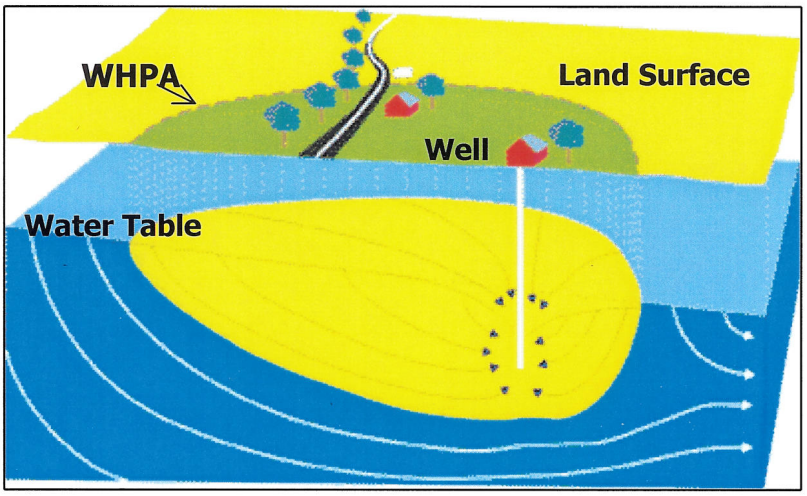
SOURCE WATER ASSESSMENT

FOR THE TOWN OF CHESTERTOWN

KENT COUNTY, MD



Prepared By
Water Management Administration
Water Supply Program
December 2003

MDE

TABLE OF CONTENTS

SUMMARY

The Maryland Department of the Environment's (MDE) Water Supply Program has conducted a Source Water Assessment for the Town of Chestertown. The major components of this report as described in Maryland's Source Water Assessment Plan (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 management of the assessment area conclude this report.

The sources of the Chestertown's water supply are an unconfined aquifer (Aquia) and a confined aquifer (Magothy) in the Coastal Plain. Seven wells are currently being used to pump the water out of these aquifers. The source water assessment area was delineated by the Water Supply Program using methods approved by the U. S. EPA.

Potential sources of contamination within the assessment area were identified based on MDE site visits, a review of MDE's databases and land use maps. Well information and water quality data were also reviewed. Figures showing sites of potential contamination land uses and sewer service areas within the Source Water Assessment Area. An aerial photograph of the well locations is enclosed at the end of the report.

The susceptibility analysis for Chestertown's water supply is based on a review of the water quality data, potential sources of contamination, aquifer characteristics, and well integrity. There are two sites within the source water assessment area where volatile organic compounds have contaminated the Aquia aquifer supplying water to the Town's wells. It was determined that Chestertown's water supply is susceptible to nitrate, volatile organic compounds and radiological compounds, but not susceptible to other inorganic compounds, synthetic organic compounds, or microbiological contaminants. The deeper well in the Magothy aquifer is susceptible to naturally occurring iron.

INTRODUCTION

The Town of Chestertown is located approximately 25 miles northeast of Annapolis in Kent County. The Town owns and operates its water supply system that serves a population of 4000. Currently, the water is being supplied by seven wells (Nos. 1 – 7) located at the southwest corner of Kent Street and Philosopher's Terrace (figure 1). The water is pumped from the wells and treated at a plant located in the vicinity of the wells. Another well (No.8) is currently not in use.

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. A review of the well data and sanitary surveys of the system indicates that all the wells except No.1 and 2 were drilled prior to 1973, when the State's well construction regulations went into effect, and may not meet current construction standards. Well Nos. 1 and 2 should meet construction standards for grouting and casing. Table 1 contains a summary of the well construction data.

SOURCE ID	SOURCE NAME	PERMIT NO	TOTAL DEPTH (ft)	CASING DEPTH (ft)	YEAR DRILLED
01	Chestertown 1	KE731097	430	378	1981
09	Chestertown 2	KE920249	63	43	1996
03	Chestertown 3	KE000894	74	47	1946
04	Chestertown 4	KE012008	81	46	1953
05	Chestertown 5	KE044404	127	40	1961
06	Chestertown 6	KE044405	120	40	1962
07	Chestertown 7	KE046439	116	37	1964

Table 1. Chestertown Well Information.

HYDROGEOLOGY

Chestertown's wells pump water from two Coastal Plain aquifers. Six wells (Well Nos. 2-7) pump water from the sediments of the Aquia Formation and one (Well No. 1) from the Magothy Formation. In the Chestertown area, the Aquia is an unconfined aquifer with the top of the aquifer about 10 feet above sea level and bottom about 148 feet below sea level. The Aquia aquifer consists of a fine to coarse, glauconitic quartz sand, which locally contains clayey layers, shell beds, cemented zones, and highly weathered zones (Drummond, 1998). The Magothy aquifer is confined in the Chestertown area with the top of the aquifer 324 feet and the bottom of the aquifer 380 feet below sea level. The Magothy aquifer consists of yellow-brown and light gray, fine to very coarse, quartz sand interbedded with gray to black, lignitic clay. It is overlain by the Mattawan confining unit which consists of dark to olive gray, silty clay to fine sand

(Drummond, 1998). According to the latest Maryland Geological Survey study of Kent County Coastal Plain aquifers (Drummond, 1998), Well No. 1 is screened in the Upper Patapsco aquifer. Earlier studies had assigned these sands to the Magothy Formation.

SOURCE WATER ASSESSMENT AREA DELINEATION

For ground water systems, a Wellhead Protection Area (WHPA) is considered to be the source water assessment area for the system. A WHPA was delineated for Chestertown's wells in 1992 in response to contamination in the vicinity of the well field. A 10-year time-of-travel zone using a combination of the EPA WHPA Code and the Florida method (volumetric equation) was delineated as the WHPA. A combination of the two methods for the delineation was used to address the variability in the ground water flow gradient and direction. Chestertown has a permitted daily average withdrawal of 375,000 gallons per day (gpd) from the Magothy and 600,000gpd from the Aquia aquifers. The WHPA delineation for both methods was based on the permitted daily average of 600,000 gpd for the Aquia. For the WHPA Code model this permitted quantity was divided equally among the 6 Aquia wells. A gradient of 0.005 ft/ft and ground water flow direction towards the southeast and porosity of 30% were used as input parameters in the WHPA Code. In addition, for the Florida method an aquifer thickness of 46 feet was used. The volumetric equation used for the Florida method is:

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

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

Maryland's Source Water Assessment Plan (MDE, 1999), recommends using EPA's WHPA Code for delineation of systems using a daily average of >10,000 gallons per day from unconfined Coastal Plain aquifers. The recommended method for systems using > 10,000 gpd from confined Coastal Plain aquifers is the Florida method (volumetric equation). The radius produced for the WHPA delineation conducted in 1992 using the Florida method was 2532 feet. Using the Florida method, the calculated radius for the Magothy aquifer pumpage was 2323 feet. Since this is less than the one delineated in 1992, the original WHPA delineation will be used for this system. A Zone 1 was added to the WHPA for the unconfined Aquia aquifer supply using the same parameters as before.

Delineation Zones

Zone 1: Zone 1 is the WHPA delineated using a 1-year time-of-travel (TOT) criterion. Zone 1 serves as the first zone of protection. The one-year criterion was selected base on the maximum known survival times of microbial organisms in ground water. The delineated Zone 1 WHPA is an egg- shaped area with a maximum diameter of 1300 feet.

Zone 2: Zone 2 is the WHPA delineated using a 10-year TOT criterion. It would take any chemical contaminant present at the Zone 2 boundary 10 years to reach the well (if it moves at the same rate as the ground water). Zone 2 provides adequate time for facilities outside the WHPA to address chemical contamination before it could reach the well. The Zone 2 WHPA is the combination of the results of the EPA WHPA Code model and Florida method delineations. The area of this WHPA is 427 acres.

POTENTIAL SOURCES OF CONTAMINATION

Potential sources of contamination are classified as either point of non-point sources. Examples of point sources of contamination are leaking underground storage tanks, landfills, ground water discharge permits, large scale feeding operations and Superfund sites. These sites are generally associated with commercial or industrial facilities that use chemical substances that may, if inappropriately handled, contaminate ground water via discrete point location. Non-point sources of contamination are associated with certain types of land use practices such as the use of pesticides, application of fertilizers or animal wastes, or septic systems that may lead to ground water contamination over a larger area. The WSP conducted a joint field survey of the WHPA with Maryland Rural Water staff in October 2002 after a discussion of potential contaminant sources in the area with Mr. Med Caple, Superintendent of Public Works.

Point Sources

A review of MDE contaminant databases as well as the field survey revealed several point sources of contamination in and adjacent to the WHPA. Figure 2 identifies Underground Storage Tanks (UST) sites, Controlled Hazardous Substance Generators (CHS), Ground Water Discharges (GWD), and a Leaking Underground Tank (LUST) site as potential point sources of contamination. Table 2 lists the facilities identified and their potential types of contaminants. The contaminants are based on generalized categories and often the potential contaminant depends on the specific chemicals and processes being used or which had been used at the facility. The potential contaminants are not limited to those listed. Potential contaminants are grouped as Volatile Organic Compounds (VOC), Synthetic Organic Compounds (SOC) and Heavy Metals (HM).

Several incidents of ground water contamination have occurred in the WHPA. In 1991 a leaking underground storage tank at the Kent & Queen Anne's County Hospital caused VOC contamination of ground water and resulted in the shutdown of Well No. 8 to prevent the contamination plume from entering the well field. Two tanks were removed and the site was remediated. During VOC monitoring for this contamination, high levels of tetrachloroethylene (PCE) were detected in several of the Town's wells. An investigation of the area around the wells, revealed that Park's Rug and Dry Cleaners as being a possible source of the PCE. Extremely high levels of this VOC were detected at this site. A floor drain at the facility was the probable conduit for the PCE to the ground water. The site was investigated by MDE's Waste Management and the floor drain sealed. In addition, a heating oil UST was also removed from the site.

ID	Type	Site Name	Address	Potential Contaminant	Status
1	UST	College Heights Mobil	513 Washington Ave.	VOC	6 tanks, 7 removed
2	LUST	Kent & Queen Anne's County Hospital	100 Brown Street	VOC	1 tank, 2 removed
3	UST	Chestertown Middle School	400 E. Campus Ave.	VOC	1 tank, 1 removed
4	UST	Washington College	300 Washington Ave.	VOC	2 tanks, 13 removed
5	UST	Garnett Elementary School	320 Calvert St.	VOC	1 tank
6	UST	Central Office	215 Washington Ave.	VOC	2 tanks, 1 removed
7	UST	Super Soda Center	302 S. Maple Ave.	VOC	4 tanks
8	UST	Bennett's II	301 S.Maple Ave.	VOC	Several Tanks
9	UST	Bennett's II	212 S. Maple Ave.	VOC	Several Tanks
10	CHS	Park Rug & Dry Cleaners Corp	107 N. Cross St.	VOC	Active, tank removed
11	UST	Chesapeake Bank & Trust Co.	245 N. High St	VOC	1 tank
12	UST	Chestertown Bank of Maryland	211-213 N. High St.	VOC	1 tank
13	CHS	Chestertown Wire Center	119 Washington Ave.	VOC, SOC, HM	Active
14	UST	Chestertown Wire Center	119 Washington Ave.	VOC	1 tank, 2 removed
15	AST	Chestertown Utilities	405 Kent St.	VOC	2 tanks, gasoline pumps
16	CHS	Lamotte Chemical	US Route 213 N	SOC	Active
17	CHS	Geno's Auto Service	807 Washington Ave.	VOC, HM	Active
18	GWD	Geno's Auto Service	807 Washington Ave	VOC	Discharge Permit

Table 2. Potential Contaminant Point Sources within the Chestertown WHPA (see figure 2 for locations).

Non-Point Sources

The Maryland Office of Planning's 2000 digital land use map for Kent County was used to determine the predominant types of land use in the WHPA (figure 3). A large portion of the WHPA is made of residential land (71%) followed by commercial/institutional (28%).

LAND USE CATEGORIES	TOTAL AREA (acres)	PERCENTAGE OF WHPA
Low Density Residential	28.43	6.66
Medium Density Residential	253.91	59.59
High Density Residential	19.34	4.53
Commercial/Institutional	119.36	27.97
Cropland	0.79	0.02
Water	1.30	0.30
Wetlands	3.69	0.86
Feedlot	0.32	0.07
Total	426.85	100.00

Table 3. Land Use Summary for the Chestertown WHPA (Zone 2).

Residential areas may be sources of nitrates and SOCs if fertilizers and pesticides are not used carefully for lawns and gardens. Commercial areas are associated with facilities that may have point sources of contamination as described earlier. According to the Maryland Office of Planning's 1995 Kent County Sewer Map, the entire Chestertown WHPA has sewer service, and should not have any onsite sewer waste disposal.

WATER QUALITY DATA

Water Quality data was reviewed from the Water Supply Program's database and system files for Safe Drinking Water Act 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 at or greater than 50% of a MCL, this assessment will describe the sources of such a contaminant and, if possible, locate the specific sources which are the cause of the elevated contaminant level. All data reported is from the finished (treated) water unless otherwise noted. The treatment currently used at Chestertown is disinfection, aeration and filtration for iron removal, and pH adjustment for corrosion control.

A review of the monitoring data since 1993 for Chestertown's water supply indicates that it meets the current drinking water standards. The water quality sampling results are summarized in Table 4.

Nitrate		SOCs		VOCs		IOCs (except nitrate)		Radionuclides	
No. of Samples Collected	No. of samples > 50% MCL	No. of Samples Collected	No. of samples > 50% MCL	No. of Samples Collected	No. of samples > 50% MCL	No. of Samples Collected	No. of samples > 50% MCL	No. of Samples Collected	No. of samples > 50% MCL
14	1	5	0	46	13	7	0	4	1

Table 4. Summary of Water Quality Samples for Chestertown's Water Supply

Inorganic Compounds (IOCs)

Nitrate was the only IOC detected above 50% of the MCL in Chestertown's water supply since 1993. The MCL for nitrate is 10 ppm. It was detected one time at 6.29 ppm on 11-25-97.

Volatile Organic Compounds (VOCs)

Several VOCs above 50% of the MCL have been detected in the Chestertown's water supply since 1990. Table 5 lists the VOCs that were detected and the location of the where the sample was taken (at a specific well or finished water). According to State and federal drinking water regulations, MCLs are required to be met in the finished water not in individual wells.

SAMPLE SOURCE	CONTAMINANT NAME	MCL (ppm)	SAMPLE DATE	RESULT (ppm)
Well 1	TETRACHLOROETHYLENE	5	16-Aug-90	3.1
Well 4	TETRACHLOROETHYLENE	5	6-Feb-92	24
Well 2	TETRACHLOROETHYLENE	5	6-Feb-92	30
Finished Water	TETRACHLOROETHYLENE	5	29-Apr-92	2.9
Finished Water	TETRACHLOROETHYLENE	5	3-Jun-92	3.4
Finished Water	TETRACHLOROETHYLENE	5	24-Jul-92	4.1
Finished Water	TETRACHLOROETHYLENE	5	3-Feb-93	2.9
Finished Water	TETRACHLOROETHYLENE	5	10-Mar-94	3
Well 2	TETRACHLOROETHYLENE	5	26-Jul-94	38
Well 4	TETRACHLOROETHYLENE	5	26-Jul-94	90
Well 4	TRICHLOROETHYLENE	5	26-Jul-94	4
Finished Water	TETRACHLOROETHYLENE	5	11-Aug-94	4.5
Finished Water	TETRACHLOROETHYLENE	5	2-Nov-94	3.9
Well 2	TETRACHLOROETHYLENE	5	12-Dec-94	26
Well 4	TETRACHLOROETHYLENE	5	12-Dec-94	25
Well 2	TETRACHLOROETHYLENE	5	21-Dec-94	83
Well2	TRICHLOROETHYLENE	5	21-Dec-94	3
Well 4	TETRACHLOROETHYLENE	5	21-Dec-94	23
Finished Water	TETRACHLOROETHYLENE	5	21-Dec-94	6
Finished Water	1,1,2-TRICHLOROETHANE	5	20-Mar-96	3.5
Finished Water	TRICHLOROETHYLENE	5	6-May-98	4.2
Finished Water	TETRACHLOROETHYLENE	5	7-Jun-01	2.6

Table 5. VOCs above 50% of the MCL in Chestertown's water supply.

Synthetic Organic Compounds (SOCs)

No SOCs detected above 50% of the MCL were detected in Chestertown's water supply since 1993. The only SOCs detected were di (2-ethylhexyl) phthalate and dalapon. Phthalate was detected at 2.48 and 1 ppb, respectively in November 1995 and February 2002.The MCL for phthlate is 6 ppb. Phthalate was found in laboratory blanks in samples collected both the days and therefore these results do not represent water quality. Dalapon was detected at 0.05 ppb in a sample collected on January 29, 1998. The MCL for dalapon is 200 ppb.

Radionuclides

Short-term gross alpha was the only radionuclide detected above 50% of the MCL. It was detected at 8.44 picoCuries per liter (pCi/L) on August 27 1998. The MCL for gross alpha is 15 pCi/L. Long term gross alpha and gross beta were detected two and three times respectively between 1997 and 2002 at levels well below their respective MCLs of 15 and 50 pCi/L. Short term gross beta was also detected once at12.14 pCi/L on August 27, 1998.

Microbiological Contaminants

Raw water samples were collected after precipitation of at least half an inch, from Well Nos. 3 – 7 for bacteriological testing to assist in determining whether these sources are Ground Water Under the Influence of Surface Water. Raw water bacteriological tests were conducted for Well No.2 prior to its approval for public supply. No total or fecal coliform was detected in the raw water for any of the Town's wells.

SUSCEPTIBILITY ANALYSIS

Six of Chestertown's wells obtain water from an unconfined aquifer. In general, water supplies in unconfined aquifers are susceptible to contamination from land use activities in the wellhead protection area. Well completion reports indicate the presence of thin clay layers and lenses between the surface and the well screen. The clayey sediments may inhibit the infiltration of some of the surface contaminants into the aquifer. Continued routine monitoring of contaminants is essential in assuring a safe drinking water supply. The aquifer that supplies water to Well No. 1 is confined and based on the well completion reports several confining beds overlie it. These confining layers would prevent the flow of any surface contamination into the aquifer. Only direct injection into the aquifer from point sources within the WHPA like underground injection wells or improperly abandoned wells could cause a potential contamination threat to the supply. The information that was used to conduct the susceptibility analysis is as follows: (1) available water quality data (2) presence of potential contaminant sources in the WHPA (3) aquifer characteristics (4) well integrity and (5) the likelihood of change to the natural conditions. The susceptibility of Chestertown's water supply to the various contaminant groups in shown in table 6 at the end of this section.

Inorganic Compound (IOCs)

Nitrates have been detected in the Chestertown water supply since 1993 at levels below the MCL except once in 1996 at 50% of the MCL. In the past three years there appears to be an increase in nitrate levels in the water supply (figure 4). Sources of nitrate can be traced to land use. No other regulated IOCs above 50% of the MCL have been detected in the Chestertown water supply.

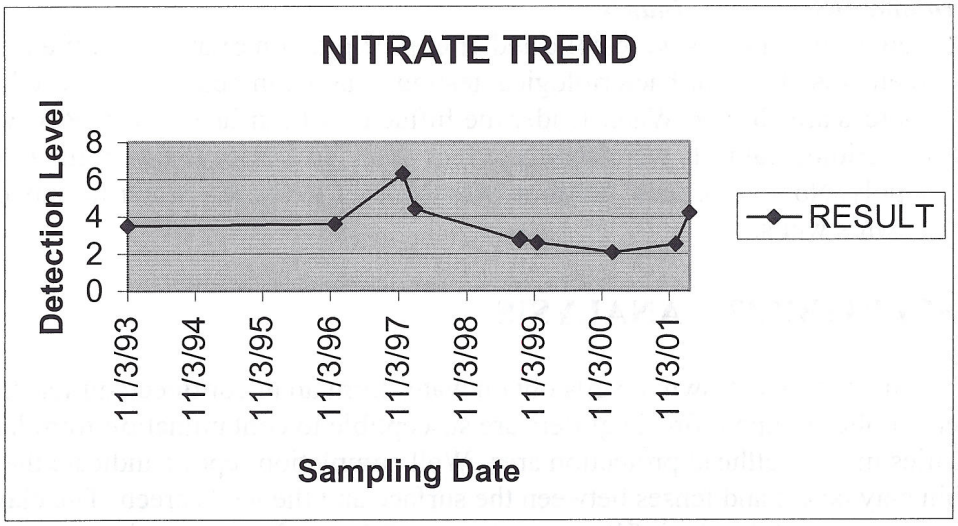


Figure 4. Nitrate Trend in Chestertown's Water Supply.

Based on the above analysis, Chestertown's water supply **is** susceptible to contamination by nitrate but **not** susceptible to contamination by other IOCs. It may be susceptible to iron since the system has treatment for removal of iron from raw water.

Volatile Organic Compounds (VOCs)

Several VOCs above 50% of the MCL were detected in Chestertown's water supply (Table 5). The VOCs most frequently detected was tetrachloroethylene (PCE) which is a solvent used in dry cleaning. Also detected were trichlorothylene, and 1,1, 2-trichlorothane. These additional solvents are used in degreasing, dry cleaning and for cleaning equipment. As described earlier, a dry cleaning facility located within the WHPA had a floor drain that provided a direct conduit for the VOCs to ground water. The floor drain has been sealed and a UST on site was also removed. The highest PCE level peaked at 90 ppb in Well No. 4 in July of 1994. No recent raw water results are available to determine if levels have improved since 1994. Finished water tests following treatment indicate that all MCLs are being met. In addition, Well No. 8 was shut off in 1992 when there was a LUST at the county hospital upgradient of the well to prevent the contaminant plume from reaching town's well field. Due on site remediation and shutting off Well No.8 the contaminant plume did not reach the Town's well field.

Based on the above analysis, Chestertown's water supply **is** susceptible to VOC contamination.

Synthetic Organic Compounds (SOCs)

No SOCs above 50% of the MCL were detected in Chestertown's water supply. The only SOC that was detected was dalapon, which is an herbicide. It has an MCL of 200 ppb and was detected only one time (Jan 1998) at an extremely low level of 0.05 ppb. Since 1995 no other pesticides have been detected in the water supply.

There is only one potential point source of SOC in the WHPA and there is insignificant cropland use in the WHPA (table 3). Based on the above analysis, Chestertown's water supply is **not** susceptible to SOC contamination.

Radionuclides

Short-term gross alpha was the only radionuclide that was detected above 50% of the MCL in the Chestertown's water supply. Gross alpha and gross beta were also detected but at levels well below the MCL. The presence of these contaminants is attributed to decay of naturally occurring minerals like uranium in the aquifer sediments especially in the deeper Magothy aquifer, where high levels of radium have been detected in other water supplies.

Based on the above analysis the Chestertown water supply **is** susceptible to the other radionuclides.

Microbiological Contaminants

Based on coliform sampling data and the aquifer characteristics, the Chestertown water supply is **not** susceptible to any microbiological contaminant present on the surface including *Giardia* and *Cryptosporidium*.

CONTAMINANT TYPE	Are Contaminant Sources present in the WHPA?	Are Contaminants detected in WQ samples at 50% of the MCL	Is Well Integrity a Factor?	Is the Aquifer* Vulnerable?	Is the System Susceptible to the Contaminant
Nitrate	YES	YES	NO	YES	YES
Inorganic Compounds (except nitrate)	NO	NO	NO	YES	NO**
Volatile Organic Compounds	YES	YES	NO	YES	YES
Synthetic Organic Compounds	NO	NO	NO	YES	NO
Radionuclides	YES	YES	NO	YES	YES
Microbiological Contaminants	NO	NO	NO	NO	NO

Table 6. Susceptibility Chart for Chestertown's Water Supply

**Aquia except for radionuclides*

*** May be susceptible to iron*

MANAGEMENT OF THE WHPA

The following itemize recommendations for protecting and minimizing the risk of contamination of the Town's water supply.

Form a Local Planning Team

- The team should represent all the interests in the community. The Town of Chestertown should take the lead seeking input from local planning agencies, local businesses and residents. Due to past contamination of the town's water supply protection of the water supply should be a priority. The majority of the WHPA is already developed. An emphasis on education and management of the use and storage of solvents would seem appropriate, especially in light of current contaminants in the wells.
- MDE has grant money available for Wellhead Protection projects.

Increase Public Awareness

- The Consumer Confidence Report should include a summary of this report and information that this report is available to the general public through their county library, or by contacting the Town or MDE.
- Conduct educational outreach to facilities that may present potential contaminant sources. Important topics include: (a) compliance with MDE and federal guidelines for USTs, (b) best management practices, (c) chemical storage and (d) appropriate use and application of fertilizers and pesticides.
- Placing signs at the WHPA boundaries is a good way to make the public aware of protecting their source of water supply. The County has placed signs at WHPA boundaries along county roads.

Conduct Monitoring

- Continue sampling as required by the Safe Drinking Water Act.
- Annual sampling for microbiological contaminants of untreated supply is a good check on well integrity.
- Sampling of individual wells for VOC contamination at annual frequency.
- The Town may want to consider installing sentry wells in locations downgradient of particular contaminant sources.

Plan and Zone to Protect the Water Sources

- Chestertown should consider a local ordinance for protection of its water supply. The applicability of an overlay zoning ordinance, such as the *State's Model Wellhead Protection Ordinance* should be considered in light of current and proposed land uses.

Purchase Conservation Easements or Property

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

Prepare Contingency Plan

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

Changes in Sources

- Any increase in pumpage or the addition of new wells to the system will require revision of the WHPA since it is affected by pumpage. It is recommended the system contact the MDE Water Supply Program when an increase in pumpage is applied for or when new proposed wells are being considered.

Manage Potential Contaminant Sources and Wells

- Conduct a detailed survey to ensure that there are no other potential or historical sources of contamination within or adjacent to the WHPA.
- Water operation personnel should have a regular inspection and maintenance program for the wells to ensure their integrity and to protect the aquifer from surficial contamination.
- Frequently monitor the gasoline dispenser, and the above ground storage tank in the well field to ensure that no product spills or leaks on to the ground. If any of the piping is underground, it should be double-walled.

REFERENCES

Drummond, D. D., 1998, Hydrogeology, Simulation of Ground-Water Flow, and Ground-Water Quality of the Upper Coastal Plain Aquifers in Kent County, Maryland: Maryland Geological Survey Report of Investigations No. 68, 76 p.

Maryland Department of the Environment, Water Supply Program, 1999, Maryland's Source Water Assessment Plan, 36 p.

Tompkins, M. D., Cooper, B. F., and Drummond, D. D., 1994, Ground-Water and Surface-Water Data for Kent County, Maryland: Maryland Geological Survey Basic Data Report No. 20, 155 p.

United States Environmental Protection Agency, Office of Ground-Water Protection, 1987, Guidelines for Delineation of Wellhead Protection Areas.

SOURCES OF DATA

Water Appropriation and Use Permit No. KE 1970G004, KE 1992G011
Public Water Supply Inspection Reports
Monthly Operating Reports
Monitoring Reports
MDE Water Supply Program Oracle Database
MDE Waste Management Sites Database
Department of Natural Resources Digital Orthophoto Quarter Chestertown 3-25-95
USGS Topographic 7.5Minute Quadrangle – Betterton
Maryland Office of Planning 1997 Kent County Land Use Map
Maryland Office of Planning 1995 Kent County Sewer Map

FIGURES

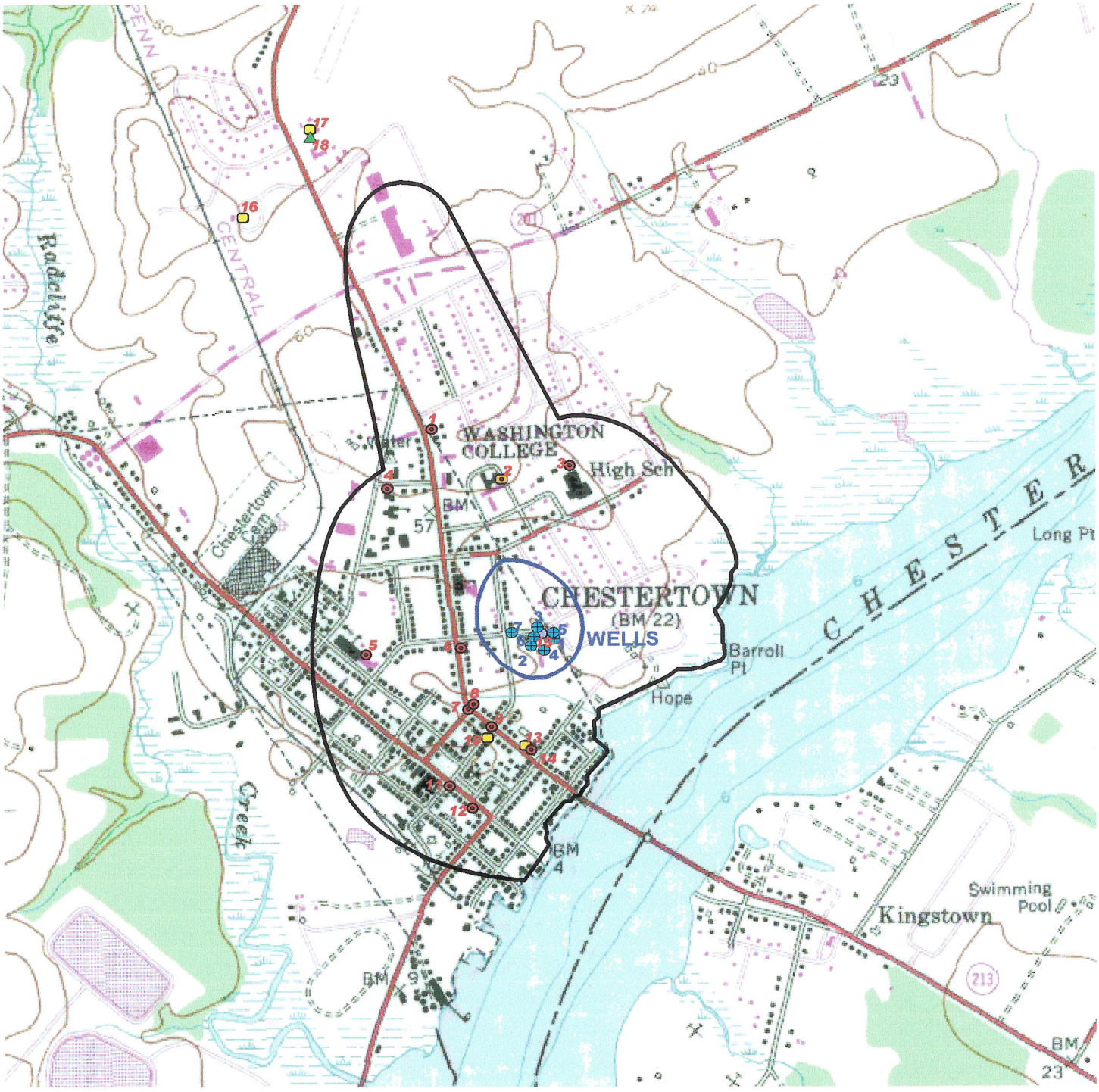


Figure 2. Chestertown Wellhead Protection Area with Potential Contaminant Sources

LEGEND

- Underground Storage Tank
- Leaking UST
- Above ground storage tanks
- Ground Water Discharge
- CHS Generators

Wellhead Protection Area

- Zone 1
- Zone 2
- Supply Well

1500 0 1500 Feet

N

Base Map: USGS 7.5 Minute Chestertown Topgraphic Quadrangle

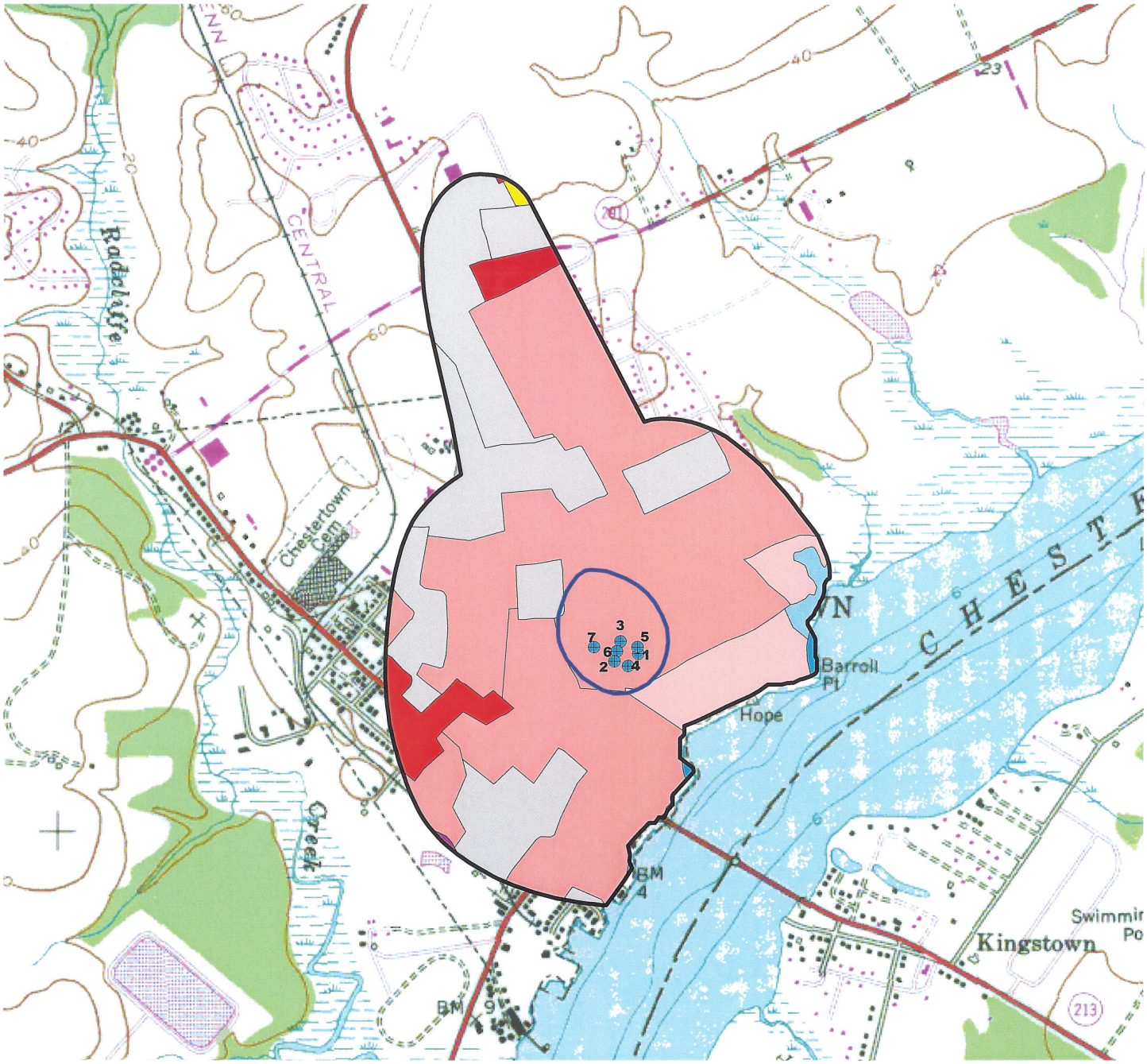


Figure 3. Land Use Map of the Chestertown Wellhead Protection Area

Source: Maryland Office of Planning 2000 Kent County Land Use Map