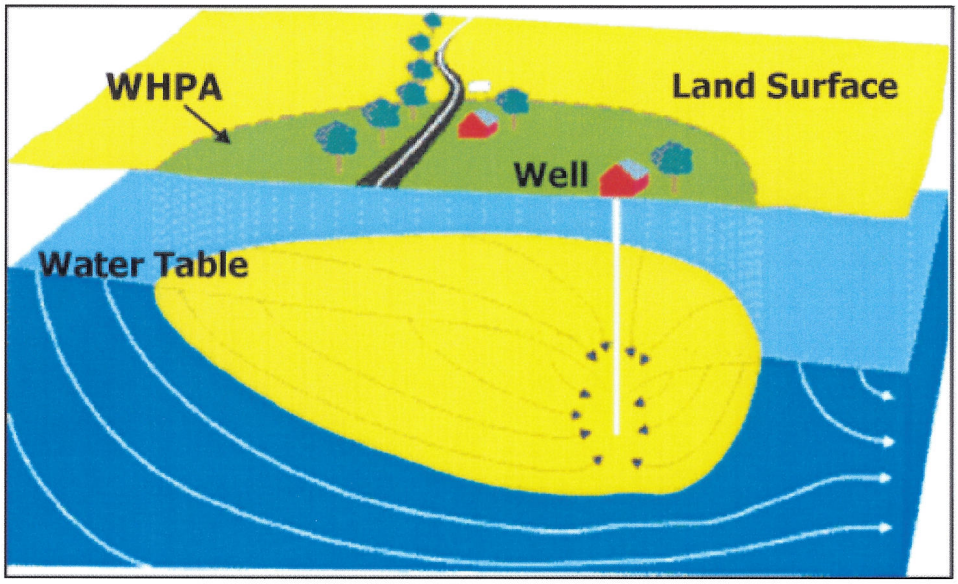
Source Water Assessment
for the Sandy Hook Water System
Washington County, Maryland



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MDE

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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for the Sandy Hook 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 Sandy Hook's water supply is an unconfined fractured-rock aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for this source type.

Point sources of contamination were investigated within the assessment area from field inspections, contaminant inventory databases, and previous studies. The Maryland Office of Planning's 2000 digital land use map for Washington County was used to identify non-point sources of contamination. Well information and water quality data were also reviewed. An aerial photograph and maps showing potential contaminants sources and land use within the Source Water Assessment area are included in the report.

The susceptibility analysis is based on a review of the existing water quality data for the Sandy Hook water systems, the presence of potential sources of contamination in the source water assessment area, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Sandy Hook water supply is not susceptible to contamination by inorganic compounds, radionuclides, volatile organic compounds, synthetic organic compounds, or microbiological contaminants.

INTRODUCTION

The Water Supply Program has conducted a Source Water Assessment for the Sandy Hook water system in Washington County. Sandy Hook is located in southern Washington County along the Potomac River near Harpers Ferry, West Virginia. The water system serves a population of 220 and has 59 service connections. The water system is owned and operated by the Washington County Water and Sewer department.

WELL INFORMATION

Well information was obtained from the Water Supply Program's database, site visits, well completion reports, sanitary survey inspection reports, and published reports. The Sandy Hook system presently obtains its water supply from two wells (Fig. 1). A review of the well completion report for Sandy Hook's wells indicates that it was drilled after 1973 and should meet construction standards for grouting and casing. Well information is summarized in Table 1.

The Sandy Hook water system has an appropriation permit to draw water from the Precambrian Erathem formation for an average use of 15,000 gallons per day (gpd) and a maximum of 20,000 gpd in the month of maximum use. Based on the most recent pumpage reports, the average daily use was 8,583 gallons in 2000 and 8,479 gallons in 2001. The months of maximum use for the last two reported years were May 2000 and December 2001 with an average daily use of 10,074 and 9,925 gallons respectively.

SOURCE ID	WELL NAME	PERMIT	TOTAL DEPTH	CASING DEPTH	YEAR DRILLED
01	SANDY HOOK 1	WA-88-0443	525	40	1990
02	SANDY HOOK 2	WA-88-0469	300	40	1990

Table 1. Sandy Hook well information.

HYDROGEOLOGY

Sandy Hook lies within the Blue Ridge physiographic province, which is the mountainous region around Catoctin and South Mountains and is underlain by the oldest sequence of rocks in the County. The Blue Ridge Province is mostly underlain by metamorphosed igneous and sedimentary rocks that are the eroded remnants of an overturned anticlinorium (Duigon and Dine, 1991). The Sandy Hook wells obtain water from a Precambrian Gneiss formation, an unconfined, fractured-rock aquifer, composed of granodiorite and biotite granite gneiss (Edwards, 1978). The primary porosity and permeability of this aquifer are small due to the dense nature of the metamorphosed rock. Ground water moves principally through secondary porosity, fractures and joint openings, and is recharged by precipitation percolating through soil and saprolite. Due to

their low primary porosity, large production wells are not common in crystalline formations unless significant, water-bearing fractures are encountered.

Ground water systems in crystalline rock tend to be localized and flow is within topographic divides towards the nearest perennial stream (Bolton, 1996). The water table is generally in the saprolite, which is characterized by high porosity and thus, the amount of storage often depends on the thickness of the saprolite. Stream valleys tend to follow fracture traces and as a result wells drilled in draws and stream valleys tend to have higher yields than those on hilltops and slopes.

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 source water assessment area for public water systems using wells in fractured-rock aquifers is the watershed drainage area that contributes to the well. The area should be modified to account for geological boundaries, ground water divides, and by annual average recharge needed to supply the well (MD SWAP, 1999).

A fracture trace analysis has not been completed in this area, however the straight-line north-south segment of the intermittent stream adjacent to the wells could be interpreted as the water bearing fracture from which the wells receive water. The WHPA is delineated as the modified watershed drainage area needed to supply the appropriated amount using the effective recharge rate. The recharge area for the wells based on an average use of 15,000 gpd and an average drought-year recharge rate of 400 gpd/acre is calculated to be 38 acres. The WHPA was delineated following topographic divides upgradient of the wells and includes the area draining to the straight-line segment of the stream. The WHPA was extended south to the riparian zone of the Potomac River due to evidence during well pump testing that indicates the river could potentially recharge the aquifer. The WHPA is 50 acres and is illustrated in Figure 2.

POTENTIAL SOURCES OF CONTAMINATION

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 types of land use practices such as use of pesticides, application of fertilizers or animal wastes, or septic systems that may lead to ground water contamination over a larger area.

Point Sources

A review of MDE contaminant databases revealed no potential point sources of contamination within the WHPA. A gasoline station is located just *outside* the WHPA boundary and is therefore not considered a potential source of contamination to the water supply. However, due to its proximity and upgradient position relative to the WHPA, a description is provided here for information purposes. The Hillside Station currently has one 20,000-gallon gasoline tank in use and it has removed five previously used tanks from the site to remain in compliance with tank construction standards. The site location is noted on Figure 2.

Non-Point Sources

The Maryland Office of Planning's 2000 digital land use coverage of Washington County was used to determine the predominant types of land use in the WHPA (Fig. 3). The land use summary is given in Table 2. The majority of the WHPA is made up of residential and forested land, with a smaller proportions of agricultural and commercial areas.

Land Use Type	Total Acres	Percent of WHPA
Low Density Residential	12	24.0
Commercial	2	4.7
Urban Public Land	3	6.3
Cropland	7	13.2
Forest	26	51.8
Total	50	100

Table 2. Land Use Summary

Agricultural land (cropland and pasture) is commonly associated with nitrate loading of ground water and also represents a potential source of SOCs depending on fertilizing practices and use of pesticides. Residential areas without sewer service may be a source of nitrate from septic systems. Additionally, residential areas may be a source of nitrate and SOCs if fertilizers, pesticides, and herbicides are not used carefully in lawns and gardens. Commercial areas are generally associated with point sources of contamination as described above.

The Maryland Office of Planning's 1996 digital sewer map of Washington County shows that most of the WHPA is either in the planned or not planned service areas with a smaller area in Sandy Hook that has existing sewer service (Fig. 4).

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 a MCL, this assessment 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. The Sandy Hook water system currently has chlorination for disinfection and green sand filtration for iron removal.

A review of the monitoring data for Sandy Hook's water system indicates that the water supply has met drinking water standards. Contaminants have not been detected above the SWAP threshold level, with one exception, which was confirmed in a laboratory blank sample. The water quality sampling results are summarized in Table 3.

Contaminant Group	No. of Samples Collected	No. of Samples over 50% of an MCL
Inorganic Compounds (except Nitrate)	59	0
Nitrate	16	0
Radiological Contaminants	4	0
Volatile Organic Compounds	8	0
Synthetic Organic Compounds	3	0

Table 3. Summary of Water Quality Samples

Inorganic Compounds (IOCs)

Inorganic compounds were not detected above 50% of an MCL. Several compounds such as Flouride, Nickel, Nitrate, and Sodium have been detected in the water supply but at very low levels.

Radionuclides

A review of the data shows that radionuclides have not been detected above 50% of an MCL. 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 EPA received many comments in response to their proposed rule, and promulgation may be delayed. Radon-222 was detected at 95 pCi/L in the water supply, which is lower than the proposed MCLs.

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 SOCs have not been detected above 50% of an MCL, with the exception of Di(2-Ethylhexyl)Phthalate for which the highest level reported was 4.2 ppb. This contaminant is commonly found in laboratory blank

samples and the it was confirmed that it was present at ten times the level in the blank for this sample.

Microbiological Contaminants

Raw water bacteriological data is available from evaluation for ground water under the direct influence of surface water (GWUDI). A review of the data shows that coliform bacteria were not detected in raw water from the well.

SUSCEPTIBILITY ANALYSIS

The wells serving the Sandy Hook water supply draw water from an unconfined fractured-rock aquifer. Wells in unconfined aquifers are generally vulnerable to any activity on the land surface that occurs within the wellhead protection area. Therefore, continued monitoring of contaminants is essential in assuring a safe drinking water supply. The *susceptibility* of the source to contamination is determined for each group of contaminants based on the following criteria: 1) the presence of potential contaminant sources within the WHPA, 2) water quality data, 3) well integrity, and 4) the aquifer conditions. Table 4 summarizes the susceptibility of Sandy Hook's water supply to each of the groups of contaminants.

In fractured-rock areas, if a well is constructed properly with the casing extended to competent rock and with sufficient grout, the saprolite serves as a natural filter and protective barrier. Properly constructed wells with no potential sources of contamination in their WHPA should be well protected from contamination.

Inorganic Compounds

The water supply is **not** susceptible to inorganic compounds, based on water quality data and the lack of potential contaminant sources within the WHPA.

Radionuclides

The water supply is **not** susceptible to radionuclides. The source of radionuclides in ground water is the natural occurrence of uranium in rocks. The concentration of constituents such as Radon-222, Radium-226, and Radium-228 can vary considerably in the same aquifer to due to many factors such as pH, exposed surface area of minerals, and other natural conditions. Based on available data, the water the aquifer is not a significant source of these contaminants and therefore the water supply is not susceptible.

Volatile Organic Compounds

The water supply is **not** susceptible to inorganic compounds, based on water quality data and the lack of potential contaminant sources within the WHPA.

Synthetic Organic Compounds

The wells are **not** susceptible to synthetic organic compounds. SOCs were not detected in the water supply. A potential source of SOCs in the WHPA may be

pesticide or herbicide use in the agricultural or residential areas. However, because these contaminants have not been detected, it appears that any chemicals that may be used in the WHPA are degrading or being attenuated in the soil and are not reaching the wells.

Microbiological Contaminants

The wells are **not** susceptible to microbiological contaminants. Raw water data shows that coliform bacteria, which are used as an indicator for other microbiological contaminants, was not detected in the water supply.

Contaminant Group	Are Contaminant Sources Present in WHPA?	Are Contaminants Detected Above 50% of MCL?	Is Well Integrity a Factor?	Is the Aquifer Vulnerable?	Is the System Susceptible?
Nitrate	YES	NO	NO	YES	NO
Inorganic Compounds (except nitrate)	NO	NO	NO	YES	NO
Radiological Compounds	NO	NO	NO	NO	NO
Volatile Organic Compounds	NO	NO	NO	YES	NO
Synthetic Organic Compounds	YES	NO	NO	YES	NO
Microbiological Contaminants	YES	NO	NO	NO	NO

Table 4. Susceptibility Analysis Summary.

MANAGEMENT OF THE SOURCE WATER ASSESSMENT AREA

With the information contained in this report the Washington County Department of Water and Sewer are in a position to protect the Sandy Hook water supply by staying aware of the area delineated for source water protection and evaluating future development and land planning. Specific management recommendations for consideration are listed below:

Form a Local Planning Team

- The Water and Sewer Department should contact the County Planning Department to form a local planning team to begin to implement a wellhead protection plan. The team should represent all the interests in the community, such as the water supplier, home association officers, the County Health Department, 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.
- A management strategy adopted by the County should be consistent with the level of resources available for implementation. MDE remains available to assist in anyway we can help the process.
- MDE has grant money available for Wellhead Protection projects.

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 Water and Sewer Department or MDE.
- Conduct educational outreach to facilities and residents to prevent unknown potential contaminant sources. Important topics include (a) appropriate use and application of fertilizers and pesticides, and (b) chemical storage.
- Road signs at the WHPA boundary are an effective way of keeping the relationship of land use and water quality in the public eye, and help in the event of spill notification and response.

Monitoring

- Continue to monitor for all Safe Drinking Water Act contaminants as required by MDE.
- Annual raw water bacteriological samples are a good test for well integrity.

Planning/ New Development

- Review the State's model wellhead protection zoning ordinances for potential adoption. Coordinate with Washington County Department of Planning to adopt a wellhead protection ordinance.

Land Acquisition/Easements

- Loans are available for the purchase of property or easements for protection of the water supply. Eligible property must lie within the designated WHPA. Loans are currently offered at zero percent interest and zero points. Contact the Water Supply Program for more information.

Contingency Plan

- Sandy Hook should have a Contingency Plan for its water system. 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.
- Develop a spill response plan in concert with the Fire Department and other emergency response personnel.

Contaminant Source Inventory Updates/ Inspections

- The Water and Sewer Department should conduct their own field survey of the source water assessment area to ensure that there are no additional potential sources of contamination.
- Periodic inspections and a regular maintenance program for the supply wells will ensure their integrity and protect the aquifer from contamination.

Changes in Use

- The Water and Sewer Department is required to notify MDE if new wells are to be put into service. Drilling a new well outside the current WHPA would modify the area; therefore the Water Supply Program should be notified if a new well is being proposed.

REFERENCES

Bolton, D.W., 1996, Network Description and Initial Water-Quality Data from a Statewide Ground-Water-Quality Network in Maryland: Maryland Geological Survey Report of Investigations No. 60, 167 pp.

Committee on Health Risks of Exposure to Radon, 1999, Health Effects of Exposure to Radon: BEIR VI, (http://www.epa.gov/iaq/radon/beirvi1.html).

Duigon, M.T., and J.R. Dine, 1991, Water Resources of Washington County, Maryland, MGS Bulletin 36, 109 pp.

MDE, Water Supply Program, 1999, Maryland's Source Water Assessment Plan, 36 p.

Meyer G. and R.M. Beall, 1958, The Water Resources of Carroll and Frederick Counties: Department of Geology, Mines and Water Resources Bulletin 22, 355 pp.

U.S. Environmental Protection Agency, 1991, Delineation of Wellhead Protection Areas in Fractured Rocks: Office of Ground Water and Drinking Water, EPA/570/9-91-009, 144 pp.

OTHER SOURCES OF DATA

Water Appropriation and Use Permit WA1960G005
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 for Keedysville
USGS Topographic 7.5 Minute Quadrangles for Keedysville
Maryland Office of Planning 2000 Washington County Digital Land Use Map
Maryland Office of Planning 1996 Washington County Digital Sewer Map

FIGURES

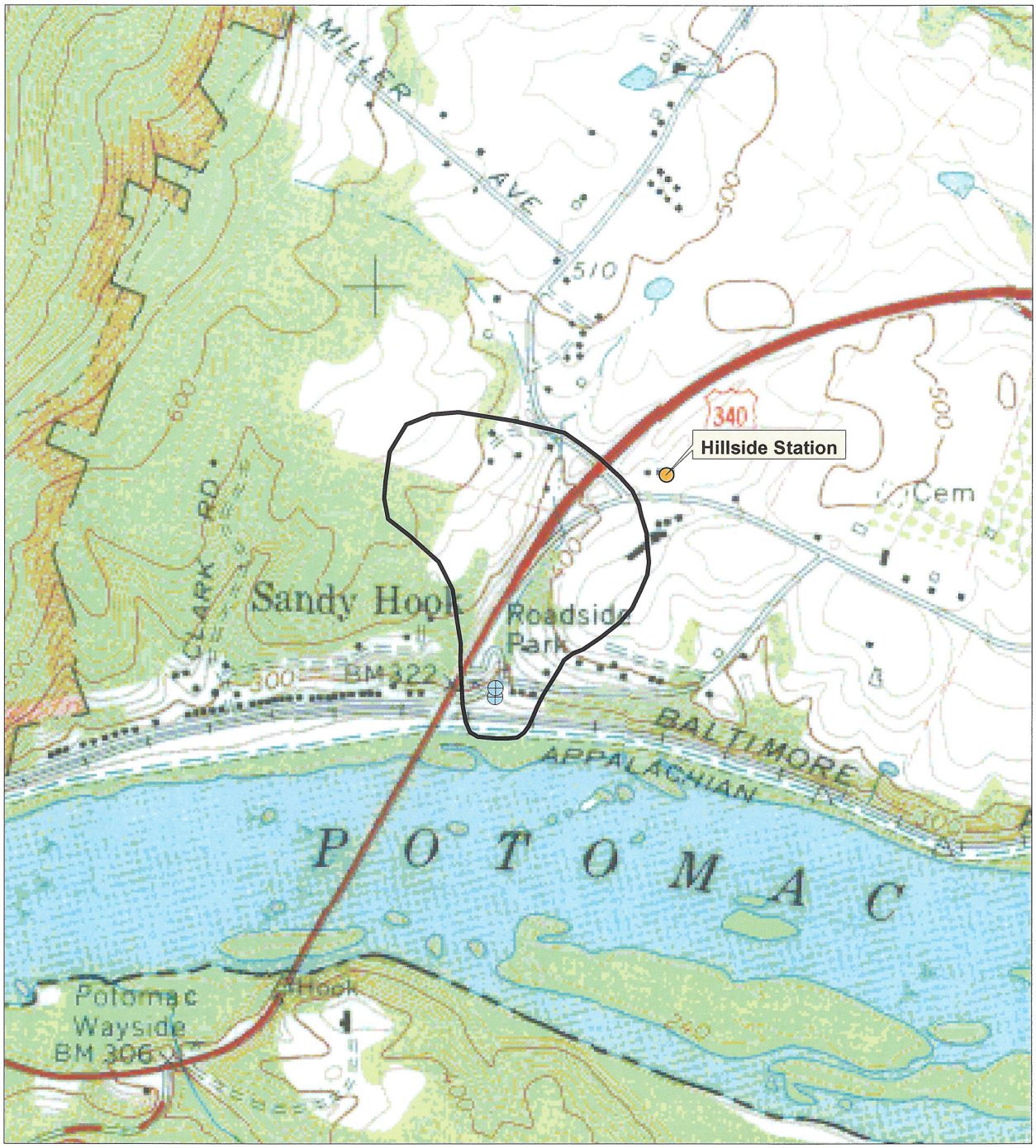

Figure 2. Sandy Hook Wellhead Protection Area

Legend

- Wells
- Wellhead Protection Area
- Underground Storage Tank site

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Base Map: USGS 7.5' Quadrangle for Harpers Ferry

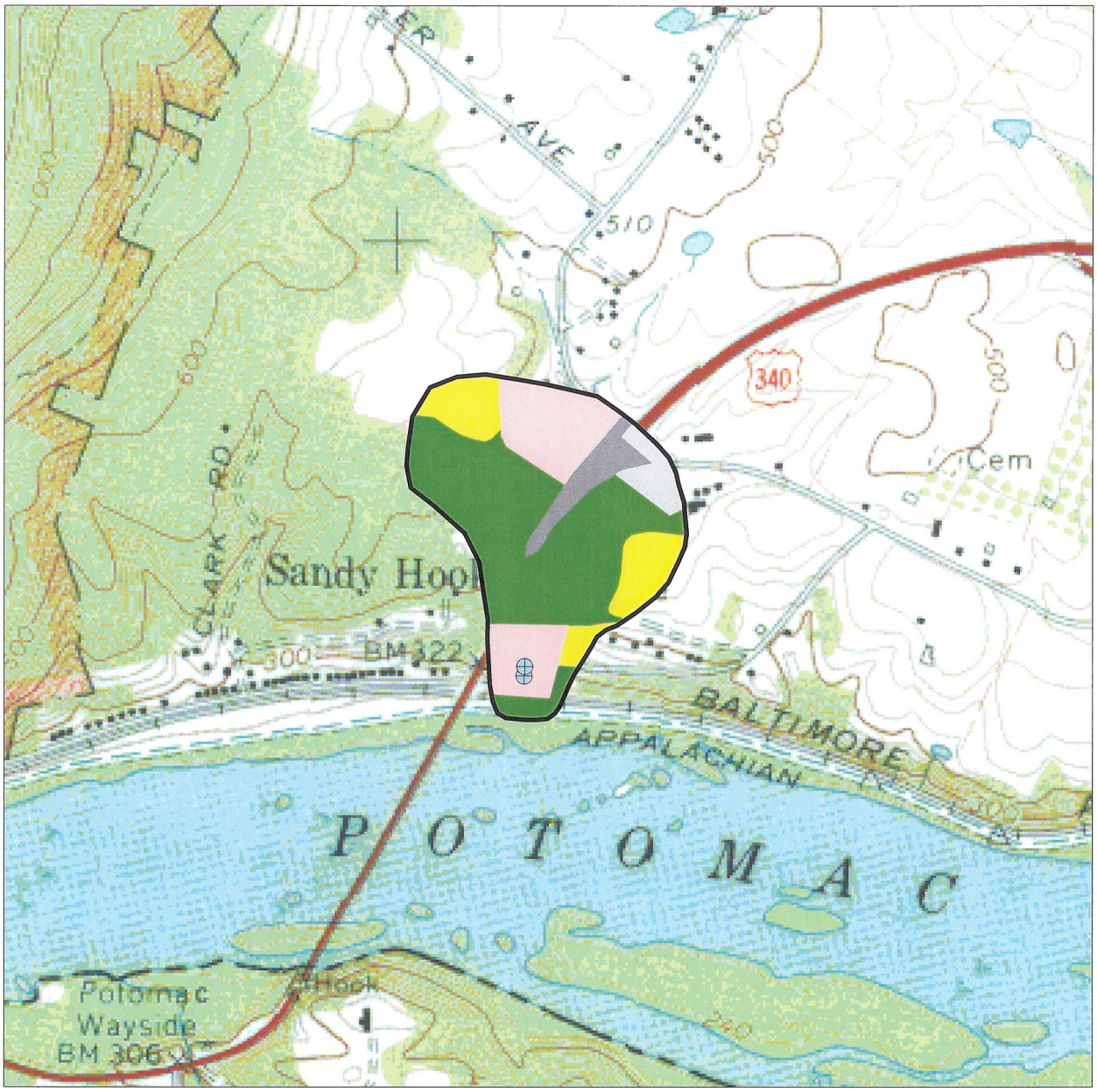

Figure 3. Sandy Hook Wellhead Protection Area with Land Use

Legend

Washington County 2000 Land Use

- Low Density Residential
- Commercial
- Open Urban Land
- Cropland
- Forest

- Wells
- Wellhead Protection Area

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1000 0 1000 Feet

Base Map: USGS 7.5' Quadrangle for Harpers Ferry

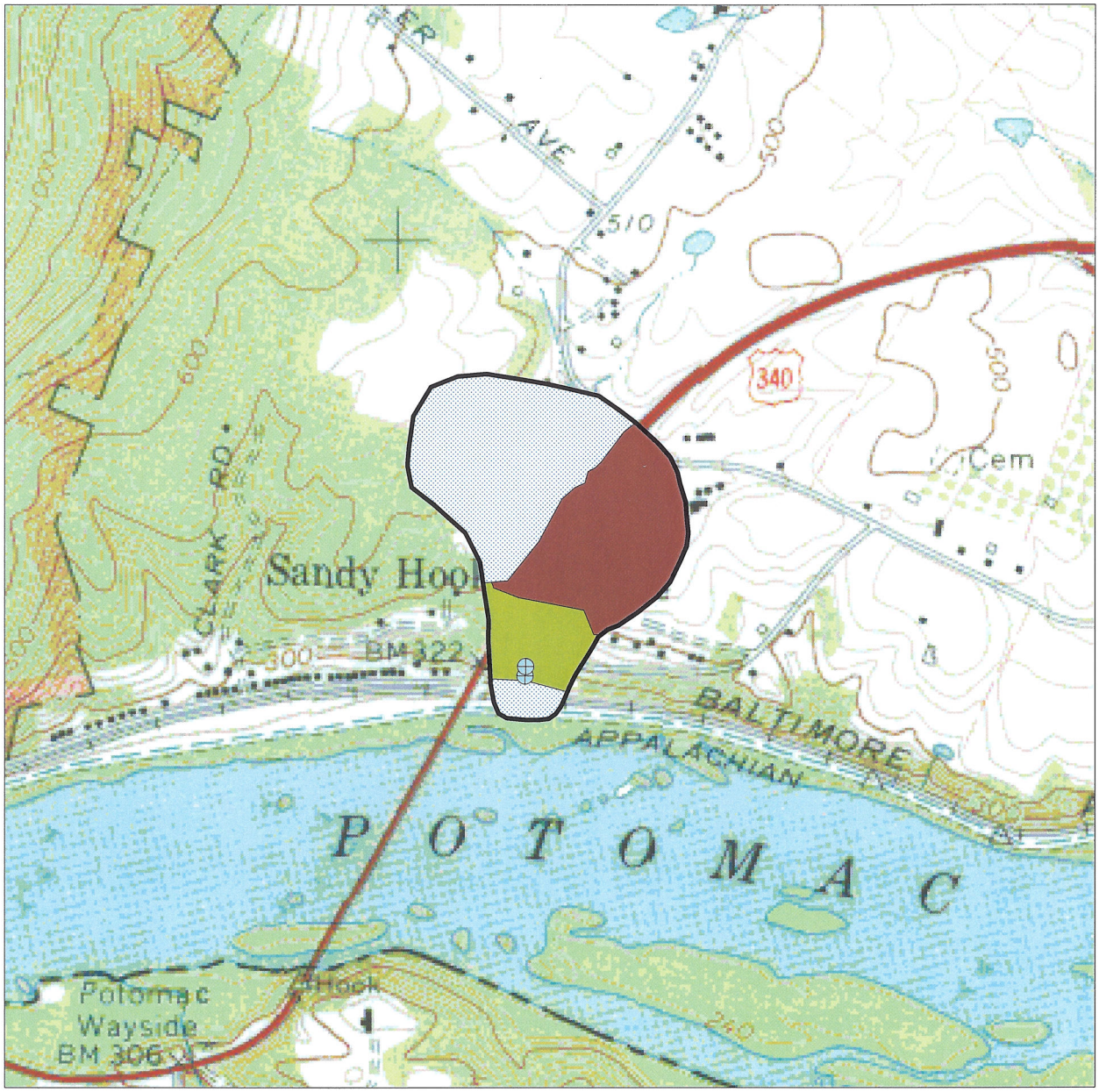

Figure 4. Sandy Hook Wellhead Protection Area with Sewer Service Areas