62,500.

Figure 6. Altitude of the top of the Choptank aquifer

MGS BUL 35

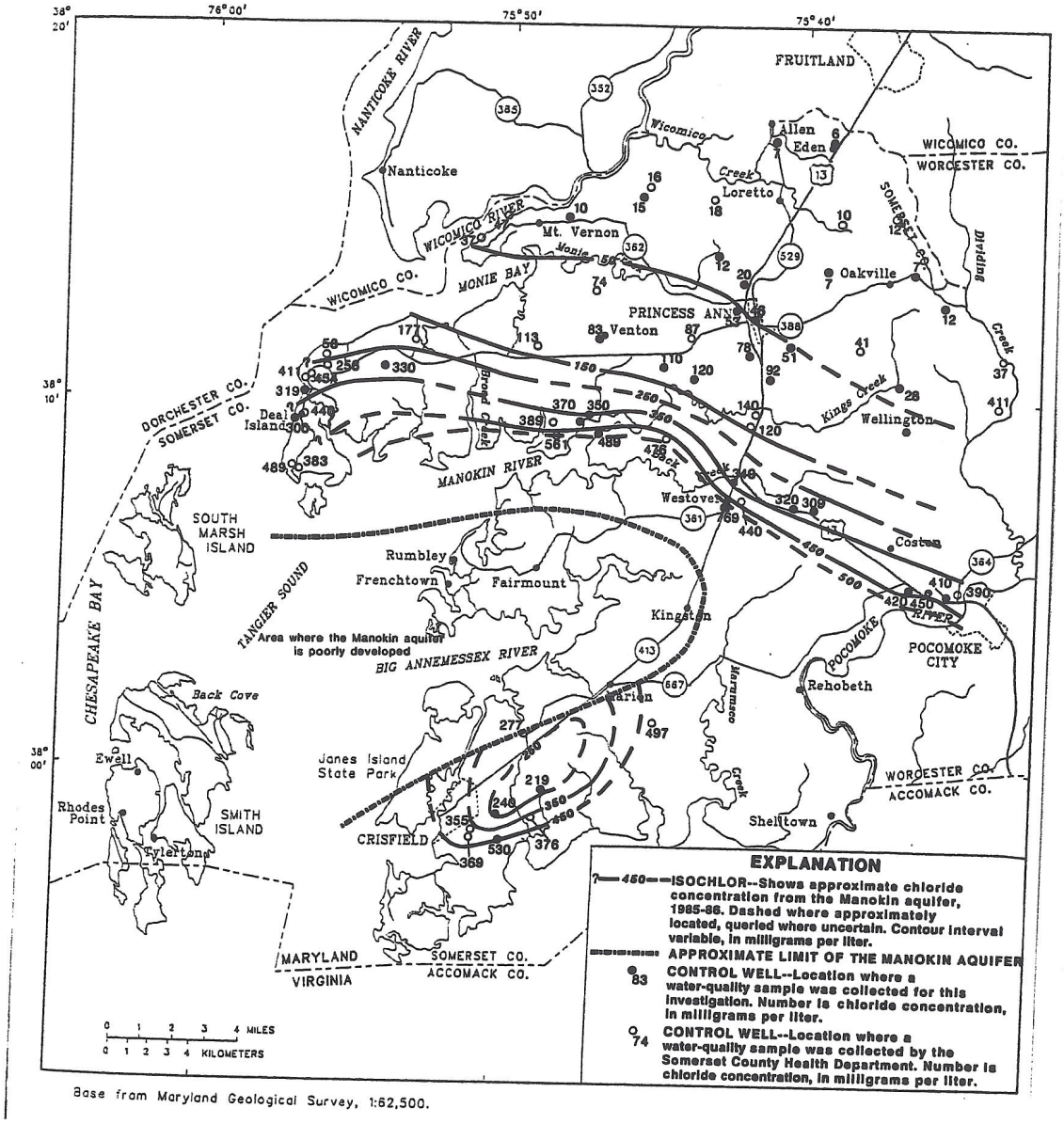


Figure 7. Chloride concentration in water from the Manokin aquifer, 1985-86

MGS BUL 35

EXECUTIVE SUMMARIES
for
community systems

EXECUTIVE SUMMARY
EDEN MOBILE HOME PARK

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for eleven community water systems in Somerset County, including the Eden Mobile Home Park water system. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Somerset County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Eden Mobile Home Park water system is currently using three wells that pump water from the Manokin aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for Eden Mobile Home Park water system is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Eden Mobile Home Park water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of high iron from its raw water.

EXECUTIVE SUMMARY
PRINCESS ANNE

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for eleven community water systems in Somerset County, including the Princess Anne water system. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Somerset County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Princess Anne water system is currently using six wells that pump water from the Manokin aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Princess Anne water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers.

EXECUTIVE SUMMARY
EASTERN CORRECTIONAL INSTITUTE

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for eleven community water systems in Somerset County, including the Eastern Correctional Institute water system. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Somerset County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Eastern Correctional Institute's water system is currently using two wells that pump water from the Patapsco aquifer. There are also two stand-by wells in the Manokin aquifer that are used when needed. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for Eastern Correction Institute water system is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Eastern Correctional Institute water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring radon depending on the final MCL that is adopted for this contaminant, naturally occurring fluorides and sodium chloride.

EXECUTIVE SUMMARY
FAIRMOUNT

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for eleven community water systems in Somerset County, including the Fairmount's water system. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Somerset County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Fairmount water system is currently using two wells that pump water from the Patapsco aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for the Fairmount water system is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Fairmount water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply is susceptible to naturally occurring fluorides.

EXECUTIVE SUMMARY
CRISFIELD

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for eleven community water systems in Somerset County, including the Crisfield water system. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Somerset County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Crisfield water system is currently using six wells that pump water from the Patapsco aquifer. The Source Water Assessment areas were delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report. Potential contaminant sources located within the WHPA are shown on the map.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Crisfield water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The susceptibility of the water supply to radon, a naturally occurring element, will depend upon the final MCL that is adopted for this contaminant. The water supply is susceptible to naturally occurring fluoride.

EXECUTIVE SUMMARY
EWELL WATERWORKS COOPERATIVE

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for eleven community water systems in Somerset County, including the Ewell Waterworks Cooperative water system. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Somerset County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Ewell Waterworks Cooperative water system is currently using one well that pumps water from the Patapsco aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Ewell Waterworks Cooperative water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. Since its well is above ground is may be susceptible to flooding. The well should be two feet above high tide and have a water- proof cap to prevent sea water from entering the well during sea events.

EXECUTIVE SUMMARY
MIDTOWN WATERWORKS COOPERATIVE

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for eleven community water systems in Somerset County, including the Midtown Waterworks Cooperative water system. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Somerset County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Midtown Waterworks Cooperative water system is currently using two wells that pump water from the Patapsco aquifer. The Source Water Assessment areas were delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Midtown Waterworks Cooperative water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers.

EXECUTIVE SUMMARY
HILL WATERWORKS COOPERATIVE

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for eleven community water systems in Somerset County, including the Hill Waterworks Cooperative water system. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Somerset County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Hill Waterworks Cooperative water system is currently using one well that pumps water from the Patapsco aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that Hill Waterworks Cooperative Apartments water supply is may be susceptible to microbiological contaminants due to well construction. It is not susceptible to inorganic, volatile organic, synthetic organic or radiological contaminants. Since its well is above ground is may be susceptible to flooding. The well should be two feet above high tide and have a water-proof cap to prevent sea water from entering the well during sea events.

EXECUTIVE SUMMARY
FIELD WATERWORKS COOPERATIVE

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for eleven community water systems in Somerset County, including the Field Waterworks Cooperative water system. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Somerset County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Field Waterworks Cooperative water system is currently using one well that pumps water from the Patapsco aquifer, respectively. The Source Water Assessment areas were delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems for is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that Field Waterworks Cooperative water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers.

EXECUTIVE SUMMARY
RHODES POINT SOUTH WATERWORKS

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for eleven community water systems in Somerset County, including the Rhodes Point South Waterworks water system. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Somerset County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Rhodes Point South Waterworks water system is currently using one well that pumps water from the Patapsco aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Rhodes Point South Waterworks water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. It is susceptible to naturally occurring fluorides.

EXECUTIVE SUMMARY
TYLERTON WATERWORKS COOPERATIVE

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for eleven community water systems in Somerset County, including the Tylerton Waterworks Cooperative water system. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Somerset County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Tylerton Waterworks Cooperative water system is currently using one well that pumps water from the Patapsco aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Tylerton Waterworks Cooperative water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply is susceptible to naturally occurring fluorides.