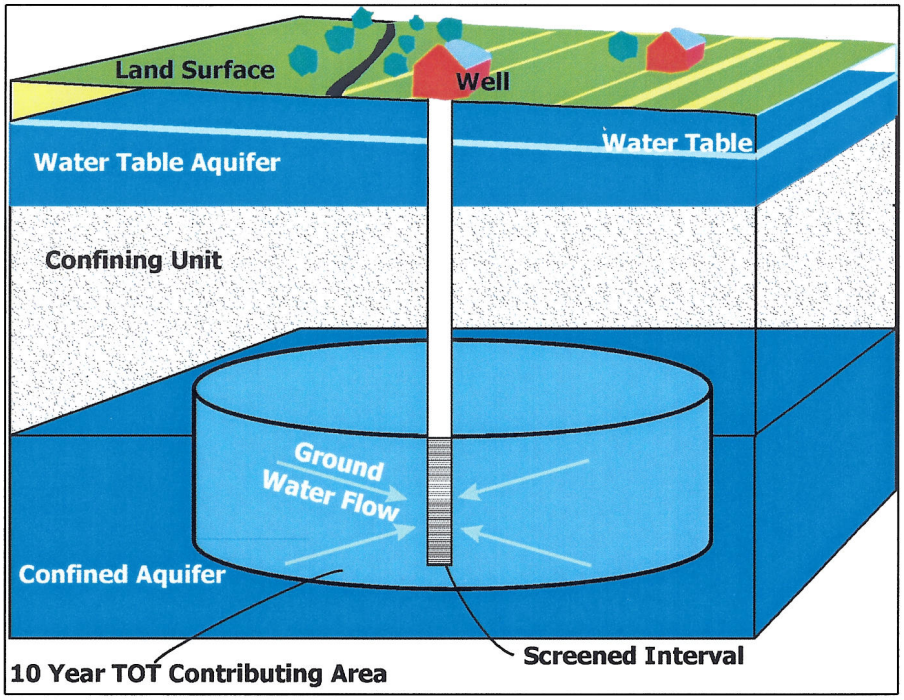
SOURCE WATER ASSESSMENT

FOR 24 NON-TRANSIENT NON-COMMUNITY WATER SYSTEMS IN ST. MARY'S COUNTY, MD



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Summary

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted as Source Water Assessment for 24 non-transient non-community water systems in St. Mary's 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 the source; 2) identification of potential sources of contamination; and, 3) determination of the susceptibility of the water supply to contamination. Recommendations for protecting the drinking water supply conclude this report.

Confined aquifers protect water supplies from contaminants originating on the land surface. All 24 of these non-transient water supply systems in St. Mary's County use confined aquifers. Twenty-seven wells supply these non-transient systems. The Source Water Assessment Areas for all wells were delineated by the WSP using Environmental Protection Agency (EPA) approved methods specifically designed for each source.

Potential point sources of contamination within the assessment areas were identified from field inspections and contaminant inventory databases. The more common potential sources of contamination are on-site septic systems, ground water discharge sites, underground storage tanks, and hazardous substance generators commonly associated with commercial areas. In confined aquifer settings, sources of contaminant at the 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 have no grout seal. Aerial photographs showing supply wells, and spot satellite images of the wellhead protection areas are enclosed at the end of 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 the inherent vulnerability of the aquifers. Some of the non-transient non-community water systems are susceptible to naturally occurring arsenic (based on the new EPA standard). All the systems that were measured to have arsenic levels exceeding the maximum contaminant levels in at least one sample withdraw water from the Aquia aquifer. None of the supplies using the Piney Point formation had levels of arsenic greater than 50% of the MCL. All 24 systems were determined not to be susceptible to synthetic organic compounds, volatile organic compounds, microbiological contaminants, or other inorganic compounds. This susceptibility could change if the well condition or conditions around the well change. Most of the supply sources were not found to be susceptible to these contaminants and the evidence of proper well construction practices were observed from on-site inspections throughout the county.

INTRODUCTION

The Water Supply Program (WSP) has conducted a Source Water Assessment for 49 non-transient non-community water systems in St. Mary's County (Figure 1). As defined in Maryland's Source Water Assessment Plan (SWAP), a non-transient non-community water system is any non-community water system that regularly serves at least twenty-five (25) of the same individuals over six months per year. Some good examples of non-transient water systems include schools, large businesses, and shopping malls. The populations served by the non-transient non-community water in St. Mary's County are shown in Table 1.

St. Mary's County is located in Southern Maryland and forms the southernmost peninsula of the Western Shore of Maryland. The county is bounded by Charles County to the northwest, the Patuxent River to the northeast, the Potomac River to the south, and by the Chesapeake Bay to the east. Based on July 2005 data, the total population of Calvert County is 94,200 persons (Md. Assoc. of Counties, 2005/2006). The County lies within the Atlantic Coastal Plain Physiographic Province. The Coastal Plain, geologically the youngest province in Maryland and covers nearly half of the State and consists entirely of unconsolidated sediments. All 24 of the non-transient non-community water systems in Calvert County covered in this report obtain their water supply from wells of various diameter and depth. All of the wells serving these systems are completed in confined aquifers. For the purpose of this report, depth of well, lithology, and nitrate data were used to determine whether the wells are in confined or unconfined aquifers. An accurate determination of the aquifer type is very important in determining the shape of the wellhead protection area (WHPA) or source water assessment area (SWAA).

WELL INFORMATION

Well information for each system was obtained from the Water Supply Program's database, owner interviews, site visits, well completion reports, sanitary survey inspection reports, and published reports. A total of 27 wells are used by the 24 systems assessed in this report. The well tag number and well completion report, which provides vital well information, was found for 26 of the 27 wells. From the well tag information, ground water appropriation data, and nitrate sampling data it was concluded that all the wells are completed in confined aquifers. Twenty of the wells were drilled after 1973 and should comply with Maryland's well construction regulations for grouting and casing. The remaining six wells drilled prior to 1973, when current regulations went into effect, may not meet the current construction standards. Table 2 contains a summary of well information.

Accurate well location information was needed to delineate the contribution areas for the St. Mary's County non-transient system wells. This was obtained by using a global positioning system (GPS) unit at all of the well locations. The data was then differentially corrected to increase the exactness of the information for each location. If a well was inside a building a GPS point was taken outside the building and the offset

distance was measured. GPS coordinates were not obtained for one well, as the well could not be definitively located at the site.

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. There are some wells observed during field inspections that appear unused or in disrepair. If these wells are screened in the same aquifer as the water supply well, they may represent a potential route for contamination to the water supply. Even if some of these are backup wells, 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 aquifer.

HYDROGEOLOGY

St. Mary's County is located in Southern Maryland and is underlain by unconsolidated sediments of the Coastal Plain Physiographic Province. This province is characterized by low topography due to the underlying horizontal layers of unconsolidated clastic sediments that are Lower Cretaceous to recent in age and thicken to the southeast. In St. Mary's County, the non-transient non-community water systems included in this report draw water from two different aquifer systems known as the Piney Point/Nanjemoy and the Aquia aquifers. These aquifers have been studied considerably and hydrologic, lithologic, and geochemical data is available in several Maryland Geological Survey Reports (1977, 1979, 1983, 1984, 1988, 1996, 2003). A geologic section from Northern Calvert County to Southern St. Mary's County showing the hydrogeologic units beneath Calvert County is shown in Figure 2 (Kapple and Hansen, 1976). Note that the deeper aquifers are overlain by confining clay units of low permeability that may inhibit the infiltration of contaminants from the land surface. The descriptive material below is summarized from these reports.

All of the wells in the St. Mary's County draw water from unconsolidated sediments. Ground water flows through pores between gravel, sand, and silt grins in unconsolidated sedimentary aquifers. Confined aquifers are those formations that are overlain by a confining layer consisting of clay or fine silt. This confining layer allows very little water to travel vertically through it.

Piney Point Aquifer (124E) / Nanjemoy Formation (124C)

The Piney Point/Nanjemoy system is a significant aquifer used by some of the non-transient non-community water systems in Calvert County due to its accessibility at relatively shallow depths, its generally good transmissivity, and its good water quality. The top of the aquifer in Calvert County ranges from 50 feet below sea level near the northern tip of the county, where its limited thickness prohibits its use, to approximately 250 feet below sea level at the southeastern end of the county. The Piney Point/Nanjemoy does not crop out at the surface in Maryland and is overlain by the Chesapeake Group sediments, which vary in thickness depending on the geographic location. The formations are composed primarily of quartz sand, glauconite, and shell fragments. Clay content tends to increase towards the bottom of the formation. The effective thickness (the thickness of the sandy portion of the formation that produces water) of the Piney Point/Nanjemoy in Calvert County ranges form approximately 0 to 80 feet. Transmissivity values, estimated by modeling and aquifer tests, range from less than 100 to 500 ft^2/day, and are the highest near Solomons in the southern part of the county.

Aquia Aquifer (125B)

The Aquia aquifer is the most widely used source of water in Calvert County, by both community water systems and non-transient non-community water systems, due to its accessibility in the northern half of the County, its high transmissivity, and its relatively good water quality. The top of the Aquia aquifer in Calvert County ranges from 125 feet below sea level near the northern tip of the county to approximately 450 feet below sea level at the southern end of the county near Solomons Island. The Aquia is overlain by the Nanjemoy formation, which acts as a leaky confining unit, and is between 100 and 200 feet thick, depending on the geographic location. The Aquia is composed of fine to medium-grained sands, of varying composition but are generally quartz and glauconite rich with calcite cementation. Shell material is more abundant in the upper portion of the aquifer. Transmissivity values, as determined by aquifer tests, range from 900 to 1300 ft^2/day, and tend to be highest in the northernmost portions of the county

SOURCE WATER ASSESSMENT AREA DELINEATION

For ground water systems, a wellhead protection area (WHPA) is considered to be the source water assessment area. Within the EPA approved Maryland SWAP there are four different WHPA delineation methods used for coastal plain wells. Two of the four methods are used in this report. The delineation method to define a WHPA for a well varies with aquifer type and the amount of water pumped from the well. Monthly operation reports (MORs) and semi-annual water withdrawal reports for the past twelve months were used to determine the amount of water withdrawn from a well. If any of the pumpage data for the system was incomplete the withdrawal amounts were divided between the wells.

Confined Wells < 10,000 gpd

Maryland's SWAP prescribes using a circle with a fixed radius of 600 feet for all confined wells pumping less than 10,000 gpd. The 600-foot radius circle was calculated using the following parameters: minimum aquifer thickness of 20 feet, porosity of 0.25, and daily pumpage of less than 10,000 gpd for ten years. A more detailed explanation of this calculation is described under the next method.

This method was used to define the WHPA for 21 of the non-transient non-community water systems.

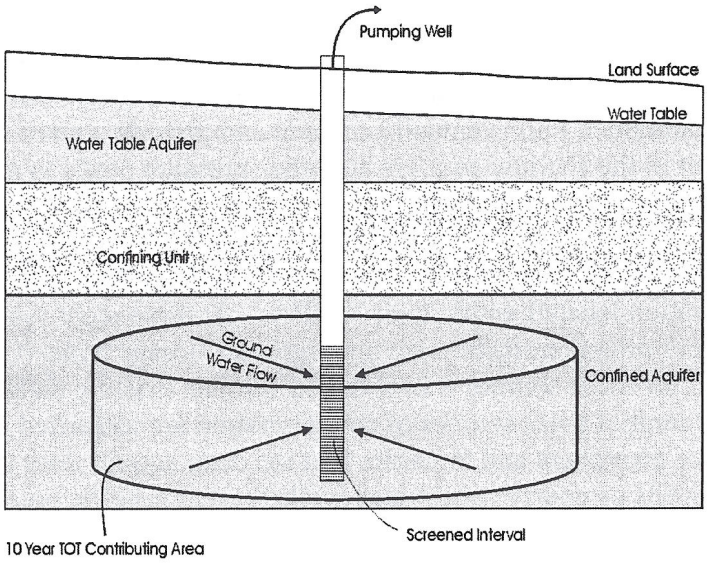
Confined Wells > 10,000 gpd

The "Florida Method" is used to define the WHPA for confined wells pumping more than 10,000 gpd. The area is a radial zone of transport within the aquifer and is based on a 10-year time-of-travel, the pumping rate and the screened interval(s) of the well(s) include in the WHPA, and the porosity of the aquifer (see illustration below for conceptual model). The Florida Method equates the volume of water pumped over 10 years to the volume of aquifer needed to store the quantity pumped assuming horizontal flow. 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 in years (yr)
n = aquifer porosity (dimensionless)
H = length of well screen (ft)

The circle shown in the figure below represents the aquifer zone of transport in the subsurface as illustrated below.



Conceptual illustration of a zone of transport for a confined aquifer

Pumping rates were obtained from the permitted allocation in the water appropriation permit. A conservative estimate of porosity (n) of 25% was used for each of the aquifers based on published reports. The lengths of well screens (H) were obtained from well completion reports. In the instance that a well had multiple screens, the sum of the individual screen lengths was used. The circles represent the aquifer zone of transport in the subsurface as illustrated above.

Using these parameters the radius was calculated with the above equation for the WHPA delineation for three of the water systems (Table 3). Of these three, the calculated distance for two of the water systems was less than 600 feet. In both of these cases, a default radius of 600 feet was used.

POTENTIAL SOURCES OF CONTAMINATION

Potential sources of contamination are classified into two types. The first type is point source contamination. Some examples of point source contamination are leaking underground storage tanks, landfills, ground water discharge permits, feed lots, large scale feeding operations, and known ground water contamination sites. These sites are generally associated with commercial or industrial facilities that use chemical substances that may, if inappropriately handled, contaminate ground water via a discrete point location. The second type of potential sources of contamination is non-point sources. Non-point sources are associated with certain land use practices such as pesticide and herbicide applications, land application of sludge or animal wastes, and row-crop farming, all of which may lead to ground water contamination over a large are. On-site septic systems are often referred to as non-point pollution as they are very common in areas not served by public sewerage collections systems.

In confined aquifer settings, sources of contamination at the land surface are generally not a threat unless there is a pathway for direct injection into the deeper aquifer such as unused wells or along well casing that are not intact or have no grout seal. Wells that are not being used or maintained will eventually corrode and provide a pathway for contaminants present in the shallow aquifers at higher-pressure heads to migrate to the deeper aquifers.

Eight of the 24 water systems drawing water from confined aquifers had potential point sources of contamination located within their WHPAs. At these eight systems the potential point sources of contamination are underground storage tanks (USTs). The location information for these sources was obtained from an existing database and was not field verified. 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 located near the potential sources of contamination.

WATER QUALTIY DATA

Water quality data was reviewed from the Water Supply Program's (WSP) 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 a monitoring result is greater than 50% of the MCL, 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 4 summarizes the various treatment methods used at the water treatment plants for each of the 24 non-transient water systems.

A review of the monitoring data was conducted for each non-transient non-community water system. A summary of the water quality sampling results exceeding 50% of the Maximum Contaminant Level (MCL) is shown in Table 5. More detailed water quality sampling results are contained in Appendix A at the end of the report.

Inorganic Compounds (IOCs)

A review of the available data shows that arsenic and antimony were the only IOCs reported at or above 50% of their respective MCLs (Table 6). Only one system reported an antimony sample value greater than 50% of the MCL. All subsequent samples (8) from this system were reported as non-detect, therefore this one sample result is not credible and believed to be a data entry error. Fifteen water systems detected arsenic at levels equal to or greater than 50% of the MCL of 10 parts per billion (ppb). The arsenic standard was recently lowered from 50 ppb to 10 ppb by the USEPA. All of the fifteen systems with arsenic levels at least 50% of the MCL use the Aquia aquifer. Of the fifteen, seven systems have reported at least one sample greater than the MCL. None of the eight systems using the Piney Point formation had arsenic levels above 5 ppb.

Arsenic is present in ground water in Maryland's Coastal Plain due to the natural presence of this contaminant in aquifer material. All fifteen systems reporting arsenic above 5 ppb mainly draw water from the Aquia aquifer. A recent study of arsenic concentrations in the major aquifers of the Coastal Plain indicates that arsenic is present at the highest concentrations in the Aquia aquifer on the Eastern Shore of Maryland (MGS, 2003). However, levels above 10 ppb are common in the Aquia in Southern Maryland as shown both in the MGS study and the monitoring data in this report.

Synthetic Organic Compounds (SOCs)

No SOCs were detected above the 50% threshold at any of the 24 non-transient non-community water systems.

Volatile Organic Compounds (VOCs)

No VOCs were detected at levels above 50% of the MCL at 23 of the 24 non-transient non-community water systems. One system, Margaret Brent Middle School had a single detect of vinyl chloride on December 20, 2004 at 1.2 ppb, which exceeds 50% of the MCL (2 ppb) for the parameter.

Microbiological Contaminants

Raw water testing is not required for any of the non-transient non-community water systems in Calvert County, since the wells draw water from confined aquifers that are considered not at risk to surface water influence.

All of the non-transient non-community systems have quarterly routine bacteriological samples that are collected as required by the Safe Drinking Water Act. Since less than 50% of the water systems disinfect their water, the finished water data may be indicative 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. Four of the 24 water systems have had positive total coliform results in at least one sample, between August 1997 and August 2004. Additional sampling and/or repeat sampling at these four systems have shown that the contamination seems to have been addressed.

Total coliform bacteria are ubiquitous in the environment and detection could be a result of a variety of deficiencies in the water system or an indicator of poor well integrity. Loose caps or insufficient seals are common causes of coliform contamination since insects are able to crawl in the wellhead. Many of these situations are easily remedied.

SUSCEPTIBILITY ANALYSIS

Wells serving the St. Mary's County non-transient water systems all draw water from wells in the unconsolidated sedimentary aquifers. All 24 non-transient non-community water systems reviewed in this report have wells that are in confined aquifers. Confined

aquifers are naturally protected from land use activities at the ground surface due to the confining layers that provide a barrier for water movement from the surface into the aquifers below. This protection can be jeopardized by poorly constructed wells, wells out of use that penetrate the aquifer, or underground injection wells drilled into the aquifer.

Some contaminants like 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 at the land surface.

Confined aquifers are recharged very slowly from the water stored in the confining unit above and from precipitation that infiltrates into the formation where it reaches the ground surface. Generally, water stored in confined aquifers has traveled great distances from it origin at the ground surface. Likewise, the travel time of a contaminant through the very low permeability confining layers above the confined aquifers would take thousands of years.

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 7.

The susceptibility analysis of each system was based on current conditions and sample results. If changes occur within the WHPA or sample results for a system change, the system's susceptibility could change. Some common changes that may occur resulting in changes to a well's susceptibility are land use changes within the WHPA, an underground storage tank starts to leak, the well becomes damaged, or changes in uses of local wells completed in the same aquifer.

Inorganic Compound (IOCs)

The source of inorganic compounds can be either the aquifer material or from human activity. Due to the confined nature of the aquifers, these contaminants are unlikely to originate from the land surface. In addition, the arsenic levels are reported for both aquifers are consistent with naturally occurring levels measured in studies on the occurrence of arsenic in the State.

Arsenic is present in 15 of the non-transient non-community water systems in Calvert County at levels above 50% of the MCL. The source of the arsenic in these water supplies is the natural occurrence and mobility of this contaminant in the aquifer material. A recent study of the occurrence of arsenic in Coastal Plain aquifers indicates that the Aquia and Piney Point/Nanjemoy aquifer systems have ground water arsenic concentrations that range between non-detectable and 11 ppb in St. Mary's County (MGS, 2003). The data has not been fully interpreted, but it does not seem to be related to any geochemical indices such as pH or specific conductance. The concentration of arsenic in ground water of these aquifers may simply be

dependent on the amount of arsenic in the aquifer at certain locations. Due to the presence and levels of arsenic in the Aquia and Piney Point/Nanjemoy aquifers, many water supplies drawing from these aquifers **are susceptible** to this contaminant. Since arsenic levels are variable within each aquifer, the susceptibility determination is based on the actual levels measured for each water system.

The remaining water systems that did not detect arsenic at levels exceeding 50% of the MCL are determined **not susceptible** to arsenic if they had enough samples results to verify that arsenic levels are consistently below 5 ppb. The 24 non-transient non-community systems **are not susceptible** to other inorganic compounds.

Synthetic Organic Compounds (SOCs)

No SOCs were detected above the 50% threshold at any of the 24 non-transient non-community water systems.

Based on the above analysis, the water supply drawn from confined aquifers for the 24 non-transient non-community water systems **are not susceptible** to SOC contamination.

Volatile Organic Compounds (VOCs)

No VOCs were detected above the 50% threshold at 23 of the 24 non-transient non-community water systems. At the other system, Margaret Brent Middle School, vinyl chloride was detected on December 20, 1994 at 1.2 ppb, which exceeds 50% of the MCL (2 ppb) for the parameter. Testing for vinyl chloride before and after this date has been negative. It appears that the detection may have been analytical error.

Due to the naturally protected characteristics of the confined aquifers, the water quality data, and the lack of potential sources of contamination in the aquifers, the water supply drawn from confined aquifers for the 24 non-transient non-community water systems **are not susceptible** to VOC contamination.

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. Twelve systems did have positive total coliform in their routine sample collection, however, they did not occur at a significant rate to warrant further investigation. These are likely to be the result of water system distribution or well construction deficiencies and are unlikely to be representative of the water quality of the aquifer. In these instances the wellheads should be inspected and any obvious deficiencies remedied. Due to the confined nature of the aquifers the water supplies **are not susceptible** to microbiological contaminants.

SUMMARY AND RECOMMENDATIONS FOR PROTECTING WATER SUPPLIES

With the information contained in this report, the individual non-transient systems in St. Mary's 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. The following recommendations are intended for individual water systems.

Monitoring

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

Arsenic

Those whose arsenic concentrations exceed the new lower standard of 0.010 ppm should consider locating water in a different aquifer with acceptable water quality, where possible.

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 Inspection/Maintenance

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. All unused wells must be abandoned and seal as per State well construction regulations.

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.

Wells drilled prior to 1973 that do not meet current construction standards should be upgraded to protect them from contamination associated with poor or outdated construction.

Two-piece insect-proof well caps should be installed onto wells that have one-piece caps.

Changes in Use

The system is required to notify the MDE Water Supply Program if new wells are to be added or an increase in water usage is proposed. An increase in use or the addition of new wells may require revisions to the WHPA.

References

Maryland Association of Counties, Directory of County Officials - 2005/2006, 53 pp.

Maryland Department of the Environment (MDE), Water Supply Program, 1999, Maryland's Source Water Assessment Plan.

Maryland Department of Natural Resources (DNR), 1987, The Quantity and Natural Quality of Ground Water in Maryland: DNR Water Resources Administration.

Maryland Geological Survey Report of Investigations No. 38, 1983, by Chapelle, F.H. and D.D. Drummond, Hydrogeology, Digital Simulation, and Geochemistry of the Aquia and Piney Point-Nanjemoy Aquifer System in Southern Maryland, 100 pp.

Maryland Geological Survey Interim Report, 2003, Summary of Ground-Water Arsenic Concentrations in Major Aquifers of the Maryland Coastal Plain, 23 pp.

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

Other Sources of Data

Water Appropriation and User Permits
MDE Water Supply Program (PDWIS) Database
MDE Waste Management Sites Database
2005 AEexpress Photo Index
Department of Natural Resources Digital Orthophoto Quarter Quadrangles
USGS Topographic 7.5-Minute Quadrangles
ADC Maps of St. Mary's County
SpecPrint Tax Maps of St. Mary's County
Maryland Department of Assessments and Taxation Real Property Database

TABLES

Table 1. Population Served by Calvert County Non-Transient Non-Community Water Systems		
PWSID	**System Name**	**Population Served**
1180001	BANNEKER ELEMENTARY SCHOOL	400
1180006	CHOPTICON HIGH SCHOOL	1700
1180008	CREATIVE BEGINNINGS PRE-SCHOOL & DAYCARE	100
1180010	DYNARD ELEMENTARY SCHOOL	450
1180019	HOLLYWOOD ELEMENTARY SCHOOL	600
1180020	HOLY ANGEL SACRED HEART SCHOOL	171
1180024	LEONARDTOWN HIGH SCHOOL	1750
1180026	LEONARDTOWN MIDDLE SCHOOL AND FORREST TECHNICAL CENTER	1200
1180027	LETTIE MARSHALL DENT ELEMENTARY SCHOOL	650
1180028	LITTLE FLOWER SCHOOL	380
1180031	LOVEVILLE SCHOOL	100
1180032	MARGARET BRENT MIDDLE SCHOOL	900
1180035	MECHANICSVILLE ELEMENTARY SCHOOL	350
1180036	MOTHER CATHERINE SPALDING SCHOOL	250
1180037	OAKVILLE ELEMENTARY SCHOOL	475
1180040	PINEY POINT ELEMENTARY SCHOOL	500
1180044	RIDGE ELEMENTARY SCHOOL	300
1180049	SPRING RIDGE MIDDLE SCHOOL	850
1180051	ST. JOHNS SCHOOL	240
1180052	ST. MARY'S CENTER FOR LIFE ENRICHMENT	70
1180053	ST. MICHAELS SCHOOL	200
1180056	WHITE MARSH ELEMENTARY SCHOOL	325
1180062	TAKE-IT-EASY CAMPGROUND	100
1180070	BAY MONTESSORI SCHOOL	100

Table 2. Well Information for the St. Mary's County Non-Transient Non-Community Water Systems

PWSID	System Name	Plant ID	Source ID	Well Tag ID	Well Depth	Casing Depth	Completion Date	Hydro Unit	Aquifer	Aquifer Type	Ground Water Appropriation	Avg GPD
1180001	BANNEKER ELEMENTARY SCHOOL	01	01	SM943913	555	500	6/20/2002	125B	AQUIA FORMATION	C	SM1981G003	5,000
1180006	CHOPTICON HIGH SCHOOL	01	01	SM941371	475	415	4/7/1998	125B	AQUIA FORMATION	C	SM1997G002	20,300
1180008	CREATIVE BEGINNINGS PRE-SCHOOL & DAYCARE	01	01	SM812016	365	290	4/14/1986	124E	PINEY POINT FORMATION	C	SM1986G005	900
		02	02	SM812320	415	305	1/7/1987					
1180010	DYNARD ELEMENTARY SCHOOL	01	01	SM882277	440	420	1/29/1993	125B	AQUIA FORMATION	C	SM2000G006	3,000
1180019	HOLLYWOOD ELEMENTARY SCHOOL	01	01	SM943488	590	540	12/29/2000	125B	AQUIA FORMATION	C	SM1991G027	5,000
1180020	HOLY ANGEL SACRED HEART SCHOOL	01	01	SM733186	360	160	9/26/1978	125B	AQUIA FORMATION	C	SM1978G013	2,000
			02	SM951323	FUTURE WELL - NOT IN SERVICE AS OF THIS REPORT							
		02	03	SM950768	340	320	5/20/2005					
1180024	LEONARDTOWN HIGH SCHOOL	01	01	SM942700	575	520	7/1/2000	125B	AQUIA FORMATION	C	SM1967G009	30,000
1180026	LEONARDTOWN MIDDLE SCHOOL AND FORREST TECHNICAL CENTER	01	01	SM944197	565	525	4/12/2002	125B	AQUIA FORMATION	C	SM1967G009	30,000
1180027	LETTIE MARSHALL DENT ELEMENTARY SCHOOL	01	01	SM733604	471	460	12/12/1980	125B	AQUIA FORMATION	C	SM1979G007	5,000
1180028	LITTLE FLOWER SCHOOL	01	01	SM007732	320	312	5/18/1951	124E	PINEY POINT FORMATION	C	SM2006G005	1,500
			02	SM023113	380	366	6/12/1956					
1180031	LOVEVILLE SCHOOL	01	01	SM950324	465	440	9/4/2004	125B	AQUIA FORMATION	C	SM1981G003	5,000
1180032	MARGARET BRENT MIDDLE SCHOOL	01	01	SM945575	557	462	10/9/2003	125B	AQUIA FORMATION	C	SM2002G004	5,000
1180035	MECHANICSVILLE ELEMENTARY SCHOOL	01	01	SM950325	506	480	9/11/2004	125B	AQUIA FORMATION	C	SM2004G010	2,100
1180036	MOTHER CATHERINE SPALDING SCHOOL	01	01	SM053184	455	438	8/30/1963	125B	AQUIA FORMATION	C	SM1963G003	3,100
1180037	OAKVILLE ELEMENTARY SCHOOL	01	01	SM670152	340	315	12/3/1966	124E	PINEY POINT FORMATION	C	SM1967G006	5,400
1180040	PINEY POINT ELEMENTARY SCHOOL	01	01	SM940997	461	400	10/24/1997	125B	AQUIA FORMATION	C	SM1997G009	6,600
1180044	RIDGE ELEMENTARY SCHOOL	01	01	SM024505	386	377	9/12/1956	124E	PINEY POINT FORMATION	C	SM2006G002	2,000
1180049	SPRING RIDGE MIDDLE SCHOOL	01	01	SM950452	427	400	10/29/2004	124E	PINEY POINT FORMATION	C	SM1973G010	3,000
1180051	ST. JOHNS SCHOOL	01	01	SM733504	378	270	9/1/1979	124E	PINEY POINT FORMATION	C	SM1979G023	5,000
1180052	ST. MARY'S CENTER FOR LIFE ENRICHMENT	01	01	SM920352	607	420	4/11/1994	125B	AQUIA FORMATION	C	SM1975G013	2,000
1180053	ST. MICHAELS SCHOOL	01	01	SM006252	417	411	10/6/1950	124E	PINEY POINT FORMATION	C	SM2006G006	1,300
1180056	WHITE MARSH ELEMENTARY SCHOOL	01	01	SM940990	560	520	9/27/1997	125B	AQUIA FORMATION	C	SM1997G018	3,200
1180062	TAKE-IT-EASY CAMPGROUND	01	01	SM930274	595	465	3/6/1995	125B	AQUIA FORMATION	C	SM1990G032	2,200
1180070	BAY MONTESSORI SCHOOL	01	01	NO TAG				124E	PINEY POINT FORMATION	C	SM1997G021	800

Table 3. Parameters Used for the Wellhead Protection Area Delineations for Systems Using >10,000 gpd

PWSID	System Name	Source ID	Avg GPD	Well pumpage (Q) in ft^3/yr	Screened interval in feet (H)	Aquifer	Calculated radius for WHPA in feet (r)	Acreage of WHPA	Comments on WHPA
1180006	CHOPTICON HIGH SCHOOL	01	20300	989880	35	AQUIA	600	26	
1180024	LEONARDTWON HIGH SCHOOL	01	30000*	735840	50	AQUIA	433	14	r = 600 ft used *(Q split between the two wells)
1180026	LEONARDTOWN MIDDLE SCHOOL AND FORREST TECHNICAL CENTER	01	30000*	735840	40	AQUIA	484	18	

Table 4. St. Mary's County Non-Transient Non-Community Water Systems Treatment Methods				
PWSID	**System Name**	**Plant ID**	**Treatment Method**	**Reason for Treatment**
1180001	BANNEKER ELEMENTARY SCHOOL	1	NO TREATMENT	
1180006	CHOPTICON HIGH SCHOOL	1	NO TREATMENT	
1180008	CREATIVE BEGINNINGS PRE-SCHOOL & DAYCARE	1	NO TREATMENT	
		2	NO TREATMENT	
1180010	DYNARD ELEMENTARY SCHOOL	1	NO TREATMENT	
1180019	HOLLYWOOD ELEMENTARY SCHOOL	1	NO TREATMENT	
1180020	HOLY ANGEL-SACRED HEART SCHOOL	1	NO TREATMENT	
1180024	LEONARDTOWN HIGH SCHOOL	1	NO TREATMENT	
1180026	LEONARDTOWN MIDDLE & FORREST TECH CENTER	1	NO TREATMENT	
1180027	LETTIE MARSHALL DENT ELEMENTARY	1	NO TREATMENT	
1180028	LITTLE FLOWER SCHOOL	1	HYPOCHLORINATION, POST	DISINFECTION
1180031	LOVEVILLE SCHOOL	1	NO TREATMENT	
1180032	MARGARET BRENT MIDDLE SCHOOL	1	NO TREATMENT	
1180035	MECHANICSVILLE ELEMENTARY	1	NO TREATMENT	
1180036	MOTHER CATHERINE SPALDING SCHOOL	1	NO TREATMENT	
1180037	OAKVILLE ELEMENTARY SCHOOL	1	NO TREATMENT	
1180040	PINEY POINT ELEMENTARY SCHOOL	1	NO TREATMENT	
1180044	RIDGE ELEMENTARY SCHOOL	1	NO TREATMENT	
1180049	SPRING RIDGE MIDDLE SCHOOL	1	NO TREATMENT	
1180051	ST. JOHNS SCHOOL	1	NO TREATMENT	
1180052	ST. MARYS CO. CENTER FOR LIFE ENRICHMENT	1	NO TREATMENT	
1180053	ST. MICHAELS SCHOOL	1	NO TREATMENT	
1180056	WHITE MARSH ELEMENTARY SCHOOL	1	NO TREATMENT	
1180062	TAKE-IT-EASY CAMPGROUND RETREAT	1	HYPOCHLORINATION, POST	DISINFECTION
1180070	BAY MONTESSORI SCHOOL	1	NO TREATMENT	

Table 5 . Summary of Water Quality Samples for St. Mary's County Non-Transient Non-Community Water Systems.

PWSID	PWS_NAME	PLANT ID	IOCs		SOCs		VOCs	
			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
1180001	BANNEKER ELEMENTARY SCHOOL	1	18	1	-	-	4	-
1180006	CHOPTICON HIGH SCHOOL	1	17	3	-	-	4	-
1180008	CREATIVE BEGINNINGS PRE-SCHOOL & DAY CARE	1	19	-	1	-	6	-
		2	2	-	1		5	-
1180010	DYNARD ELEMENTARY SCHOOL	1	18	9	-	-	4	-
1180019	HOLLYWOOD ELEMENTARY SCHOOL	1	17	9	-	-	4	-
1180020	HOLY ANGEL SACRED HEART SCHOOL AND CHURCH	1	15	2	-	-	4	-
1180024	LEONARDTOWN HIGH SCHOOL	1	18	7	-	-	4	-
1180026	LEONARDTOWN MIDDLE SCHOOL AND FORREST TECHNICAL CENTER	1	15	6	-	-	4	-
1180027	LETTIE DENT MARSHALL ELEMENTARY SCHOOL	1	18	3	-	-	4	-
1180028	LITTLE FLOWER SCHOOL	1	18	-	-	-	7	-
1180031	LOVEVILLE SCHOOL	1	18	3	-	-	5	-
1180032	MARGARET BRENT MIDDLE SCHOOL	1	18	4	-	-	6	1
1180035	MECHANICSVILLE ELEMENTARY SCHOOL	1	18	1	-	-	5	-
1180036	MOTHER CATHERINE SPALDING SCHOOL	1	18	2	-	-	7	-
1180037	OAKVILLE ELEMENTARY SCHOOL	1	16	-	-	-	4	-
1180040	PINEY POINT ELEMENTARY SCHOOL	1	16	1	-	-	4	-
1180044	RIDGE ELEMENTARY SCHOOL	1	16	-	-	-	4	-
1180049	SPRING RIDGE MIDDLE SCHOOL	1	19	-	-	-	4	-
1180051	ST. JOHNS SCHOOL	1	17	-	-	-	8	-
1180052	ST. MARY'S COUNTY CENTER FOR LIFE ENRICHMENT	1	23	11	2	-	4	-
1180053	ST. MICHAELS SCHOOL	1	14	-	-	-	7	-
1180056	WHITE MARSH ELEMENTARY SCHOOL	1	18	-	-	-	4	-
1180062	TAKE-IT-EASY CAMPGROUND	1	15	1	-	-	4	-
1180070	BAY MONTESSORI SCHOOL	1	10	-	1	-	8	-

Table 6. Regulated Inorganic Compounds (IOCs) Exceeding 50% of the MCL

PWSID	System Name	PL	Contaminant Name	MCL*	Sample Date	Result*
1180001	BANNEKER ELEMENTARY SCHOOL	1	ARSENIC	0.01	16-Dec-03	0.009
1180006	CHOPTICON HIGH SCHOOL	1	ARSENIC	0.01	10-Dec-01	0.008
					15-Sep-04	0.0099
					16-Dec-04	0.008
1180010	DYNARD ELEMENTARY SCHOOL	1	ARSENIC	0.01	17-Sep-98	0.012
					10-Dec-01	0.011
					15-Sep-04	0.014
					16-Dec-04	0.011
					25-Feb-05	0.0114
					25-Feb-05	0.0114
					20-May-05	0.0097
					6-Jul-05	0.012
					3-Oct-05	0.011
1180019	HOLLYWOOD ELEMENTARY SCHOOL	1	ARSENIC	0.01	10-Nov-98	0.01
					12-Dec-01	0.014
					15-Sep-04	0.015
					16-Dec-04	0.13
					14-Jan-05	0.0124
					23-Feb-05	0.0124
					25-May-05	0.0143
					6-Jul-05	0.0119
					3-Oct-05	0.014
1180020	HOLY ANGEL-SACRED HEART SCHOOL	1	ARSENIC	0.01	6-Nov-00	0.014
					16-Dec-04	0.005
1180024	LEONARDTOWN HIGH SCHOOL	1	ARSENIC	0.01	12-Dec-01	0.014
					5-Apr-04	0.012
					15-Sep-04	0.013
					14-Jan-05	0.014
					11-Apr-05	0.013
					6-Jul-05	0.0125
					3-Oct-05	0.0131
1180026	LEONARDTOWN MIDDLE & FORREST TECH CENTER	1	ARSENIC	0.01	12-Dec-01	0.013
					5-Apr-04	0.01
					15-Sep-04	0.01
					14-Jan-05	0.0096
					6-Jul-05	0.0106
					3-Oct-05	0.0109
1180027	LETTIE MARSHALL DENT ELEMENTARY	1	ARSENIC	0.01	11-Dec-01	0.005
					15-Sep-04	0.0058
					20-Dec-04	0.005
1180031	LOVEVILLE SCHOOL	1	ARSENIC	0.01	10-Dec-01	0.01
					13-Sep-04	0.0098
					20-Dec-04	0.011
1180032	MARGARET BRENT MIDDLE SCHOOL	1	ARSENIC	0.01	19-Dec-01	0.008
					15-Sep-04	0.0085
					6-Dec-04	0.0069
					20-Dec-04	0.007
1180035	MECHANICSVILLE ELEMENTARY	1	ARSENIC	0.01	15-Sep-04	0.0055

PWSID	System Name	PL	Contaminant Name	MCL*	Sample Date	Result*
1180036	MOTHER CATHERINE SPALDING SCHOOL	1	ARSENIC	0.01	19-Dec-01	0.008
					20-Dec-04	0.008
1180040	PINEY POINT ELEMENTARY SCHOOL	1	ARSENIC	0.01	9-Oct-97	0.007
1180052	ST. MARYS CO. CENTER FOR LIFE ENRICHMENT	1	ARSENIC	0.01	21-Apr-97	0.02
					13-May-97	0.014
					11-Sep-97	0.02
					20-Mar-00	0.016
					12-Dec-00	0.017
					3-Dec-03	0.014
					3-Dec-03	0.014
					16-Dec-03	0.013
					6-Apr-05	0.014
					15-Dec-05	0.014
			ANTIMONY	0.006	1-Dec-94	0.02 *
1180062	TAKE-IT-EASY CAMPGROUND RETREAT	1	ARSENIC	0.01	6-Jun-05	0.005

*All other results were below detection levels.

Table 7. Susceptibility Analysis Summary

PWSID	SYSTEM NAME	Is the Water System Susceptible to....				
		Inorganic Compounds (except arsenic)	Arsenic	Volatile Organic Compounds	Synthetic Organic Compounds	Microbiological Contaminants
1180001	BANNEKER ELEMENTARY SCHOOL	NO	YES	NO	NO	NO
1180006	CHOPTICON HIGH SCHOOL	NO	YES	NO	NO	NO
1180008	CREATIVE BEGINNINGS PRE-SCHOOL & DAYCARE	NO	NO	NO	NO	NO
1180010	DYNARD ELEMENTARY SCHOOL	NO	YES	NO	NO	NO
1180019	HOLLYWOOD ELEMENTARY SCHOOL	NO	YES	NO	NO	NO
1180020	HOLY ANGEL SACRED HEART SCHOOL	NO	MAYBE	NO	NO	NO
1180024	LEONARDTOWN HIGH SCHOOL	NO	YES	NO	NO	NO
1180026	LEONARDTOWN MIDDLE SCHOOL AND FORREST TECHNICAL CENTER	NO	YES	NO	NO	NO
1180027	LETTIE MARSHALL DENT ELEMENTARY SCHOOL	NO	MAYBE	NO	NO	NO
1180028	LITTLE FLOWER SCHOOL	NO	NO	NO	NO	NO
1180031	LOVEVILLE SCHOOL	NO	YES	NO	NO	NO
1180032	MARGARET BRENT MIDDLE SCHOOL	NO	YES	NO	NO	NO
1180035	MECHANICSVILLE ELEMENTARY SCHOOL	NO	MAYBE	NO	NO	NO
1180036	MOTHER CATHERINE SPALDING SCHOOL	NO	YES	NO	NO	NO
1180037	OAKVILLE ELEMENTARY SCHOOL	NO	NO	NO	NO	NO
1180040	PINEY POINT ELEMENTARY SCHOOL	NO	NO	NO	NO	NO
1180044	RIDGE ELEMENTARY SCHOOL	NO	NO	NO	NO	NO
1180049	SPRING RIDGE MIDDLE SCHOOL	NO	NO	NO	NO	NO
1180051	ST. JOHNS SCHOOL	NO	NO	NO	NO	NO
1180052	ST. MARY'S CENTER FOR LIFE ENRICHMENT	NO	YES	NO	NO	NO
1180053	ST. MICHAELS SCHOOL	NO	NO	NO	NO	NO
1180056	WHITE MARSH ELEMENTARY SCHOOL	NO	NO	NO	NO	NO
1180062	TAKE-IT-EASY CAMPGROUND	NO	MAYBE	NO	NO	NO
1180070	BAY MONTESSORI SCHOOL	NO	NO	NO	NO	NO

FIGURES

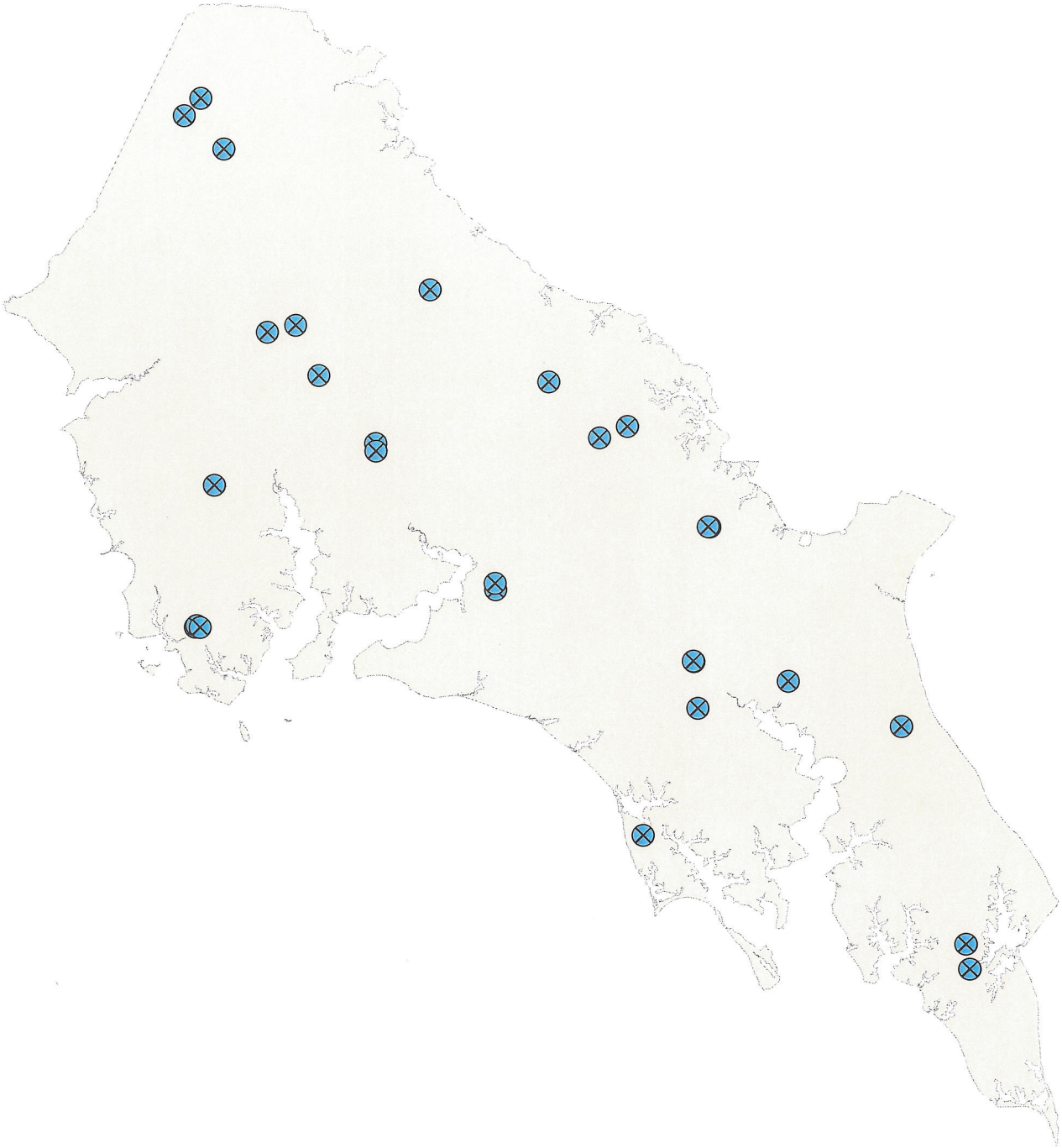


Figure 1. St. Mary's County Non-transient Non-community Water Systems

0 4,250 8,500 17,000 Meters

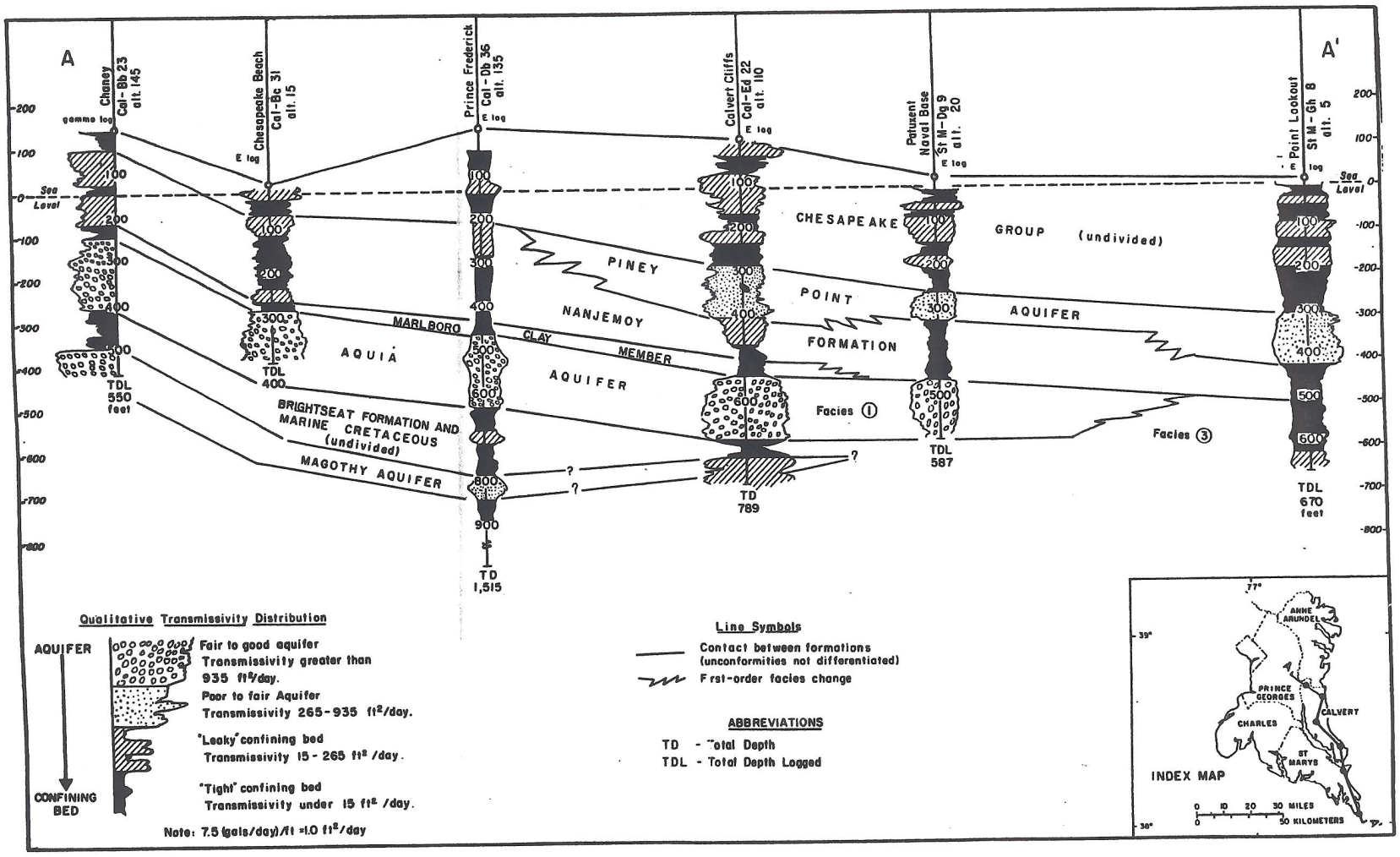


Figure 2 · Geologic Section from Northern Calvert County to Southern St. Mary's County (Kapple and Hansen, 1976)