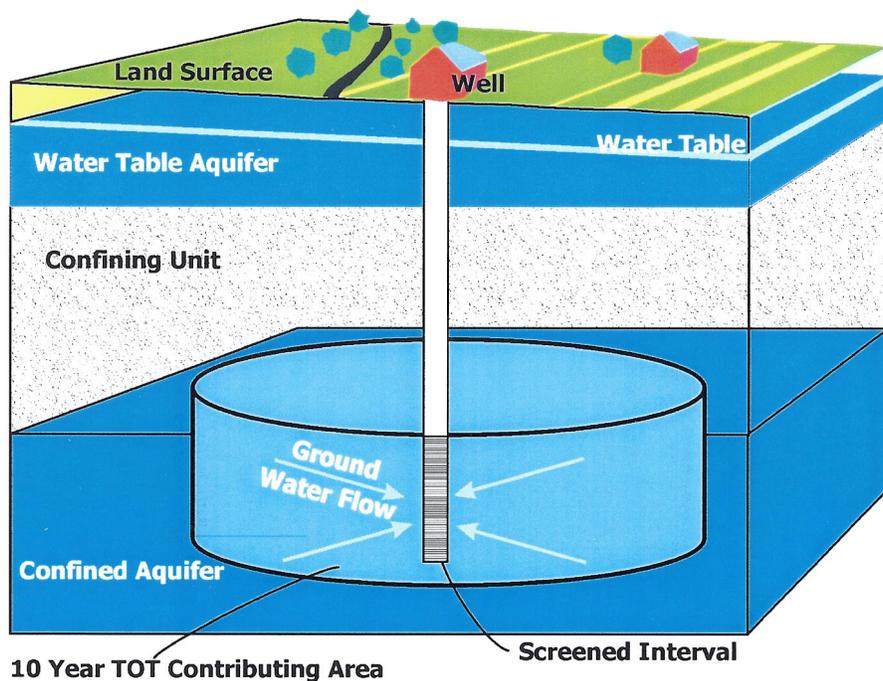


Source Water Assessment for Community Water Systems in Prince George's County, MD



Prepared By
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FINAL

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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted Source Water Assessments for seven community water systems in Prince George'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) a determination of the susceptibility of the water supply to contamination. Recommendations for protecting drinking water supplies conclude this report.

The water supply sources of the community water systems in Prince George's County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The seven community water systems included in this report are currently using twelve wells that draw from three different confined aquifers. The Source Water Assessment areas were delineated by the WSP using U.S. EPA approved methods specifically designed for water supplies in confined aquifers.

Potential 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 photography showing the 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 supplies are not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. Naturally occurring contaminants, such as Radon, may pose a risk to some of the water supplies.

EXECUTIVE SUMMARY CHELTENHAM BOYS VILLAGE

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted Source Water Assessments for seven community water systems in Prince George's County, including the Cheltenham Boys Village 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 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.

The source of Cheltenham Boys Village's water supply is the Magothy aquifer, a naturally protected confined aquifer of the Atlantic Coastal Plain physiographic province. The Cheltenham Boys Village water system currently uses two wells in the Magothy. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for water supplies in confined aquifers.

Potential sources of contamination were researched and identified within the assessment area from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. Maps and aerial photography showing the 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 Cheltenham Boys Village water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers.

EXECUTIVE SUMMARY

CALVERT MANOR CORPORATION

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted Source Water Assessments for seven community water systems in Prince George's County, including the Calvert Manor Corporation 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 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.

The source of Calvert Manor Corporation's water supply is the Patapsco aquifer, a naturally protected confined aquifer of the Atlantic Coastal Plain physiographic province. The Calvert Manor Corporation's water system currently uses two wells in the Patapsco. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for water supplies in confined aquifers.

Potential sources of contamination were researched and identified within the assessment area 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 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 Calvert Manor Corporation 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.

EXECUTIVE SUMMARY

MARLBORO MEADOWS WATER SYSTEM

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted Source Water Assessments for seven community water systems in Prince George's County, including the Marlboro Meadows 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 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.

The source of Marlboro Meadows' water supply is the Magothy aquifer, a naturally protected confined aquifer of the Atlantic Coastal Plain physiographic province. The Marlboro Meadows' water system currently uses two wells in the Magothy. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for water supplies in confined aquifers.

Potential sources of contamination were researched and identified within the assessment area from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. Maps and aerial photography showing the 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 Marlboro Meadows water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers.

EXECUTIVE SUMMARY

POTOMAC VISTA WATER SYSTEM

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted Source Water Assessments for seven community water systems in Prince George's County, including the Potomac Vista 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 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.

The source of Potomac Vista's water supply is the Patuxent aquifer, a naturally protected confined aquifer of the Atlantic Coastal Plain physiographic province. The Potomac Vista's water system currently uses two wells in the Patuxent. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for water supplies in confined aquifers.

Potential sources of contamination were researched and identified within the assessment area 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 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 Potomac Vista 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.

EXECUTIVE SUMMARY

EDGEMEADE SCHOOL RESIDENCE WATER SYSTEM

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted Source Water Assessments for seven community water systems in Prince George's County, including the Edgemeade School Residence 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 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.

The source of Edgemeade School Residence's water supply is the Magothy aquifer, a naturally protected confined aquifer of the Atlantic Coastal Plain physiographic province. The Edgemeade School Residence water system currently uses one well in the Magothy. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for water supplies in confined aquifers.

Potential sources of contamination were researched and identified within the assessment area from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. Maps and aerial photography showing the 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 Edgemeade School Residence water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers.

EXECUTIVE SUMMARY

CEDARVILLE MOBILE HOME PARK WATER SYSTEM

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted Source Water Assessments for seven community water systems in Prince George's County, including the Cedarville 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 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.

The source of Cedarville Mobile Home Park's water supply is the Patapsco aquifer, a naturally protected confined aquifer of the Atlantic Coastal Plain physiographic province. The Cedarville Mobile Home Park water system currently uses one well in the Patapsco, and has plans to replace a second well. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for water supplies in confined aquifers.

Potential sources of contamination were researched and identified within the assessment area from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. Maps and aerial photography showing the 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 Cedarville Mobile Home Park water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers.

EXECUTIVE SUMMARY

NORBOURNE MOBILE HOME PARK

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted Source Water Assessments for seven community water systems in Prince George's County, including the Norbourne 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 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.

The source of Norbourne Mobile Home Park's water supply is the Magothy aquifer, a naturally protected confined aquifer of the Atlantic Coastal Plain physiographic province. The Norbourne Mobile Home Park's water system currently uses one well in the Magothy. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for water supplies in confined aquifers.

Potential sources of contamination were researched and identified within the assessment area 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 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 Norbourne Mobile Home Park water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers.

INTRODUCTION

The Water Supply Program has conducted Source Water Assessments for seven community water systems in Prince George's County. Prince George's County makes up a large portion of the metropolitan Washington D.C. area, with a total population of 801,515 (U.S. Census, 2000), and the large majority of its residents are served by the Washington Suburban Sanitary Commission water utility. However, a few smaller community water systems exist, mostly in the southern half of the County, and provide approximately 5,000 residents with water. An additional 25,000 residents in Bowie are served by their City's water system. Because prior wellhead protection work has been completed, the City of Bowie water system is assessed in a separate report. In addition, there are approximately 14,000 residents in the rural outskirts of the county that use individual wells for their water supply. The seven community water systems assessed in this report include six privately owned and operated water systems and one State facility (Table 1). The locations of the community water systems are shown in Figure 1.

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. Amongst the seven community water systems included in this report, a total of twelve wells are currently used or are backup wells. Four of these wells were drilled after 1973 and should comply with Maryland's well construction regulations. The remaining eight wells were drilled prior to 1973, when regulations went into effect, and may not meet the current construction standards. Table 2 contains a summary of well information for each of the community water systems.

Based on site visits, most wells were in good condition and appeared to be regularly maintained, sealed, and protected to insure integrity. Some wells had a one-piece well cap, which may present a possible route of contamination (insects) through unscreened vents and electrical holes. This situation is easily remedied with the installation of a new two-piece sanitary well cap to prevent contamination. Another threat to wells observed during field inspections are unused wells in the same aquifer. Two water systems, Calvert Manor and Cedarville Mobile Home Park, have wells that are not in use and are in various stages of being replaced. These wells should be abandoned and sealed as soon as the replacement wells are completed so as not to present a source of contamination to the supply wells. 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.

HYDROGEOLOGY

Ground water flows through pores between gravel, sand, and silt grains in unconsolidated sedimentary aquifers such as those used by the community water systems in Prince George's 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 unit is a layer 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 and from precipitation that infiltrates into the formation where it is exposed at the surface. Due to the depth and areal extent of the unconsolidated sediments in Southern Maryland, water stored in these aquifers is very old and the water pumped from wells in these aquifers has generally traveled a good distance from its origin at the land surface.

Prince George's County lies within the Atlantic Coastal Plain physiographic province, which is characterized by low topography due to the underlying horizontal sedimentary layers. 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. In Prince George's County, the community water system wells draw water from three confined aquifer systems known as the Magothy, Patapsco, and Patuxent formations (Appendix, Table 2). These aquifers have been studied for their water supply potential and thus hydrologic, lithologic, and geochemical data is available in several Maryland Geological Survey Reports (1977, 1983, 1984, 1986, 1991, 1996, 2003). The descriptive material below is summarized from these reports and the reader is referred to them for further information.

The Magothy formation represents the largest water use by community water systems in Prince George's County due to its accessibility as the shallowest of the aquifers, its generally high transmissivity and good water quality. The Magothy formation outcrops on the north side of Bowie, but where it is utilized as an aquifer in Prince George's County, it is confined and the top of the formation ranges from 200 to 450 feet below sea level. The clays of the Matawan formation form the upper confining unit for the Magothy aquifer. The average thickness of the Magothy is reported as 100 feet and the thickness likely ranges from 100 to 200 feet in this area. The Magothy formation consists of white, lignitic sand interbedded with dark gray laminated silt and clay and this composition makes it readily distinguishable from the contiguous formations.

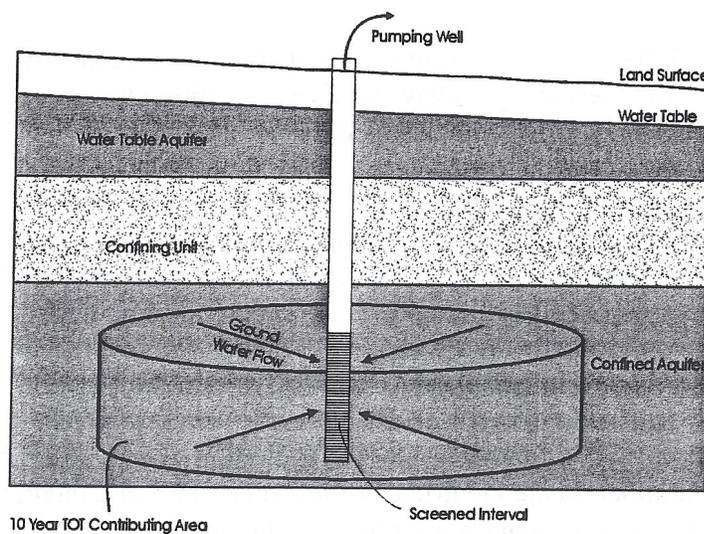
The Patapsco formation is utilized by two water systems in southern Prince George's County near the Charles County border. This aquifer provides a good alternative to the Magothy in areas where large users such as the Cheltenham Boys Village and the Town of Waldorf in Charles County stress that aquifer. The Patapsco is the uppermost formation of the Potomac group, which also consists of the Arundel and Patuxent formations and are the deepest of the unconsolidated sedimentary aquifers in

Maryland. The formations of the Potomac group are difficult to distinguish because of their similar composition and their lateral discontinuity. These formations consist of medium and fine sands and silts that were deposited in fluvial environments that shifted laterally, thus making the formations laterally inconsistent in lithology. This also makes it difficult to characterize the aquifer over a large area since sand content can vary considerably. Several sandy layers at different depths have been studied in the Chalk Point Area of Prince George's County and transmissivity values in these layers varied from 570 to 1,800 feet²/day.

The Patuxent formation is the deepest of the aquifers utilized in Prince George's County. Potomac Vista near the Potomac River outside of Washington D.C. is the only water system of those included in this report utilizing the Patuxent aquifer. In this area of the County this aquifer represents a good water supply, whereas to the south and east it is likely too deep to be a feasible source for most users. The Patpasco formation outcrops at the surface in this area and the Arundel Clay unit acts as the confining unit above the Patuxent aquifer. The aquifer is approximately 250 feet below land surface and approximately 200 feet thick at this location.

SOURCE WATER ASSESSMENT AREA DELINEATION

For ground water systems, a Wellhead Protection Area (WHPA) is considered the source water assessment area for the system. The WHPA's 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-year 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:



Conceptual illustration of a zone of transport for a confined aquifer

$$r = \sqrt{\frac{Qt}{\pi nH}}$$

where r = calculated fixed radius in feet (ft)
 t = time of travel in years (yr)
 Q = pumping rate of well (ft³/yr)
 n = aquifer porosity (dimensionless)
 H = length of well screen (ft)

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 multiples 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 Figure 2. The circles represent the aquifer zone of transport in the subsurface as illustrated above.

POTENTIAL SOURCES OF CONTAMINATION

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 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. 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. Non-point sources of contamination are associated with certain land use activities 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. Therefore, as long as there is no

potential for direct injection into the deeper confined aquifers, the water supply used by the community water systems should be well protected from ground water contamination.

Potential sources 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, as potential sources of contamination and their locations are shown in Figure 3. Underground storage tanks (UST's) sites are facilities that store petroleum on site in underground tanks registered with the MDE Waste Management Administration. Some of the facilities no longer use onsite petroleum storage, as noted in the Table 4, however they are still mapped for awareness of the former use. Controlled Hazardous Substance generators (CHS) are facilities that may use or store any hazardous substance on site. 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), Metals (M), Nitrate/Nitrite (NN), and Microbiological Pathogens (MP).

WATER QUALITY DATA

Water Quality data was reviewed from the Water Supply Program's database for Safe Drinking Water Act (SDWA) contaminants. 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 an 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. All data reported is from the finished (treated) water unless otherwise noted. Table 5 summarizes the various treatment methods used at the water treatment plants for each of the seven community water systems. Most of the water systems use treatment simply for disinfection, a reflection of the excellent water quality in these aquifers.

A review of the monitoring data for the seven community water systems indicates that the water supplies meet 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 nickel was detected above 50% of the previous MCL in Well 2 at the Cedarville Mobile Home Park (Table 7a). The contaminant was not detected above the 50% threshold level in subsequent samples. An MCL had been established for nickel at 0.1 mg/L, but has since been remanded and there is currently no MCL for this contaminant. Nickel comes from a variety of ores including sulfides and it is possible that there is some naturally occurring nickel in the Patapsco aquifer, although published values are not available. No other inorganic compounds were detected at a level of concern.

Radionuclides

Radon-222 was reported above 150 pCi/L in two water systems (Table 7b). 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 health effects of Radon at the levels in ground water are negligible compared to breathing Radon. However, since an MCL has not been determined, this report considers the lowest proposed MCL in an effort to be conservative. The EPA received many comments in response to their proposed rule, and promulgation may be delayed. Radon-222 was reported above 50% of the lower proposed MCL of 300 pCi/L but well below the higher proposed MCL of 4000 pCi/L.

Volatile Organic Compounds (VOCs)

A review of the data shows that VOCs have not been detected above 50% of an MCL.

Synthetic Organic Compounds (SOCs)

A review of the data shows that SOC's have not been detected above 50% of an MCL and confined aquifer waivers have been issued for these water systems which allows for the minimum sampling frequency of these contaminants.

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 all 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. Three water systems had positive Total Coliform in their routine bacteriological samples (Table 8), but in no instance were follow-up samples found to have positive Total or Fecal Coliform present.

SUSCEPTIBILITY ANALYSIS

The wells serving the community water systems in Prince George's County draw 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 confined 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 could 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.

Some contaminants such as radionuclides and other chemical elements 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. Water supplies in the Magothy and Patuxent aquifers have shown elevated Radionuclides, although levels are much less significant in Prince George's County than other parts of the State. Iron can also be present in these aquifers, although it does not pose a health risk it is considered a "Taste and Odor" nuisance, and in some instances requires treatment.

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

The only inorganic compound detected at a significant level was nickel as described above. However, the presence of this contaminant was not consistent and the cause of the elevated level was unclear. The source of inorganic compounds can be either the aquifer material, stainless steel water system components, or from human activity. Sources of nickel could be naturally occurring or from human activity. In addition, there is currently no MCL for nickel and thus the risk this contaminant presents to the water supply is minimal.

Due to the naturally protected characteristics of the confined aquifers, the water quality data, and the lack of potential sources of contamination, the water supplies are considered **not susceptible** to inorganic compounds.

Radionuclides

The source of radionuclides 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 a program to address the more significant risk from radon in indoor air. Radon is present in two water systems at a level that is greater than 50% of the lower proposed MCL of 300 pCi/L. The EPA has information on proposed regulations for radon in indoor air and drinking water on their web site (<http://www.epa.gov/OGWDW/radon.html>). Currently, it appears that these two water systems may be susceptible to radon if the lower standard is adopted.

Other radionuclides were not detected at significant levels. Based on the water quality data, the community water systems are **not susceptible** to radiological contaminants other than Radon-222.

Volatile Organic Compounds

Volatile organic compounds have not been detected in the routine samples collected for the water systems. Several potential sources for these types of contaminants were identified in the Wellhead Protection Areas, mostly in the form of gasoline or heating oil storage. However, as long as there is no potential for direct injection into the aquifer, the water supplies should **not** be susceptible to VOC contamination.

Synthetic Organic Compounds

Synthetic organic compounds have not been detected in the water supplies and a confined aquifer waiver has been issued for each water system for monitoring for these contaminants. SOC sources are generally pesticides and herbicides application and due to the confined nature of the aquifers, they do not pose a threat to the water supply. Therefore based on lack of contaminant sources and water quality data, the water supplies are considered **not** susceptible to SOCs.

Microbiological Contaminants

Raw water microbiological monitoring is not required of water systems in confined aquifers because they are considered naturally protected from sources of pathogens at the land surface. Therefore, the water supplies are considered **not** susceptible to microbiological contaminants.

MANAGEMENT OF THE SOURCE WATER ASSESSMENT AREA

The information contained in this report can assist local governments and the community water systems in Prince George's County to protect their water supplies. The protection provided by the confined aquifer system is substantial, but an effective countywide program could address issues that would ensure the long-term protection of these aquifers. Specific management recommendations for consideration are listed below:

Form a Local Planning Team

- The team should represent all the interests in the community, such as the water suppliers, home association officers, the County Health Department, local planning agencies, local business, developers, and property owners, and residents within and near the WHPA. The team should work to reach a consensus on how to protect the water supply.

Aquifer Recharge Areas

- The confined aquifers used by the water systems in this report outcrop to some extent within the County. Mapping the outcrop areas will provide additional information on the source of water supply and the potential for contamination of these aquifers in the long term.
- The time of travel from aquifer recharge areas to water supply wells is considerable, however it the time scale can range significantly based on distance from the recharge area and other aquifer properties. Age dating the water supplies using Tritium isotopes could provide valuable information to elucidate the time of travel from recharge areas.

Public Awareness and Outreach

- The Consumer Confidence Report should list that this report is available to the general public through their county library, by contacting the operator or MDE.
- Conduct educational outreach to businesses and residents within the WHPA focusing on potential contaminant sources. Important topics include: (a) compliance with MDE and federal guidelines for gasoline and heating oil UST's, (c) hazardous material disposal and storage, (d) well abandonment regulations and procedures.

Monitoring

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

Contingency Plan

- COMAR 26.04.01.22 requires all community water systems to prepare and submit for approval a plan for providing a safe and adequate drinking water supply under emergency conditions.

Contaminant Source Inventory Updates/ Inspections/Maintenance

- Conduct a survey of the WHPA and inventory any potential sources of contamination, including unused wells that may have not 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.
- Work with the County Health Department to ensure that there are no unused wells within the wellhead protection areas. 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.

Changes in Use

- An increase in use or the addition of new wells may require revisions to the WHPA. The water system is required to notify MDE if such changes are proposed.
- The Cedarville Mobile Home Park and the Calvert Manor Corporation have unused wells that are in the process of being replaced. As soon as new wells are placed into service, the old wells must be abandoned and sealed by a licensed well driller and in accordance with well construction regulations to ensure protection of the aquifers.

REFERENCES

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- Maryland Geological Survey Report of Investigations No. 60, 1996, by Bolton, D.W., *Network Description and Initial Water-Quality Data from a Statewide Ground-Water-Quality Network in Maryland*, 167 pp.
- Maryland Geological Survey Interim Report, 2003, *Summary of Ground-Water Arsenic Concentrations in the Major Aquifers of the Maryland Coastal Plain.*, 23 pp.
- MDE, Water Supply Program, 1999, *Maryland's Source Water Assessment Plan*, 36 pp.
- 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 pp.

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 in Prince
George's County**

USGS Topographic 7.5 Minute Quadrangles in Prince George's County

Maryland Office of Planning 2000 Prince George's County Digital Land Use Map

Maryland Office of Planning 1996 Prince George's County Digital Sewer Map

TABLES

PUBLIC WATER SYSTEM ID (PWSID)	SYSTEM NAME	POPULATION SERVED	OWNER/OPERATOR TYPE
0160003	CHELTENHAM BOYS VILLAGE	330	STATE GOVERNMENT
0160004	CALVERT MANOR CORPORATION	300	INVESTOR/TRUST/WATER ASSOCIATION
0160006	MARLBORO MEADOWS	3173	INVESTOR/TRUST/WATER ASSOCIATION
0160009	POTOMAC VISTA	150	INVESTOR/TRUST/WATER ASSOCIATION
0160203	EDGEMEADE SCHOOL RESIDENCE	110	INVESTOR/TRUST/WATER ASSOCIATION
0160207	CEDARVILLE M.H.P.	780	INVESTOR/TRUST/WATER ASSOCIATION
0160209	NORBOURNE M.H.P.	120	INVESTOR/TRUST/WATER ASSOCIATION

Table 1. Community Water Systems in Prince George's County

PWSID	SYSTEM NAME	PLANT ID	SOURCE ID	USE CODE	WELL NAME	WELL PERMIT NO.	WELL DEPTH	CASING DEPTH	SCREENED DEPTH(S)	YEAR DRILLED	AQUIFER
0160003	CHELTENHAM BOYS VILLAGE	01	01	P	WELL 1	PG024111	438	388	388-399, 411-438	1956	MAGOTHY FORMATION
			02	P	WELL 2	PG731183	431	376	376-381, 393-398, 416-426	1980	MAGOTHY FORMATION
0160004	CALVERT MANOR CORPORATION	01	02	P	WELL 2	PG670013	635	392	614-635	1966	PATAPSCO FORMATION
			03	P	WELL 3	PG941402	485	447	470-485	2000	PATAPSCO FORMATION
0160006	MARLBORO MEADOWS	01	01	P	WELL 1	PG650098	540	242	242-262, 270-281, 322-338, 369-379, 384-394, 409-425	1965	MAGOTHY FORMATION
			02	P	WELL 2	PG680043	500	222	222-225, 266-244, 272-282, 320-332, 342-358, 362-396	1968	MAGOTHY FORMATION
0160009	POTOMAC VISTA	01	01	P	WELL 1	PG010418	285	285	275-285	1952	PATUXENT FORMATION
			02	P	WELL 2	PG020466	331	295	295-300, 315-320	1955	PATUXENT FORMATION
0160203	EDGEMEADE SCHOOL RESIDENCE	01	01	P	WELL	PG810592	495	440	485-495	1984	MAGOTHY FORMATION
0160207	CEDARVILLE M.H.P.	01	01	P	WELL 1	PG810666	618	474	588-612	1984	PATAPSCO FORMATION
			02	U	WELL 2	PG680011	627	424	596-621	1967	PATAPSCO FORMATION
0160209	NORBOURNE M.H.P.	01	01	P	WELL	PG013029	325	316	315-325	1953	MAGOTHY FORMATION

Table 2. Well Information for Community Water Systems in Prince George's County

WATER SUPPLY PROGRAM DATABASE FIELD NAMES:

PWSID = Public Water System ID Number

PLANT ID = Water Treatment Plant ID Number

SOURCE ID = Unique Identifier Number for Well

USE CODE: P = Production, S = Standby, F = Future, T* = Test, U* = Unused. (* Wells not included in assessment delineation)

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
0160003	Cheltenham Boys Village	Wells 1 And 2	Magothy Formation	100,000	20	1,800	232	Well 2 Area encompasses Well 1 Area
0160004	Calvert Manor Corporation	Well 2	Patapsco Formation	24,000	21	900	58	
0160004	Calvert Manor Corporation	Well 3	Patapsco Formation	24,000	15	1,000	72	
0160006	Marlboro Meadows	Well 1	Magothy Formation	600,000	83	2,200	347	
0160006	Marlboro Meadows	Well 2	Magothy Formation	600,000	83	2,200	347	
0160009	Potomac Vista	Wells 1 and 2	Patuxent Formation	18,000	10	1,100	90	Two circles merged
0160203	Edgemeade School Residence	Well	Magothy Formation	6,000	10	700	35	
0160207	Cedarville M.H.P.	Well 1	Patapsco Formation	60,000	24	1,300	121	
0160207	Cedarville M.H.P.	Well 2	Patapsco Formation	60,000	25	1,300	121	
0160209	Norbourne M.H.P.	Well	Magothy Formation	10,000	10	800	46	

Table 3. Parameters used for WHPA delineations.

ID*	Type	Facility Name	Address	*Reference Location	WHPA System Name	No. of UST's/ Capacity/Substance/ Other Comments	Potential Contaminants
1	UST	Cheltenham Boys Village Maintenance Shop	Off Frank Tippett Rd	Figure 3a	Cheltenham Boys Village	Status of tanks is unknown. Gasoline filling station on site as reported by operator	VOC
2	UST/CHS	Amoco Service Station #3054	3507 Crain Highway	Figure 3b	Marlboro Meadows	Three 10,000 gal. Gasoline tanks in use, One 550 gal. Diesel tank in use, One 550 gal. Used Oil tank in use, Six other tanks permanently out of use	VOC
3	UST	Edgemeade School Residence	13400 Edgemeade Rd	Figure 3c	Edgemeade School Residence	Three tanks permanently out of use	VOC
4	UST	Cedarville Mobile Home Park	10505 Cedarville Rd.	Figure 3d.	Cedarville Mobile Home Park	One 1,000 gal. Gasoline in use. Three other tanks permanently out of use.	VOC

Table 4. Potential Contaminant Point Sources Within Wellhead Protection Areas.

*See referenced figure for location

PWSID	PWS NAME	PLANT ID	TREATMENT METHOD	PURPOSE
0160003	CHELTENHAM BOYS VILLAGE	01	GASEOUS CHLORINATION, POST	Disinfection
0160004	CALVERT MANOR CORPORATION	01	HYPPOCHLORINATION, POST	Disinfection
0160006	MARLBORO MEADOWS	01	pH ADJUSTMENT	Corrosion Control
			GASEOUS CHLORINATION, POST	Disinfection
			FILTRATION, RAPID SAND	Iron Removal
			SEDIMENTATION	Iron Removal
0160009	POTOMAC VISTA EDGEMEADE SCHOOL RESIDENCE	01	HYPPOCHLORINATION, PRE	Disinfection
0160203	CEDARVILLE M.H.P.	01	HYPPOCHLORINATION, POST	Disinfection
0160207	NORBOURNE M.H.P.	01	HYPPOCHLORINATION, POST	Disinfection
0160209	NORBOURNE M.H.P.	01	HYPPOCHLORINATION, PRE	Disinfection

Table 5. Treatment Methods

PWSID	PWS NAME	PLANT ID	IOCs		Radionuclides		VOCs		SOCs	
			No. of Samples Collected	No. of Samples > Half MCL	No. of Samples Collected	No. of Samples > Half MCL	No. of Samples Collected	No. of Samples > Half MCL	No. of Samples Collected	No. of Samples > Half MCL
0160003	CHELTENHAM BOYS VILLAGE	01	63	0	9	0	3	0	0	0
0160004	CALVERT MANOR CORPORATION	01	74	0	12	4 ²	5	0	2	0
0160006	MARLBORO MEADOWS	01	76	0	13	0	5	0	3	0
0160009	POTOMAC VISTA	01	48	0	9	1 ²	6	0	0	0
0160203	EDGEMEADE SCHOOL RESIDENCE	01	40	0	9	0	5	0	1	0
0160207	CEDARVILLE M.H.P.	01	43	0	9	0	7	0	0	0
0160207	CEDARVILLE M.H.P.	02	24	1 ¹	5	0	6	0	0	0
0160209	NORBOURNE M.H.P.	01	45	0	5	0	4	0	0	0

Table 6. Summary of Water Quality Results

¹ Result was for Nickel, which no longer has an MCL.

PWSID	PWS NAME	PLANT ID	CONTAMINANT	MCL (mg/L)	SAMPLE DATE	RESULT (mg/L) ¹
0160207	CEDARVILLE M.H.P.	01	NICKEL	0.10	29-Dec-98	0.01
		02	NICKEL	0.10	27-Nov-01	-0.05
		02	NICKEL	0.10	29-Dec-98	0.08

Table 7a. Results of Inorganic Compounds where detected at least once above 50% of their MCL.

PWSID	PWS NAME	PLANT ID	CONTAMINANT	MCL (pCi/L)	SAMPLE DATE	RESULT (pCi/L) ¹
0160004	CALVERT MANOR CORPORATION	01	RADON-222	300 ³	11-Oct-94	465
		01	RADON-222	300 ³	11-Oct-94	230
		01	RADON-222	300 ³	20-Mar-97	155
		01	RADON-222	300 ³	22-Oct-00	389
0160009	POTOMAC VISTA	01	RADON-222	300 ³	18-Feb-99	450

Table 7b. Results of Radionuclides where detected at least once above 50% of their MCL.

(Results in bold indicate those above 50% of their MCL.)

¹ A negative symbol indicates below the detectable level shown.

² Proposed MCL

PWSID	PWS NAME	No. of Samples Collected	No. of Positive Samples	Disinfection Treatment?
0160003	CHELTENHAM BOYS VILLAGE	74	2	Y
0160004	CALVERT MANOR CORPORATION	69	0	Y
0160006	MARLBORO MEADOWS	74	0	Y
0160009	POTOMAC VISTA	74	0	Y
0160203	EDGEMEADE SCHOOL RESIDENCE	74	0	Y
0160207	CEDARVILLE M.H.P.	73	1	Y
0160209	NORBOURNE M.H.P.	71	1	Y

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

PWSID	PWS Name	Is the Water System Susceptible to...					
		Inorganic Compounds (except Arsenic)	Arsenic	Radionuclides	Volatile Organic Compounds	Synthetic Organic Compounds	Microbiological Contaminants
0160003	CHELTENHAM BOYS VILLAGE	NO	NO	NO	NO	NO	NO
0160004	CALVERT MANOR CORPORATION	NO	NO	YES ¹	NO	NO	NO
0160006	MARLBORO MEADOWS	NO	NO	NO	NO	NO	NO
0160009	POTOMAC VISTA	NO	NO	YES ¹	NO	NO	NO
0160203	EDGEMEADE SCHOOL RESIDENCE	NO	NO	NO	NO	NO	NO
0160207	CEDARVILLE M.H.P.	NO	NO	NO	NO	NO	NO
0160209	NORBOURNE M.H.P.	NO	NO	NO	NO	NO	NO

Table 9. Susceptibility Analysis Summary

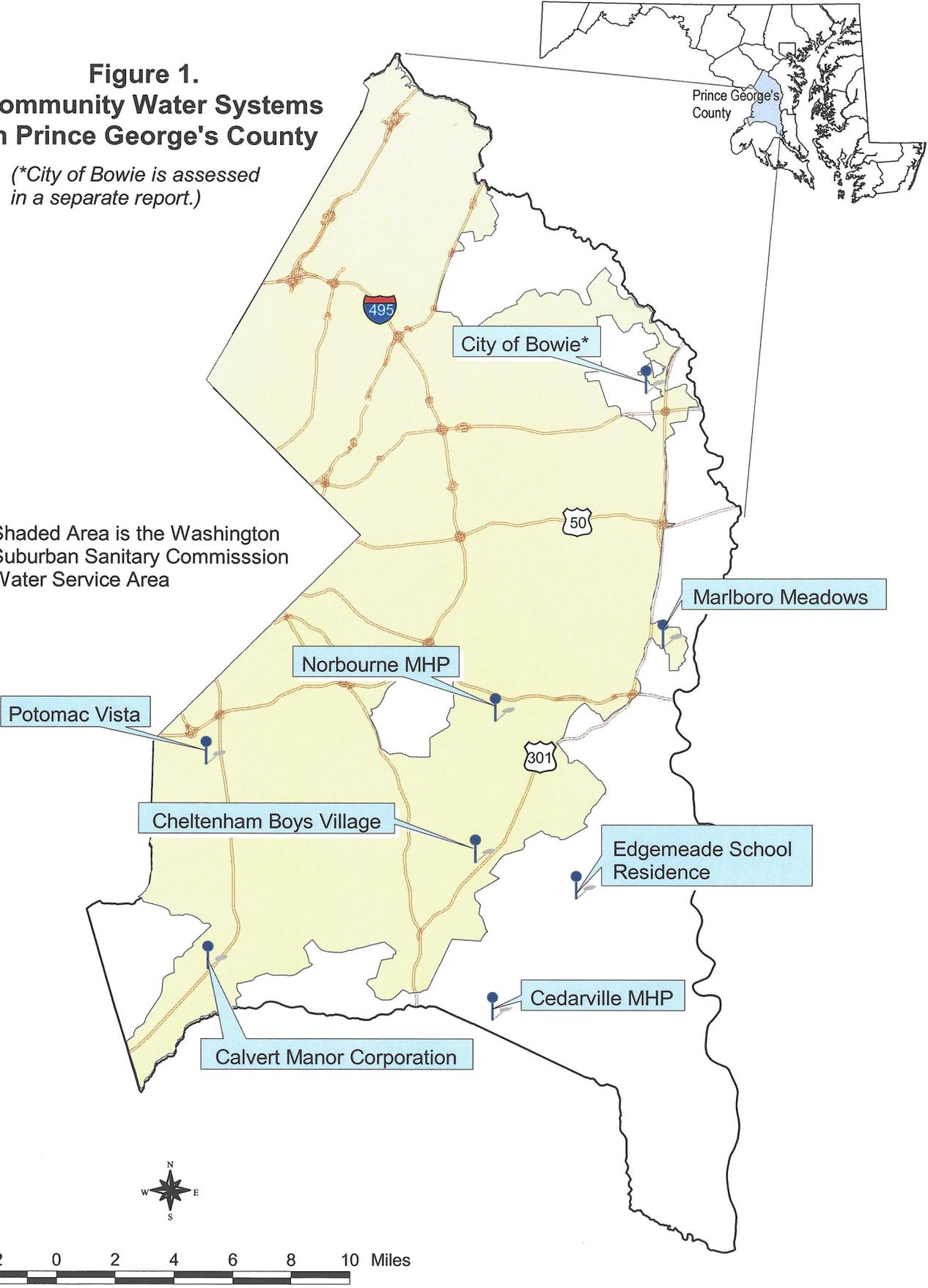
¹ Based on Proposed MCL for Radon-222

FIGURES

Figure 1. Community Water Systems in Prince George's County

(*City of Bowie is assessed
in a separate report.)

Shaded Area is the Washington
Suburban Sanitary Commission
Water Service Area



APPENDIX

Table 1. Lithology and water-bearing characteristics of geologic formations penetrated by water wells in Prince George's County

System	Series (Group)	Stratigraphic units	Thickness (feet)	Dominant lithologic character	Water-bearing properties
Quaternary and Tertiary (?)	Holocene Pleistocene Pliocene (?)	Lowland and upland deposits	0 - 190	Irregularly bedded sand, gravel, silt, and clay. Tan to rusty orange; predominantly quartz.	Yields small to moderate amounts of water to wells. Utilized primarily as a water source for shallow, domestic, and farm wells.
Tertiary	Miocene (Chesapeake Group)	Choptank Formation	0 - 50	Fine sand, sandy clay, and clay.	May yield small supplies of water to some shallow domestic and farm wells in the southeasternmost part of the county.
		Calvert Formation	0 - 200	Gray and greenish-gray clay and sandy clay; generally contains diatoms.	Yields small supplies of water to domestic and farm dug wells.
	Eocene	Nanjemoy Formation	0 - 225	Gray to dark-gray glauconitic silt and clay; the upper portion of formation is predominantly sand; the lower portion is predominantly silt and clay.	Not an important aquifer.
	Paleocene	Marlboro Formation	0 - 35	Pinkish-red to silvery-gray clay; very plastic; thin lenses of pale gray silt.	Functions as a confining bed.
		Aquia Formation	0 - 143	Gray and greenish-gray glauconitic sand and sandy clay; contains indurated layers, some with fossil shells.	Yields small to moderate supplies of water to dug wells in the outcrop area in the east-central part of the county; yields as much as 100 gallons a minute to drilled wells in the southeastern part of the county.
		Brightseat Formation	0 - 70 (?)	Gray to dark-gray micaceous silty and sandy clay.	Not an important aquifer.
Cretaceous	Upper Cretaceous	Monmouth Formation	0 - 50 ±	Gray to dark-gray glauconitic, micaceous silty and sandy clay.	Not an important aquifer.
		Magothy Formation	0 - 150	Light-gray sand and gravel and interbedded light-colored clay; generally contains lignite and pyrite and, in places, some glauconite.	Important water-bearing formation in southeastern half of county; yields as much as 1200 gallons a minute to drilled wells.
	Lower Cretaceous	Patapsco Formation	200 - 650	Interbedded sand, clay, and sandy clay; in many places upper part consists of about 200 feet of red or pink clay.	Important water-bearing formation in north-central and northwestern parts of county; yields as much as 1230 gallons a minute to drilled wells.
		Arundel Clay	0 - 500	Red and brown clay.	Not an important water-bearing formation.
		Petuxent Formation	140 - 600	Predominantly white, yellow, gray, and brown sand, and interbedded sandy clay and clay; contains kaolinized feldspar and lignite and pyrite.	Important water-bearing formation in northern, northwestern, and western parts of county; yields as much as 1500 gallons a minute to drilled wells.
Paleozoic and Precambrian		Crystalline rocks (basement)		Chiefly schist, granite, gabbro, and gneiss.	Yields small supplies of water, generally less than 10 gallons a minute, to wells in northwestern part of county.

Modified from Mack (1966)