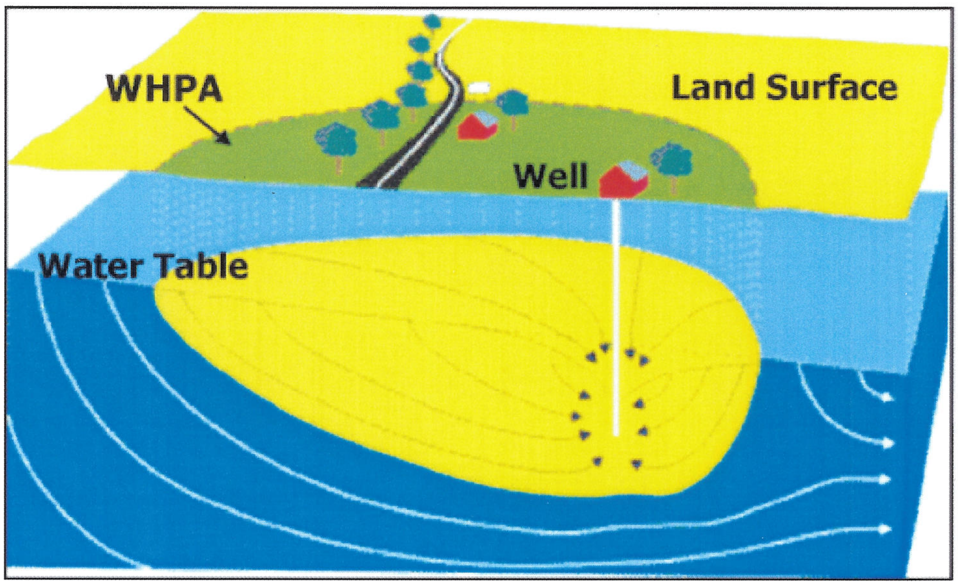
Source Water Assessment
for the Town of Hancock Water System
Washington County, Maryland



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Water Management Administration
Water Supply Program
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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 Town of Hancock 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 sources of Hancock's water supply are two wells in 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 identified 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 Hancock water system, 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 Hancock water supply is susceptible to contamination by volatile organic compounds. The water supply is not susceptible to contamination by inorganic compounds, radionuclides, synthetic organic compounds, or microbiological contaminants.

INTRODUCTION

The Water Supply Program has conducted a Source Water Assessment for the Town of Hancock water system in Washington County. Hancock is located in western Washington County along the Potomac River. The water system serves a population of 1,921 and has 650 service connections. The water system is owned and operated by the Town of Hancock.

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 Hancock system presently obtains its water supply from two wells (Table 1). The wells are located in Town on the north side of Interstate-70 (Fig. 1). A review of the well completion reports and sanitary surveys of Hancock's water system indicates that the wells were drilled after 1973 and should meet construction standards for grouting and casing. Well information is summarized in Table 1.

The Hancock water system has an appropriation permit to draw water from the Oriskany Sandstone formation for an average use of 300,000 gallons per day (gpd) and a maximum of 350,000 gpd in the month of maximum use. Based on the most recent pumpage reports, the average daily use was 298,593 gallons in 2000 and 324,655 gallons in 2001. The months of maximum use for the last two reported years were December 2000 and October 2001 with an average daily use of 333,970 and 406,370 gallons respectively.

SOURCE ID	WELL NAME	PERMIT	TOTAL DEPTH	CASING DEPTH	YEAR DRILLED
01	WELL 1	WA-94-0508	520	126	1996
02	WELL 2	WA-73-2313	420	40	1979

Table 1. Hancock well information.

HYDROGEOLOGY

Hancock lies within the Valley and Ridge physiographic province, which is marked by a sequence of narrow valleys and ridges formed by the tight folds of the underlying sedimentary strata. In general, the less resistant shales underlie the valleys and the ridges are formed by the more resistant sandstone strata (Duigon and Dine, 1991). The Hancock wells obtain water from the Oriskany formation, which is a consolidated sedimentary bedrock aquifer, composed of a medium to coarse-grained, fossiliferous and calcareous quartz sandstone (Edwards, 1978). The primary porosity and permeability of this aquifer may be more comparable to an unconsolidated sedimentary aquifer than a typical fractured rock aquifer due to its composition. In addition, there is some indication from available pump test data that the Oriskany formation responds like a confined coastal plain aquifer due to the overlying Romney Shale formation that is exposed in the valley where the wells are located. However, the data also indicates that ground water flow is heavily influenced by secondary porosity (fractures and bedding plane partings), thus, this is considered a fractured-bedrock aquifer.

Ground water systems in consolidated rock tend to be localized and flow is within topographic divides towards the nearest perennial stream (Bolton, 1998). The water table is recharged by precipitation percolating through soil and saprolite, which is characterized by high porosity and therefore, 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 and 72-hour pump test were completed for the Town in support of their ground water appropriation permit by RE Wright, Inc. The WHPA is delineated as the modified watershed drainage area needed to supply the appropriated amount using the effective recharge rate. Drought year base flow (effective recharge) in the unnamed tributary basin in Hancock was estimated at 315 gpd/acre (Duigon and Dine, 1991). The recharge area for the wells using an average use of 300,000 gpd and the drought year recharge rate is calculated to be 952 acres. The results of the pump test indicate that the appropriate criteria for delineating the WHPA are as follows:

- The northern and eastern boundaries are the extent of the North-South fracture trace and the topographic basin contributing to it;
- The western boundary is extended to the Oriskany formation outcrop on the western ridge (because thickening of Oriskany at distance from the well provides storage and probably was the reason for rapid recovery (95%) of drawdown w/in 72 hours of end of test);
- The southern boundary is extended to the Potomac River due to results of 90-day drawdown simulation (theoretically the river could be recharging aquifer) and 38 feet of drawdown observed in an observation well (Fig. 2) along the N-S fracture, 780 feet south of the pumping well, during the 72 hour pump test, confirms expansion of cone of depression in southward direction.

The WHPA is 740 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 several potential point sources of contamination within and near the WHPA borders (Table 2). Underground storage tanks (UST) were identified in eight facilities, three of which are currently in use (Fig. 3). In addition, several facilities designated as Controlled Hazardous Substance Generators (CHS) were identified within the WHPA.

ID*	Type	Facility Name	Address	Comments
1	UST	Sheetz #43	192 W Main St	2 - 15,1000 gal. gasoline tanks in use, 1-6,000 kerosene tank in use
2	UST	Hancock United Methodist Church	168 W Main St	Tank removed from ground
3	UST	Hancock Gas & Go	179 W Main St	3 - 10,000 gal. gasoline tanks in use, 1 - 4,000 gal. diesel in use
4	UST	Gary's	223 W Main St	3 - 12,000 gal gasoline tanks in use
5	UST	Hancock Fire Co., Inc.	3 Fulton St	Tank removed from ground
6	UST	London Fog	266 N Pennsylvania Ave	Tank removed from ground
7	UST	The Church of Jesus Christ of LDS	200 Douglas Ave	Tank removed from ground
8	UST	Stoner's Florist	139 Washington St	2 - Tanks closed in place
9	CHS	Chesapeake & Potomac Tele Co		
10	CHS	Douglas Auto Body	107 Methodist Ave	
11	CHS	Outdoor Equipment Service Comp	7 S. Pennsylvania Avenue	
12	CHS	Douglas Motors, Inc.	295 Resley Street	
13	CHS	Londontown Hancock Sewing	266 Pennsylvania Avenue	

Table 2. Potential Contaminant Sources in Hancock WHPA **(*See Figure 3)**

Underground Storage Tanks (UST's) are a potential source of volatile organic compounds from petroleum products if they leak. Newer tanks are less likely to leak due to new construction standards, however leaks may still be common in underground piping. Leaks often go undetected unless a water supply is impacted, because they are located in the subsurface.

Controlled hazardous substance (CHS) generators are those facilities that are registered with MDE and either produce, store, or utilize a hazardous substance on site. Their potential to contaminate the ground water depends on how the substances are used and whether or not they are disposed of properly.

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. 4). The land use summary is given in Table 3. The majority of the WHPA consists of forested land, with smaller proportions of a variety of residential, commercial, and agricultural areas.

Land Use Type	Total Acres	Percent of WHPA
Low Density Residential	76	10.3
Medium Density Residential	98	13.2
High Density Residential	34	4.6
Commercial	57	7.7
Industrial	12	1.6
Open Urban Land	9	1.2
Cropland	48	6.5
Pasture	7	0.9
Forest	399	53.9
Total	740	100

Table 3. 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, although most of the residential areas within the WHPA are connected to public sewer. 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 and industrial areas are associated with facilities that may have point sources of contamination as described above. A concern, noted by the Town operator, is the proximity of the wells to the Interstate-70 bridge and the potential for an accident and/or chemical spill.

Forested areas within the WHPA serve as protective buffers for the water supply as they do not contribute contaminants and may take up nutrients (such as nitrogen) that may be introduced to ground water from other types of land use.

The Maryland Office of Planning's 1996 digital sewer map of Washington County shows that the approximately most of the WHPA in residential and commercial areas has existing sewer service or is planned for service in the near future (Fig. 5). The remaining area is in an area of the county that is not planned for service and is all forested or agricultural land. Table 4 summarizes the sewer service categories in the WHPA.

Service Category	Total Acres	Percent of WHPA
Existing Service	252	34
Planned Program Service Area	84	11
Not Planned for Service	364	49
Unknown (Outside of Maryland)	40	5
Total	740	100

Table 4. Sewer Service Area Summary

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 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 Hancock water system has two points of entry or plants, one of which is no longer active on Tonoloway Creek. Plant 02 is the point of entry for the two wells and has chlorination for disinfection, pH adjustment for corrosion control, and fluoridation for health benefits.

A review of the monitoring data since for Hancock's water indicates that the water supply meets drinking water standards. Inorganic compounds and radionuclides have not been detected above the SWAP threshold level. The only volatile organic compound that has been detected in significant concentrations is Trichloroethylene, but it has not been detected above half the MCL. No synthetic organic compounds, other than Di(2-ethylhexyl)Phthalate which is routinely found in laboratory blanks, were detected. The water quality sampling results are summarized in Table 5.

Contaminant Group	No. of Samples Collected	No. of Samples over 50% of an MCL
Inorganic Compounds (except Nitrate)	44	0
Nitrate	9	0
Radiological Contaminants	14	0
Volatile Organic Compounds	12	0
Synthetic Organic Compounds	2	0

Table 5 . Summary of Water Quality Samples

Inorganic Compounds (IOCs)

Inorganic compounds were not detected above 50% of an MCL. Nitrate, fluoride, barium, and sodium have been detected in very low levels.

Radionuclides

A review of the data shows that no radionuclides were 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 results have been reported below the lower proposed MCL.

Volatile Organic Compounds (VOCs)

A review of the data shows that VOCs have not been detected above 50% of an MCL. Trichloroethylene (TCE) has been detected consistently at levels less than 1.5 ppb in seven samples collected since November 2000. The levels appeared to have been on the rise, however the most recent sample shows a slight decline (Table 6).

Sample Date	Trichloroethylene (in ppb)*
18-May-98	-0.5
16-Mar-99	-0.5
13-Apr-99	-0.5
22-Sep-99	-0.5
20-Dec-99	-0.5
27-Nov-00	0.6
31-Jan-01	0.7
29-Aug-01	0.8
22-Oct-01	1.0
25-Mar-02	1.1
09-May-02	1.3
15-Oct-03	0.8

Table 6. Trichloroethylene (TCE) detections. The MCL for TCE is 5 ppb.
*A negative value represents less than the detection limit indicated.

Synthetic Organic Compounds (SOCs)

The only SOC detected was Di(2-Ethylhexyl)Phthalate for which the highest level reported was 2.9 ppb. This contaminant is commonly found in laboratory blank samples and laboratory confirmed that it was present at ten times the level in the blank for this sample.

Microbiological Contaminants

Raw water bacteriological data is available for the wells 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 supply.

SUSCEPTIBILITY ANALYSIS

The wells serving the Hancock water supply draw water from unconfined fractured-rock aquifers. 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 7 summarizes the susceptibility of Hancock's water supply to each of the groups of contaminants.

In the 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. Based on the low levels detected in the water supply, the aquifer is not a source of these contaminants in this area.

Volatile Organic Compounds

The water supply **is** susceptible to contamination by VOC's, due to the presence of contaminant sources in the WHPA and the presence of TCE in recent samples. Other VOC's have not been detected at a level of concern. The levels of TCE in the wells are low, however it is persistent and thus cannot be disregarded. The source of this contaminant in the Hancock WHPA is not clear. The most common use of this chemical is for vapor degreasing of fabricated metal parts and some textiles (US EPA, 2002). Wastewater from metal finishing, paint and ink formulation, electrical/electronic components, and rubber processing industries also may contain TCE. Several controlled hazardous substance generators were identified in the WHPA, however none have been directly linked to TCE releases to ground water.

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 is 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)	YES	NO	NO	YES	NO
Radiological Compounds	NO	NO	NO	NO	NO
Volatile Organic Compounds	YES	NO	NO	YES	YES
Synthetic Organic Compounds	YES	NO	NO	YES	NO
Microbiological Contaminants	NO	NO	NO	NO	NO

Table 7. Susceptibility Analysis Summary.

Management of the Source Water Assessment Area

With the information contained in this report the Town of Hancock is in a position to protect their 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 Town 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 Town 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 Town or MDE.
- Conduct educational outreach to the facilities that may present potential contaminant sources. Important topics include: (a) compliance with MDE and federal guidelines for UST's, (b) monitoring well installation near UST's, (c) appropriate use and application of fertilizers and pesticides, and (d) chemical storage and disposal.
- 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

- Hancock 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 Town 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 Town 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.

U.S. Environmental Protection Agency, 2002, "Technical Factsheet on: Trichloroethylene", URL: http://www.epa.gov/safewater/dwh/t-voc/trichlor.html.

OTHER SOURCES OF DATA

Water Appropriation and Use Permit WA1994G016
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 Hancock
USGS Topographic 7.5 Minute Quadrangles for Hancock
Maryland Office of Planning 2000 Washington County Digital Land Use Map
Maryland Office of Planning 1996 Washington County Digital Sewer Map

FIGURES

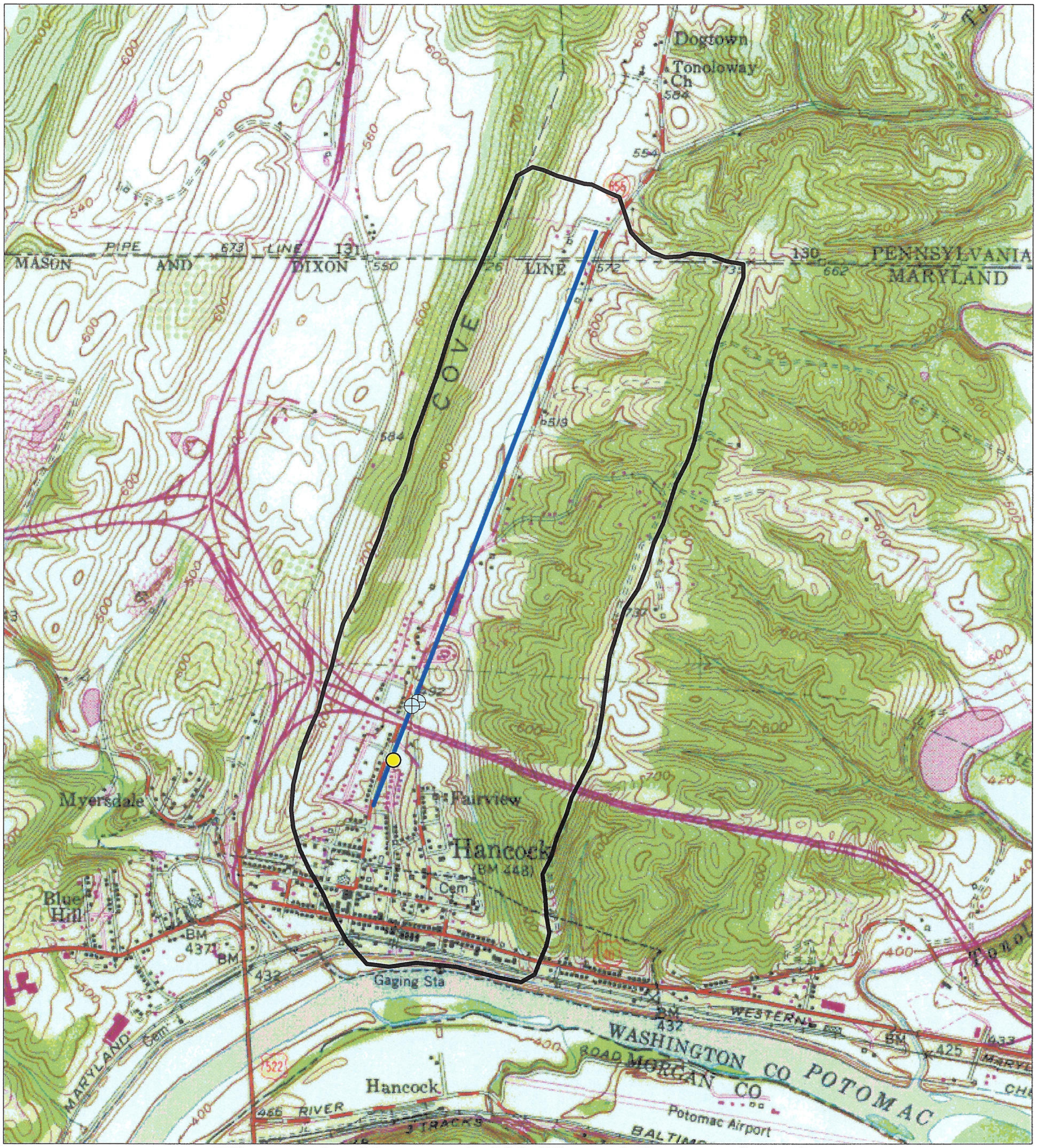

Figure 2. Hancock Wellhead Protection Area

Legend

⊕ Town Wells

Fracture Trace

Observation Well

Wellhead Protection Area

N

1000 0 1000 2000 Feet

Base Map: USGS 7.5' Quadrangle for Hancock

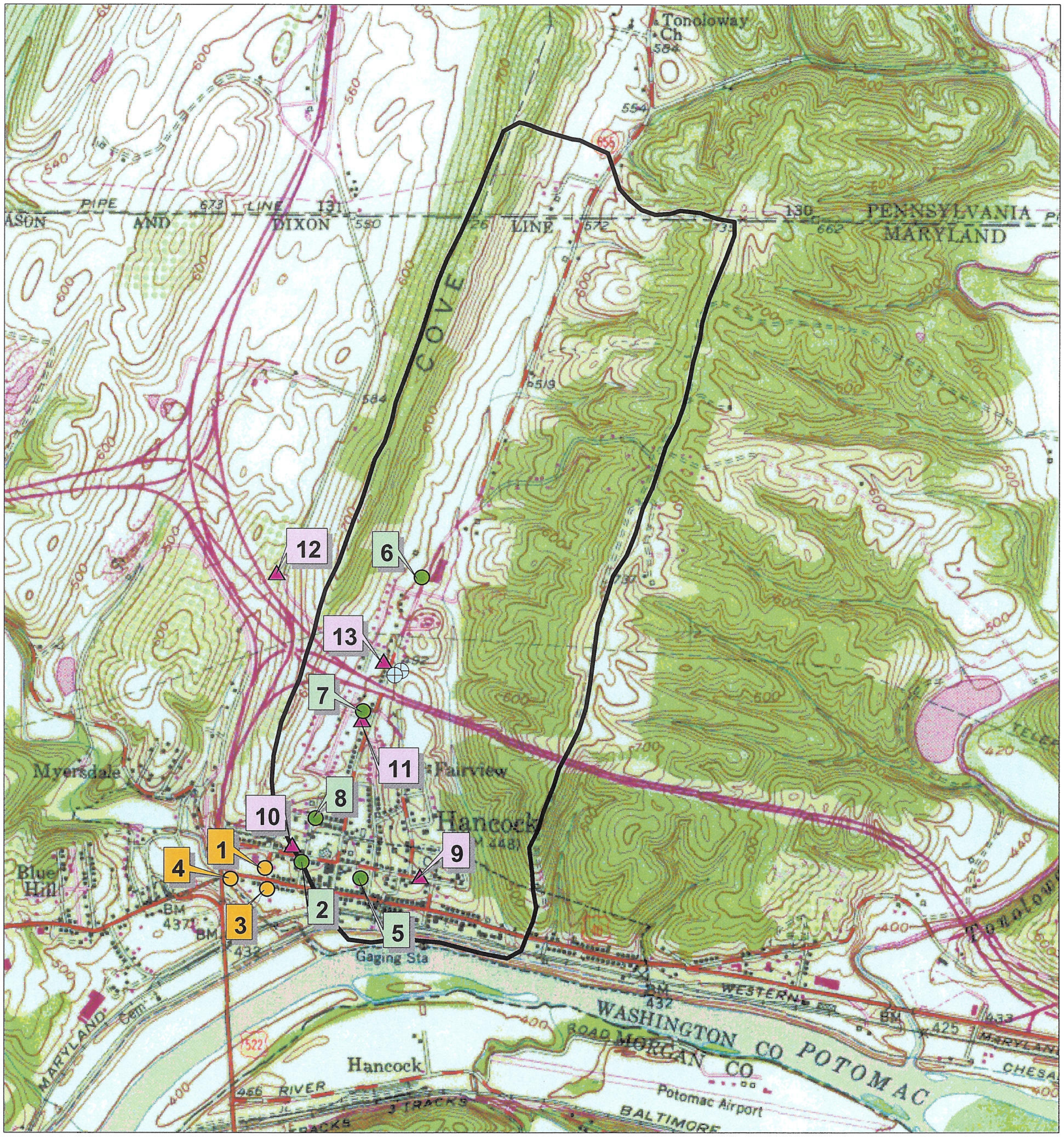

Fig 3. Hancock Wellhead Protection Area with Potential Contaminant Sources

Legend

- Controlled Hazardous Substance Generator (CHS)
- Underground Storage Tanks (UST)
  - Currently In Use
  - Permanently Out of Use
- Wells
- WHPA

N

1000 0 1000 2000 Feet

Base Map: USGS 7.5' Quadrangle for Hancock

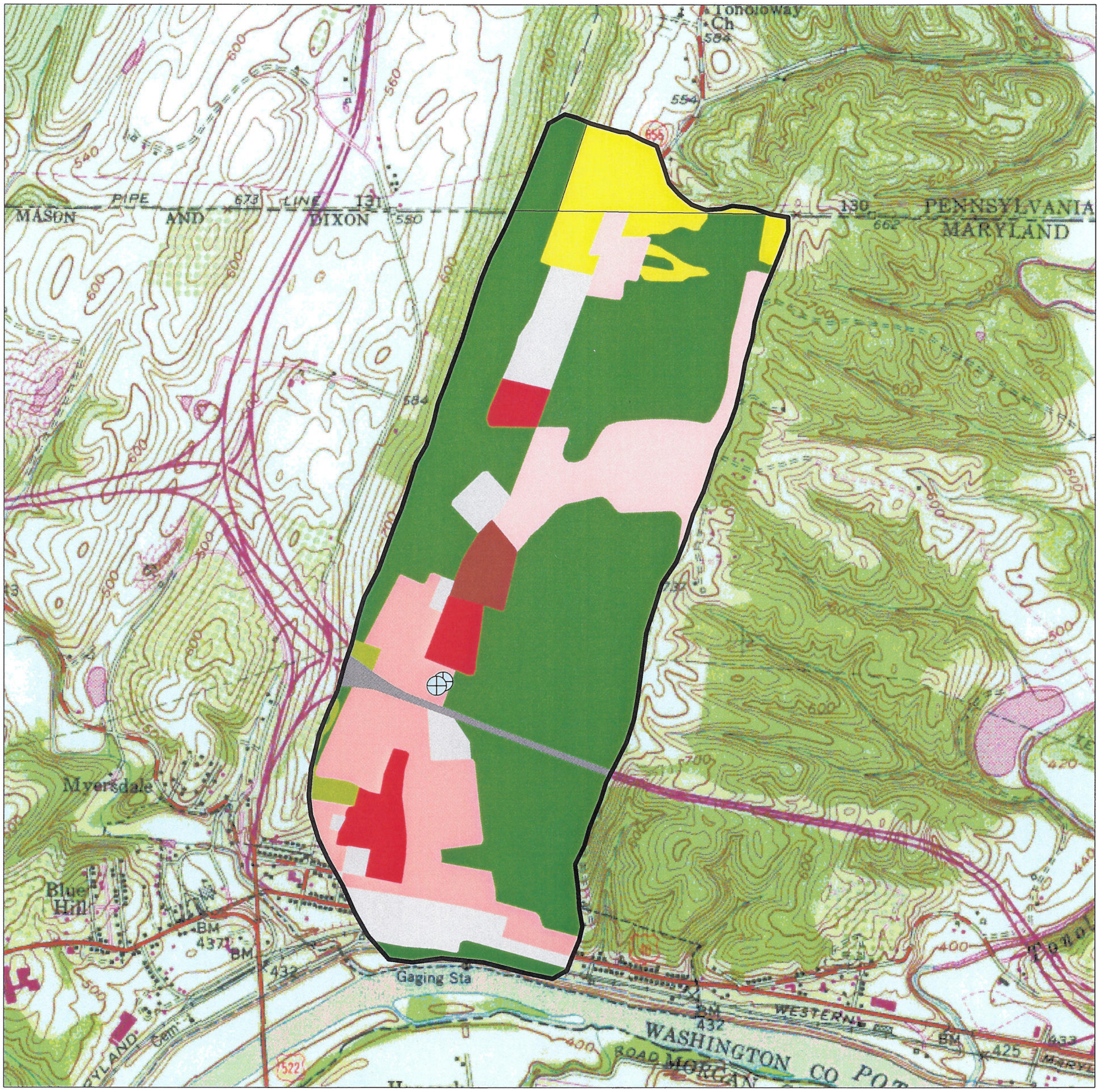

Figure 4. Hancock Wellhead Protection Area with Land Use

Legend

Town Wells

Wellhead Protection Area

Pennsylvania Land Use*

Cropland and Pasture

Forest

*(*Estimated from US EPA's Multi-resolution Land Cover)*

Washington County 2000 Land Use

Low Density Residential

Medium Density Residential

High Density Residential

Commercial

Industrial

Open Urban Land

Cropland

Pasture

Forest

1000 0 1000 2000 Feet

Base Map: USGS 7.5' Quadrangle for Hancock

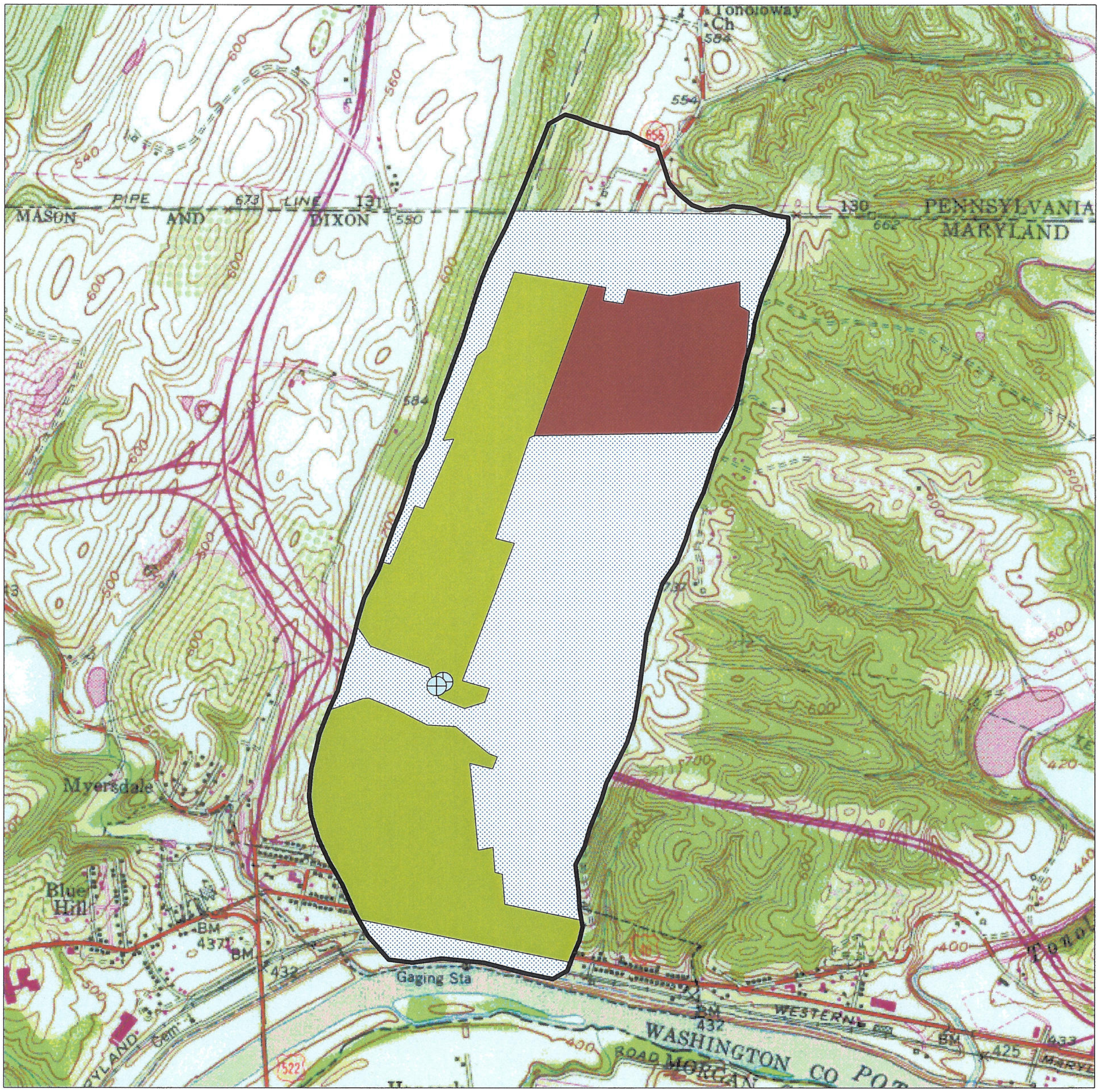

Figure 5. Hancock Wellhead Protection Area with Sewer Service Areas

Legend

Wells

Wellhead Protection Area

Sewer Service Areas*

Existing Service

Program Planned Area

Not Planned

*(*Coverage not available for Pennsylvania)*

N

1000 0 1000 2000 Feet

Base Map: USGS 7.5' Quadrangle for Hancock