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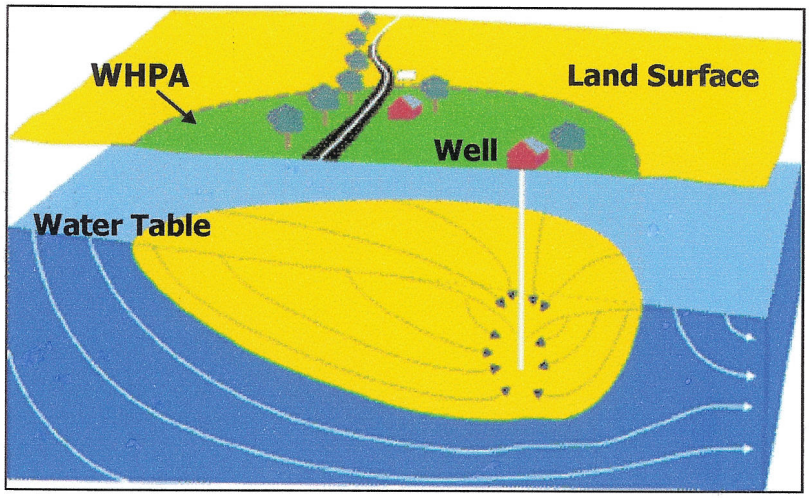
SOURCE WATER ASSESSMENT

FOR THE CITY OF ABERDEEN

HARFORD COUNTY, MD



Prepared By
Maryland Department of the Environment
Water Management Administration
Water Supply Program
September 2000

MDE

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SUMMARY

The Maryland Department of the Environment Water Supply Program (WSP) has conducted a Source Water Assessment for the City of Aberdeen. The required 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 protecting the drinking water supply conclude this report.

The source for the Aberdeen water supply is a shallow, unconfined aquifer in the Coastal Plain known as the Talbot Formation. The City currently uses eleven wells to obtain their drinking water. Recently, the City purchased the Chapel Hill Surface Water Treatment Plant from the U.S. Army. This assessment is limited to the ground water supply only. The source water assessment area for the Aberdeen wells was delineated by the WSP using U.S. EPA approved methods specifically designed for each source.

Potential sources of contamination within the assessment area were identified from site visits, database reviews, and land use maps. Well information and water quality data were also reviewed. Figures showing land use and potential contaminant sources within the source water assessment area and an aerial photograph of the well locations are enclosed at the end of the report.

The susceptibility analysis of Aberdeen's water supply was based on the review of the water quality data, potential sources of contamination, aquifer characteristics, and well integrity. It was determined that Aberdeen's water supply is susceptible to volatile organic compounds (e.g. petroleum), but is not susceptible to contamination by nitrates, synthetic organic compounds (e.g. pesticides), radionuclides and microbiological contaminants.

INTRODUCTION

The City of Aberdeen is located approximately 4 miles southwest of Havre De Grace in Harford County (Figure 1). The Aberdeen Proving Ground (APG) Army Base adjoins the City boundary on the southeast. The City's water supply system serves a population of 13,500 and has about 4,500 connections. The water is currently supplied by eleven wells. Recently, the City purchased the Chapel Hill Surface Water Treatment Plant from the U.S. Army. This assessment is limited to the ground water supply only. Figure 1 shows the locations of the supply wells.

WELL INFORMATION

A review of the well completion reports and sanitary surveys indicate that Wells 2R and 5 were drilled prior to the implementation of the State's well construction regulations in 1973. The remainder of the wells were drilled after 1973 and meet the current well construction standards. Table 1 is a summary of the well construction data. The depth unit is in feet and the well yields are in gallons per minute (gpm).

PLANT	SOURCE NAME	PERMIT	TOTAL DEPTH	CASING DEPTH	WELL YIELD	AQUIFER
1	Aberdeen 1R	HA-73-6528	72	43	211	Quaternary System
1	Aberdeen 2R	HA-01-0406	61	39	190	Quaternary System
1	Aberdeen 3R	HA-94-0825	63	40	175	Quaternary System
1	Aberdeen 4	HA-02-8021	55	28	N/A	Quaternary System
1	Aberdeen 4R	HA-94-1635	60	35	185	Quaternary System
1	Aberdeen 5	HA-02-8020	54	27	143	Quaternary System
1	Aberdeen 6R	HA-93-0090	50	32	53	Quaternary System
1	Aberdeen 7	HA-73-4541	66	51	178	Quaternary System
1	Aberdeen 8	HA-73-4540	80	50	220	Quaternary System
1	Aberdeen 9	HA-73-4543	68	53	100	Quaternary System
1	Aberdeen 10	HA-73-4542	73	58	70	Quaternary System
1	Aberdeen 11	HA-81-1140	71	50	75	Quaternary System

Table 1. Aberdeen Well Information

Original Wells 1, 2, 3, and 6 were located inside small pump houses and have been properly abandoned and sealed. Replacement Wells 1R, 2R, 3R, and 6R were all drilled adjacent to and outside of the corresponding pump houses. Original Well 4 remains on-line as an emergency back-up to the distribution. Well 4 was replaced by Well 4R as a primary production well. Well 11 is located outside and behind the Water Treatment Plant. Wells 7-10 are located in pump houses on the APG property.

HYDROGEOLOGY

Aberdeen's wells draw water from the Talbot Formation which is a part of the Coastal Plain sediments of Harford County. The Talbot Formation is within the Quaternary System and functions as an unconfined aquifer in this area. It consists of a shallow silt and

clay facies, and a deeper gravelly sand facies, interbedded with dark clay layers (Drummond and Blomquist, 1993). The lithology of the Coastal Plain sediments in Harford County is extremely variable and aquifer boundaries do not coincide with formation boundaries. Hence, in a recent Maryland Geological Survey (MGS) study of the Coastal Plain aquifers of Harford County, the Coastal Plain sedimentary sequence was divided into four aquifers and three confining units (Drummond and Blomquist, 1993). From the shallowest to the deepest the aquifers were designated numbers 1, 2, 3 and 4. They are separated by confining units 1, 2 and 3. Based on their depths and locations the City's wells were determined to be in aquifer 2, which is overlain by semi-confining unit 1.

Based on the MGS study, the average thickness of aquifer 2 in the Aberdeen area is 45 feet. Semi-confining unit 1 above the aquifer has an estimated thickness of 1 foot and a hydraulic conductivity of 0.1 ft/day. The transmissivity of aquifer 2 is 190,000 gallons per day per foot (25,400 ft^2 / day). The ground water flow direction is towards the southeast at an average gradient of 0.003. A porosity of 30% was estimated for the aquifer (Fetter, 1988).

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. According to Maryland's Source Water Assessment Plan document approved by EPA (MDE, 1999), systems using > 10,000 gallons per day (gpd) located in unconfined Coastal Plain aquifers are to be delineated using EPA's WHPA Code ground water model. WHPAs for the Aberdeen wells were originally delineated in 1995 by MDE as part of a Wellhead Protection Plan for the City of Aberdeen. The permitted daily average pumpage in 1995 was 2.0 million gallons per day (267,380 ft^3/day). Since the wells are not metered individually, the original delineation was conducted using a daily average quantity of 200,000 gpd (26,738 ft^3/day) for each of the ten wells. Since the wells in Aberdeen are concentrated in two separate areas that are approximately 0.9 miles apart, each area was modeled separately.

Based on ground water level measurements taken by the Army Corps of Engineers, the down-gradient limits of the original WHPA were expanded slightly southward and westward for this assessment report (Figure 2). Additionally, the City of Aberdeen has added Well 11 to the system as a production well. The current daily average pumpage for Aberdeen from the MDE Water Appropriation and Use Permit has remained at 2.0 million gpd (267,380 ft^3/day). Dividing the pumpage equally among the 11 wells results in each well pumping a daily average quantity of 181,818 gpd (24,307 ft^3/day). The WHPA was modified slightly from the original report to account for Well 11.

Delineation Zones **(see Figure 2)**

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 based on the maximum survival times of microbial organisms in ground water. Two Zone 1 WHPAs were produced for the City's wells (Figure 2). The WHPAs are mostly rectangular in shape and have a combined area of 259.7 acres (Figure 2).

Zone 2: Zone 2 is the WHPA delineated using a 10-year TOT criterion. It would take any contaminant present at the Zone 2 boundary 10 years to reach the well (if it moves at the same rate as the ground water), using the permitted quantity. Zone 2 provides adequate time for facilities outside the WHPA to address chemical contamination before it reaches the wells.

The Zone 2 WHPAs produced for each well are mostly rectangular in shape and adjacent to each other. Therefore, they were combined to form one larger WHPA (Figure 2). The updip (north) side of the WHPA was terminated at a watershed divide, which is north of the aquifer 2 boundary (Drummond and Blomquist, 1993). This provides a conservative WHPA with greater protection for the wells. The Zone 2 WHPA has an area of 1,613.3 acres (Figure 2).

POTENTIAL SOURCES OF CONTAMINATION

For this assessment, MDE Waste and Water Management databases were reviewed, staff consulted, and field inspections conducted, to identify potential sources of contamination in and around the Aberdeen WHPA. In addition, on May 25, 2000, MDE staff completed a field survey of the Aberdeen WHPA and wells, and interviewed the Assistant Superintendent of the Aberdeen Water Treatment Plant, Mr. Paul Visser regarding any water quality concerns and potential ground water contamination sources in the area. The primary water quality concern for this system is from petroleum-related contaminants. This will be discussed later in the report.

Potential contamination sources that were investigated for this WHPA include: underground storage tanks (USTs), leaking underground storage tanks (LUSTs), controlled hazardous substance generators (CHS), ground water discharge permits (GWDP), ground water contamination sites, solid waste facilities, and pesticide dealers. Miscellaneous sites (MISC) include commercial buildings with chemical storage, vehicle maintenance facilities, and manufacturing or industrial facilities that discharge potential contaminants from their operations. Table 2 lists the applicable facilities identified within the Aberdeen WHPA and their potential sources of contaminants. The potential contaminant groups shown in Table 2 are volatile organic compounds (VOCs) and heavy metals (HM).

ID	TYPE	SITE NAME	ADDRESS	POTENTIAL CONTAMINANT
1	LUST	W.F. Bouzarth II/Aberdeen Outdoor	606 S. Philadelphia Blvd.	VOC
2	LUST	Harco Distributors	618 Old Philadelphia Rd.	VOC
3	LUST,CHS	Hinder Ford Inc.	505 S. Philadelphia Blvd.	VOC, HM
4	LUST	J.P. Chevrolet	429 S. Philadelphia Blvd.	VOC
5	LUST	Susquehanna Bank	201 W. Belair Ave.	VOC
6	LUST	McCullough Building	105 W. Belair Ave.	VOC
7	UST	Southland 7-Eleven	602 S. Philadelphia Blvd.	VOC
8	UST	Mobil (formerly Citgo)	607 S. Philadelphia Blvd.	VOC
9	UST	Conits Building	33 W. Belair Ave.	VOC
~~10~~ Removed City purchased the property	~~UST~~	~~Clausaen Property~~	~~25 S. Philadelphia Blvd.~~	~~VOC~~
11	UST,CHS	Exxon	7 N. Philadelphia Blvd.	VOC, HM
12	UST	Getty Gas and Grocery	409 W. Belair Ave.	VOC
13	CHS	Valet Services	34 N. Parke St.	VOC
14	CHS	Hinder Motors, Inc.	317 S. Philadelphia Blvd.	VOC, HM
15	CHS	Sunrise Cleaners	22 N. Howard St.	VOC
16	CHS	Sun Cleaners	11 Aberdeen Shopg. Ctre.	VOC
17	CHS	Lumber Yard	215 S. Philadelphia Blvd.	VOC, HM
18	CHS	Starlight Cleaners	113 W. Belair Ave.	VOC
19	GWDP	Ferrell Fuel Co.	607 Old Philadelphia Rd.	VOC
20	MISC	Davis Concrete	635 Old Philadelphia Rd.	VOC, HM
21	MISC	Auto Zone	232-238 S. Philad. Blvd.	VOC, HM
22	MISC	Eastwood Auto Repair	535 S. Philadelphia Blvd.	VOC, HM
23	MISC	Auto Mart	630 S. Philadelphia Blvd.	VOC, HM
24	MISC	Havre De Grace Metal Fabricators	200 Old Post Rd.	VOC, HM

Table 2. Potential Contaminant Point Sources Within the Aberdeen WHPA (see Figure 2)

The groups are based on generalized categories and often the potential contaminant depends on the specific chemicals and processes being used at the facility. The potential contaminants for an activity may not be limited to those listed. There may be additional unidentified sites within the WHPA that are currently not inventoried. Additional sites that are located outside the WHPA Zone 2 boundaries were not included in the contaminant source inventory. The list of sites in Aberdeen is far too numerous to describe in detail. Some of the more notable sites are briefly described in the appendices of this report. For additional information on any of the facilities listed, the reader may contact the specific programs within the MDE Waste Management Administration.

There are numerous commercial establishments to the north of the wells along MD Route 40 that collectively pose a significant risk to the water quality of the wells. As shown in Figure 2, there are several sites within the Zone 1 WHPA, that could potentially contaminate the nearby supply wells. Brief descriptions of actions taken at many of these sites can be found in Appendix A.

A field inspection was conducted within and near the WHPA to determine the potential of any unpermitted ground water discharges (e.g. open floor drains) to the

shallow Coastal Plain aquifer. Several commercial and industrial facilities were inspected. The facilities that received notice of violations are shown on Table 3. The current compliance status for each facility is also summarized.

UIC NO.	FACILITY NAME	ADDRESS	COMPLIANCE STATUS
1995-0213b	R&K Automotive Services	309 W. Belair Ave.	Discharge eliminated. Drain closed
1995-0221a	F.C. Automotive	13 Bush Chapel Rd.	Discharge eliminated. Drain closed
1995-0222a	Aberdeen Outdoor Equip.	606 S. Philad. Blvd.	Discharge eliminated. Drain closed
1995-0223a	Auto Mart	630 S. Philad. Blvd.	Discharge eliminated. Drain closed
1995-0223c	Thompson's Texaco	1133 Philad. Blvd.	Discharge modified to public sewer (PS)
1995-0306b	J.P. Chevrolet	101 N. Philad. Blvd.	Discharge eliminated. Drain closed
1995-0313a	Johnson Motors Co.	1421 S. Philad. Blvd.	Discharge eliminated. Drain closed
1995-0303b	Hinder Motors, Inc.	317 S. Philad. Blvd.	Drain is connected to PS
1995-0309b	Hinder Ford, Inc.	505 S. Philad. Blvd.	Owner agreed to connect drains to PS

Table 3. Unpermitted Ground Water Discharge Notice of Violations Within or Near Aberdeen WHPA

Other areas within the WHPA that may potentially contaminate the shallow Coastal Plain aquifer are unregulated residential heating oil USTs, the major transportation corridors that includes MD Route 40 and the railroad lines that run through Aberdeen. Transportation lines are a concern in the event of a petroleum or chemical spill that occurs within the WHPA. In addition, lawn maintenance and landscaping activities on residential land are potential non-point sources of nitrates and synthetic organic compounds (SOCs) to the Aberdeen water supply.

Based on the Maryland Office of Planning's 1997 Land Use Map, the land use within WHPA Zones 1 and 2 is as follows:

LAND USE	TOTAL AREA (Acres)	PERCENT OF WHPA
Low Density Residential	7.3	< ½
Medium Density Residential	467.0	29
High Density Residential	95.6	6
Commercial	473.0	29
Industrial	11.2	1
Extractive	32.3	2
Open Urban Land	12.2	1
Cropland	21.1	1
Pasture	15.8	1
Forest	477.8	30

Table 4a. Land Use Summary Within Zones 1 & 2

The land use within the Zone 1 WHPAs only is as follows:

LAND USE	TOTAL AREA (Acres)	PERCENT OF WHPA
Medium Density Residential	35.9	14
Commercial	140.0	54
Industrial	11.0	4
Forest	72.8	28

Table 4b. Land Use Summary Within Zone 1 WHPAs Only

The breakdown of land use within the WHPA is shown in Figure 3. Note that commercial lands within the southeast areas of the WHPA are primarily on the APG federal facility property.

A review of the Maryland Office of Planning 1994 Harford County Sewerage Coverage Map shows that 64% of the land area within WHPA Zones 1 and 2 is in the existing or planned service area. The remaining 36% of land area that is not sewered is primarily on the APG property (Figure 4).

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 data described is from the finished (treated) water and raw water as noted. The treatment currently used at Aberdeen is gaseous chlorination for disinfection, pH adjustment and orthophosphate inhibitors for corrosion control, slat tray aeration for organics removal, and fluoridation. The pH adjustment is done through the addition of soda ash. The treated water goes to a clear well that is under the water treatment plant building. The City can store up to 1.15 million gallons of treated water at 4 storage tank towers. Three of the tanks have capacities of 250,000 gallons and a fourth tank has a capacity of 400,000 gallons. Also, the City purchases an average of 250,000 gallons of treated water per day from the Havre De Grace Surface Water Treatment Plant. The source of this water is the Susquehanna River. Finished water to Aberdeen's distribution system is therefore a blending of the surface water from Havre De Grace and the ground water from Aberdeen's wells.

In accordance with Maryland's SWAP, data from the treatment plant was compared with the Maximum Contaminant Levels (MCLs). If the monitoring data is greater than 50% of a MCL, the written 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. A review of the monitoring data since 1988 for Aberdeen's finished water indicates that the system's water supply meets the drinking water standards.

Inorganic Compounds (IOCs)

No IOC detects above 50% of the MCL have been reported over the past seven years of sampling data. The average nitrate value since 1993 is 2.6 ppm. The MCL for nitrate is 10 ppm.

Volatile Organic Compounds (VOCs)

The system has had numerous detects of volatile organic compounds (VOCs) every year since 1988. VOC detects above 50% of the MCL in finished water have occurred in 1989, 1992 and 1993. MDE issued letters requiring the City to continue quarterly monitoring for VOCs as a result of detections above 0.5 parts per billion (ppb) in several of the wells. Table 5a summarizes the VOC results above 50% of the MCL since 1988. Raw water data from specific wells is noted. All other data is from finished (treated) water.

CONT. ID	CONTAMINANT NAME	MCL (ppb)	SAMPLE DATE	RESULT (ppb)
2987	TETRACHLOROETHYLENE	5	07-Dec-89	5.0
2980	1,2-DICHLOROETHANE	5	21-Dec-92	2.8
2990	BENZENE	5	17-Feb-93	4.5 *(Well 2R)
2990	BENZENE	5	18-Feb-93	15.0 *(Well 3)
2983	1,2-DICHLOROPROPANE	5	18-Feb-93	3.1 *(Well 3)
2987	TETRACHLOROETHYLENE	5	18-Feb-93	23.0 *(Well 3)
2987	TETRACHLOROETHYLENE	5	21-Feb-93	23.0 *(Well 11)
2987	TETRACHLOROETHYLENE	5	27-Oct-93	3.0
2990	BENZENE	5	11-Aug-98	8.0 *(Well 2R)
2983	1,2-DICHLOROPROPANE	5	11-Aug-98	5.0 *(Well 3R)
2990	BENZENE	5	11-Aug-98	11.0 *(Well 3R)
2987	TETRACHLOROETHYLENE	5	11-Aug-98	19.0 *(Well 1R)
2987	TETRACHLOROETHYLENE	5	11-Aug-98	15.0 *(Well 3R)
2984	TRICHLOROETHYLENE	5	11-Aug-98	4.0 *(Well 1R)
2984	TRICHLOROETHYLENE	5	11-Aug-98	3.0 *(Well 10)
* Denotes raw water data from wells indicated				

Table 5a. VOC Results Above 50% of the MCL for Aberdeen Wells Since 1988

Tables 5b and 5c show all regulated VOC detections for the Aberdeen Wells since 1988.

CONT. ID	CONTAMINANT NAME	MCL (ppb)	SAMPLE DATE	RESULT (ppb)
2987	TETRACHLOROETHYLENE	5	18-Mar-88	0.2
2987	TETRACHLOROETHYLENE	5	18-Mar-88	0.3
2990	BENZENE	5	07-Dec-89	0.4
2982	CARBON TETRACHLORIDE	5	07-Dec-89	0.2
2984	TRICHLOROETHYLENE	5	07-Dec-89	0.4
2983	1,2-DICHLOROPROPANE	5	07-Dec-89	0.2
2980	1,2-DICHLOROETHANE	5	07-Dec-89	1.0
2987	TETRACHLOROETHYLENE	5	07-Dec-89	5.0
2990	BENZENE	5	27-Feb-90	0.2
2987	TETRACHLOROETHYLENE	5	02-May-90	0.7
2990	BENZENE	5	30-Jul-90	0.3
2987	TETRACHLOROETHYLENE	5	30-Jul-90	1.7
2981	1,1,1-TRICHLOROETHANE	200	30-Jul-90	0.8
2980	1,2-DICHLOROETHANE	5	26-Dec-91	2.0
2987	TETRACHLOROETHYLENE	5	18-Sep-92	1.0
2980	1,2-DICHLOROETHANE	5	21-Dec-92	2.8
2964	METHYLENE CHLORIDE	5	21-Dec-92	1.0
2990	BENZENE	5	14-Feb-93	1.9 *(Well 5)
2955	XYLENES, TOTAL	10000	14-Feb-93	1.1 *(Well 5)
2964	METHYLENE CHLORIDE	5	16-Feb-93	0.7
2987	TETRACHLOROETHYLENE	5	16-Feb-93	0.7
2990	BENZENE	5	17-Feb-93	4.5 *(Well 2R)
2980	1,2-DICHLOROETHANE	5	17-Feb-93	0.9 *(Well 2R)
2955	XYLENES, TOTAL	10000	17-Feb-93	1.8 *(Well 2R)
2990	BENZENE	5	18-Feb-93	15.0 *(Well 3)
2380	cis-1,2-DICHLOROETHYLENE	70	18-Feb-93	1.9 *(Well 3)
2987	TETRACHLOROETHYLENE	5	18-Feb-93	23.0 *(Well 3)
2983	1,2-DICHLOROPROPANE	5	18-Feb-93	3.1 *(Well 3)
2984	TRICHLOROETHYLENE	5	18-Feb-93	2.0 *(Well 3)
2981	1,1,1-TRICHLOROETHANE	200	21-Feb-93	0.7 *(Well 11)
2987	TETRACHLOROETHYLENE	5	21-Feb-93	23.0 *(Well 11)
2990	BENZENE	5	22-Jun-93	0.4
2955	XYLENES, TOTAL	10000	22-Jun-93	2.1
2964	METHYLENE CHLORIDE	5	22-Jun-93	0.7
2987	TETRACHLOROETHYLENE	5	22-Jun-93	0.9
2990	BENZENE	5	20-Sep-93	0.8
2987	TETRACHLOROETHYLENE	5	20-Sep-93	1.0
2990	BENZENE	5	27-Oct-93	1.2
2987	TETRACHLOROETHYLENE	5	27-Oct-93	3.0
2996	STYRENE	100	27-Oct-93	0.5
2984	TRICHLOROETHYLENE	5	27-Oct-93	0.4
*Denotes raw water data from wells indicated				

Table 5b. Regulated VOC Detects for the Aberdeen Wells From 1988-1993

CONT. ID	CONTAMINANT NAME	MCL (ppb)	SAMPLE DATE	RESULT (ppb)
2987	TETRACHLOROETHYLENE	5	30-Mar-94	0.6
2980	1,2-DICHLOROETHANE	5	25-Aug-94	0.3
2987	TETRACHLOROETHYLENE	5	25-Aug-94	0.6
2990	BENZENE	5	25-Oct-94	0.7
2980	1,2-DICHLOROETHANE	5	25-Oct-94	1.0
2987	TETRACHLOROETHYLENE	5	25-Oct-94	0.7
2980	1,2-DICHLOROETHANE	5	14-Dec-94	0.8
2987	TETRACHLOROETHYLENE	5	14-Dec-94	0.7
2987	TETRACHLOROETHYLENE	5	27-Jun-95	1.2
2990	BENZENE	5	13-Dec-95	0.7
2987	TETRACHLOROETHYLENE	5	13-Dec-95	2.0
2990	BENZENE	5	12-Mar-96	1.3
2987	TETRACHLOROETHYLENE	5	12-Mar-96	0.7
2990	BENZENE	5	30-May-96	1.1
2990	BENZENE	5	12-Feb-97	1.1
2987	TETRACHLOROETHYLENE	5	12-Feb-97	0.7
2990	BENZENE	5	23-Sep-97	0.6
2987	TETRACHLOROETHYLENE	5	18-Nov-97	0.8
2380	cis-1,2-DICHLOROETHYLENE	70	07-Jan-98	1.0
2996	STYRENE	100	07-Jan-98	0.5
2987	TETRACHLOROETHYLENE	5	12-May-98	1.0
2987	TETRACHLOROETHYLENE	5	12-May-98	1.0
2987	TETRACHLOROETHYLENE	5	12-May-98	1.0
2990	BENZENE	5	11-Aug-98	8.0 *(Well 2R)
2984	TRICHLOROETHYLENE	5	11-Aug-98	1.0 *(Well 3R)
2380	cis-1,2-DICHLOROETHYLENE	70	11-Aug-98	0.6 *(Well 3R)
2987	TETRACHLOROETHYLENE	5	11-Aug-98	15.0 *(Well 3R)
2987	TETRACHLOROETHYLENE	5	11-Aug-98	19.0 *(Well 1R)
2983	1,2-DICHLOROPROPANE	5	11-Aug-98	5.0 *(Well 3R)
2380	cis-1,2-DICHLOROETHYLENE	70	11-Aug-98	2.0 *(Well 1R)
2984	TRICHLOROETHYLENE	5	11-Aug-98	3.0 *(Well 10)
2984	TRICHLOROETHYLENE	5	11-Aug-98	4.0 *(Well 1R)
2990	BENZENE	5	11-Aug-98	11.0 *(Well 3R)
2981	1,1,1-TRICHLOROETHANE	200	11-Aug-98	1.0 *(Well 9)
2990	BENZENE	5	21-Aug-98	0.6
2987	TETRACHLOROETHYLENE	5	21-Aug-98	1.0
2987	TETRACHLOROETHYLENE	5	06-Oct-98	1.0
2987	TETRACHLOROETHYLENE	5	07-Sep-99	1.4
2987	TETRACHLOROETHYLENE	5	29-Dec-99	2.4
2987	TETRACHLOROETHYLENE	5	30-Mar-00	1.0
2984	TRICHLOROETHYLENE	5	30-Mar-00	2.3
* Denotes raw water data from wells indicated				

Figure 5c. Regulated VOC Detects for the Aberdeen Wells From 1994-2000

Methyl-tert-butyl-ether (MTBE) was detected at 7.0 ppb (1/7/98), at 3.6 ppb (9/7/99), at 4.4 ppb (12/29/99) and at 4.1 ppb (3/30/00). MDE currently investigates areas for potential VOC sources when MTBE levels exceed 10 ppb. 4.7 ppb (6/25/02) 6.4 ppb (6/26/01) → ave: 4.2 ppb from 9 samples 5.8 ppb (3/19/01)

Other VOCs that have been detected periodically in sampling results are the disinfection by-products known as trihalomethanes (THMs). Disinfection by-products are the result of a reaction between chlorine used for disinfection and organic material in the water supply. Elevated levels of THMs are typically detected in finished water at Surface Water Plants. Since Aberdeen purchases surface water to supplement their supply, the periodic total THM detects that are above 50% of the MCL likely are attributed to the surface water in the distribution.

Synthetic Organic Compounds (SOCs)

DI (2-Ethylhexyl) phthalate was detected on 12/10/98 at 0.5 ppb. The MCL for this SOC is 6 ppb. Low levels of phthalate ester are often found in the laboratory blanks and therefore probably do not represent actual water quality of the system. No other SOC detects were reported from four previous sets of samples since September 1993.

Radionuclides

Gross alpha was not detected. Radon-222 was detected on 4/9/97 at 20 picocuries per Liter (pCi/L). There is currently no MCL for radon-222, however EPA has proposed a MCL of 300 pCi/L or an alternate MCL of 4,000 pCi/L. MDE is waiting for EPA's final rule to determine how radon will be regulated for public water systems.

Microbiological Contaminants

Raw water sampling was conducted on 1/14/99 for the Aberdeen wells to determine the sensitivity of these wells to surface water. Samples were collected following 0.9 inches of rainfall. All results were negative for the presence of total and fecal coliform.

SUSCEPTIBILITY ANALYSIS

Aberdeen's wells draw water from an unconfined aquifer. In general, water supplies in unconfined aquifers are susceptible to contamination from land use activities. Therefore, continued routine monitoring of contaminants is essential in assuring a safe drinking water supply. The criteria that was used to conduct the susceptibility analysis is as follows: (1) evaluation of available water quality data, (2) review of the contaminant sources within the WHPA, (3) evaluation of the aquifer characteristics, (4) evaluation of the well integrity, and (5) evaluation of the likelihood of change to the natural conditions.

Inorganic Compounds (IOCs)

No IOC detects above 50% of the MCL have been reported over the past seven years of sampling data at Aberdeen. The average nitrate level since 1993 is 2.6 ppm, well below the MCL of 10 ppm. Sources of nitrate can generally be traced back to land use. Fertilization of agricultural fields and residential lawns, and on-site septic systems are non-point sources of nitrate in ground water. A review of Tables 4a and 4b indicates that only 1% of the WHPA is cropland, with none located within Zone 1. In addition,

63% of the land area within WHPA Zones 1 and 2 is in the existing or planned sewer service area (Figure 4). The 36% of the WHPA that is made-up of non-sewered land is predominantly within the APG property. Based on 1997 land use, the non-sewered areas at APG are primarily forest and commercial with smaller areas of pasture, residential, and open urban lands (Figure 3). A shooting range facility located in WHPA Zone 1 between Wells 5 and 6R has a private septic holding tank. Waste from the tank is periodically pumped out and removed.

There are potential non-point sources of nitrates located within the WHPA. However, sampling results at the Aberdeen wells over the past seven years have not shown the levels to be of significant concern. Therefore, Aberdeen's water supply is **not** susceptible to nitrates.

Volatile Organic Compounds (VOCs)

A review of Tables 5b and 5c show numerous VOC detects at the Aberdeen's wells every year since 1988. Results that exceed the 50% MCL threshold are summarized on Table 5a. As indicative of raw water results from specific wells, most of the VOC detects are from the northern-most cluster of wells closest to the high-density commercial zone along MD Route 40 (Figure 2). There are numerous sources of VOCs within the Zone 1 WHPA that may contribute to the contamination of the wells. Many of these sites have undertaken ground water cleanup under the direction of MDE; others are monitoring and have not found contamination. Still other sites need further investigation to determine if they are a potential risk.

Leaking home heating fuel tanks also have the potential to contaminate ground water. Table 4a shows that 35% of the WHPA is residential, some of which is former and active military housing. Wells 7-10 are located on the APG property. The nature of the activities at this facility pose a potential VOC threat to the wells.

VOCs are removed by air stripping at the Water Treatment Plant prior to disribution. Available data indicates that VOC concentrations in the finished water have not exceeded allowable drinking water standards. However, raw water results have shown periodic VOC detections that exceed allowable drinking water limits (Table 5a).

Currently, there are several VOC sources located within the WHPA. The wells draw water from a shallow, unconfined aquifer in the Coastal Plain. Well completion reports indicate that Wells 2R and 5 were constructed prior to the initiation of the State's current well construction regulations. The likelihood of change in land use activities for this area is unlikely. Therefore, Aberdeen's water supply **is** susceptible to VOC contamination.

Synthetic Organic Compounds (SOCs)

The current land use indicates that non-point sources exist in the WHPA that could potentially contaminate the water supply with SOCs. Currently only 1% of the land within the WHPA is agricultural (Table 4a). Residential areas account for 35% of the WHPA based on 1997 land use (Figure 3). Pesticides and chemicals used on

residential lawns are a potential threat. However, typical lawn maintenance herbicides are very biodegradable and should not pose a significant SOC risk if applied properly. Additional potential non-point sources of SOCs at Aberdeen are from the activities of the APG facility and from the diverse commercial establishments located within the WHPA.

Based on five sets of data since 1993, no SOC detects relating to water quality have been reported for Aberdeen. Therefore, the non-point SOC contaminant sources do not appear to be a significant risk to the water supply. Based on available sampling data, Aberdeen's water supply is **not** susceptible to SOC contamination. However, since the wells at Aberdeen draw water from a shallow, unconfined aquifer in the Coastal Plain, and due to the potential non-point sources within the WHPA, periodic sampling for SOCs should be continued.

Radionuclides

No gross alpha radiation was detected in water samples at Aberdeen. Radon-222 was detected at 20 pCi/L on 4/9/97. However, these results are less than 50% of the 300 pCi/L currently under consideration by EPA. The source of radon in ground water can be traced back to the natural occurrence of uranium in rocks. Based on limited sampling data, Aberdeen's water supply is **not** susceptible to radiological contaminants.

Microbiological Contaminants

The nearest natural surface water body to Aberdeen's well cluster 1R-6R is an unnamed stream that flows southward into Romney Creek. According to Figure 2, Well 5 is within about 150 feet of this stream. Field observation also revealed a small, intermittent storm water stream within about 20 feet of Well 4R. Additionally, Swan Creek is located about 4,000 feet to the east of Well 10 (Figure 2). Based on wet weather coliform sampling data, the wells were determined **not** to be susceptible to protozoans or bacteriological contaminants. The wells may be susceptible to viral contaminants, as these are much smaller, can survive longer, and may not be as effectively filtered by the aquifer as protozoans and bacteria. Future monitoring will be needed to determine susceptibility to viruses.

MANAGEMENT OF THE WHPA

Form a Local Planning Team

- Teams should represent all of the interests in the community. The water supplier, elected officials, the County Health Department, local planning agencies, local businesses, developers, and residents within and near the WHPA should work together to reach a consensus on how to protect the water supply.

Public Awareness and Outreach

- Placing signs at the WHPA boundaries is a good way to make the public aware of protecting their source of water supply and to help in the event of spill notification and response.
- Informing all property owners and businesses, particularly those within Zone 1 that they are located in a WHPA and that activities on their property can have serious impacts on the City's water supply.
- Conduct education outreach to the facilities located in the WHPA. Important topics include: (a) minimizing the risk of contamination from all in-ground tanks and lines (b) inspection of all waste streams that are connected to dry wells and eliminating waste sources that could contaminate the ground water (c) reporting chemical and petroleum spills and (d) proper material and chemical storage practices.
- Aberdeen should take a very active role in wellhead protection since there are so many potential risks to the wellfield. Whether or not a regulatory approach is needed will depend on the success of any educational and other cooperative approaches.

Cooperative Efforts with Other Agencies

- The City should develop a plan with Aberdeen's Fire Department and other emergency response personnel concerning proper spill response to protect ground water, particularly along the MD Route 40 corridor and the railway lines.
- Work with the APG to identify any base practices that could affect the City's wells. Develop a formal agreement with the APG that recognizes the importance of wellhead protection and commits the base to ensuring that their practices do not negatively affect Aberdeen's water supply.

Monitoring

- Monitoring wells were drilled at UST and LUST sites located within the City's WHPA to determine the level and extent of VOC contamination. The City should stay in contact with MDE's Oil Control Program for updates on existing and new LUST cases. Comparison of specific well sampling results with monitoring at the facilities could help determine the ultimate effectiveness of clean-up measures being taken.
- Installation of monitoring wells at UST sites not regulated by MDE may also be considered.
- Continue quarterly sampling for VOCs since they continue to be detected in ground water at Aberdeen.
- Continue to monitor for all Safe Drinking Water Act Contaminants as required by MDE.
- Annual sampling for microbiological contaminants is a good check on well integrity.

Planning/New Development

- Examine the appropriateness of adopting an ordinance that improves performance standards on the facilities within the WHPA. The State of Maryland Wellhead Protection Ordinance may be used as a template.

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. The City of Aberdeen currently purchases 250,000 gpd of treated water from the Havre De Grace Surface Water Treatment Plant to meet their daily demands. During drought conditions and other emergencies, the City can purchase up to 500,000 gallons of water per day from the Havre De Grace plant. Additionally, the City has installed a large generator at their Water Treatment Plant so that the facility can continue to operate during electrical power outages.

Changes in Uses

- Any increase in pumpage at the Water Treatment Plant or the addition of new wells will require revision of the WHPA since it is affected by pumpage. The City is required to contact the MDE Water Supply Program when an increase in pumpage is applied for and when proposed new wells are being considered.

Contaminant Source Inventory Updates/ Inspections

- The City should conduct its own detailed survey to ensure that there are no other potential sources of contamination within the WHPA. Updated records of new facilities within the WHPA should be maintained.
- The City should continue its annual inspection and maintenance program for the supply wells to ensure their integrity and to protect the aquifer from surficial contamination.
- The City should continue their regular inspections of facilities that store or use petroleum products. The City has a wastewater pre-treatment ordinance for these types of facilities to ensure that the used products are properly handled and removed.
- The City should ensure that all unused wells are properly abandoned and sealed as per COMAR 26.04.04.11.
- During the May site visit, MDE staff observed depressions in the ground surrounding Wells 6R and 11. The City should fill in and grade the ground around these wells to prevent surface water ponding and to allow for proper drainage away from the wells.

REFERENCES

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OTHER SOURCES OF DATA

Water Appropriation and Use Permit No. HA77G022
Water Treatment Plant Inspection Reports
MDE Water Supply Program Oracle Database
MDE Waste Management Sites Database
Department of Natural Resources 1994 Digital Orthophoto Quarter Quadrangles for Aberdeen SE & Perryman NE
USGS 7.5 Minute Series Topographic Maps, Aberdeen & Perryman Quadrangles
Maryland Office of Planning 1997 Harford County Land Use Map
Maryland Office of Planning 1994 Harford County Sewerage Coverage Map

APPENDICES

APPENDIX A

An open LUST case (No. 95-2734HA) is currently under investigation by the MDE Oil Control Program at the Aberdeen Outdoor Equipment facility at 606 S. Philadelphia Blvd. Three monitoring wells containing passive bailers were installed on site to recover petroleum hydrocarbons. A recent site inspection by the Oil Control Program on April 4, 2000 revealed faint to strong petroleum odors from each of the three monitoring wells. The Oil Control Program is actively monitoring the recovery of these contaminants from ground water.

The MDE Oil Control Program investigated a LUST site (Case No. 91-1040HA) at Harco Distributors at 618 Old Philadelphia Rd. Three tanks were removed in 1990 and three monitoring wells were installed. However, the Oil Control Program has not been granted access to the site to sample these wells. Therefore, the case has remained open to date.

The LUSTs at Hinder Ford, Inc. at 505 S. Philadelphia Blvd. have been removed and a monitoring well was installed. The Oil Control Program initially investigated this case (No. 94-0352HA) on 7/15/93. Sampling results from the well revealed little to no detects. Therefore, the case is currently being processed for closure.

J.P. Chevrolet at 429 S. Philadelphia Blvd. had LUSTs removed from their property. The owner recently had a Phase 1 and 2 environmental investigation performed on-site. Test pits were excavated to determine the extent of soil and ground water contamination. The findings indicate that the contamination is localized on-site. The Oil Control Program will continue to monitor this case (No. 94-0351HA) until all environmental issues are resolved.

The Oil Control Program recently reopened a heating oil LUST case (No. 97-0991HA) at the Susquehanna Bank at 201 W. Belair Ave. after determining that contaminants were seeping into a ventilation duct. A monitoring well was installed and follow-up investigation by the Oil Control Program is planned.

A leaking tank was recently removed at the McCullough Building at 105 W. Belair Ave. The Oil Control Program reported that the tank looked like "swiss cheese". A monitoring well was installed but is dry. Strong petroleum odors were detected from the monitoring well. This case (No. 99-0402HA) is still under investigation by the Oil Control Program.

New USTs were recently installed at the Southland 7-Eleven, the Mobil station, and the proposed WAWA sites respectively. The Oil Control Program completes compliance inspections of new USTs to ensure that the tanks and installations meet current State regulations. Old USTs were removed from the site of a former Citgo Service Center

(now the Mobil) at 607 S. Philadelphia Blvd. with no reported problems. Three monitoring wells were installed at the proposed WAWA site. The wells are dry with no reported detects.

The J.P Chevrolet at 101 N. Philadelphia Rd. had an UST removed and a monitoring well installed. A diesel tank was recently removed from the Clausaen Property at 25 S. Philadelphia Blvd. The Oil Control Program is presently monitoring both of these sites.

Several chemical tanks were removed from the former Paidon Products facility at 200 Old Post Rd. (near Well cluster 1R – 5) in December 1989. The Oil Control Program closed the case on 6/8/94 with no reported problems. The company has since re-located and the property is now occupied by a Metal Fabricating Company.

The LUST case (No. 90-1094HA) at the former CSX Corporation on West Belair Ave. and Mount Royal Ave. that was mentioned in the 1995 MDE Wellhead Protection Report (MDE, 1995) was closed by the Oil Control Program on 11/10/98 after monitoring results showed no further ground water concerns.

There are numerous Oil Control Program open cases at the APG facility, many of which are heating oil USTs at the various buildings on-base. However, none of the sites are located within the delineated WHPA for Aberdeen.

Dry Cleaners are examples of facilities that generate controlled hazardous substances. The facilities generate used tetrachloroethylene solvent from the dry cleaning operation. The facilities in Aberdeen have the waste solvents removed from the site on a monthly basis by Safety Kleen Corporation to ensure against the accumulation of 220 lbs. or more of material on-site. The transported wastes are managed at the Safety Kleen facility in Baltimore.

A ground water discharge permit (No. 96-DP-2858) was issued to Ferrell Fuel Company at 607 Old Philadelphia Rd. This is an above ground bulk fuel storage facility. Storm water runoff from the fuel loading and unloading pads is discharged to groundwater through an outfall pipe. The discharge is monitored for flow and for total petroleum hydrocarbons.

FIGURES

Figure 3. Land Use Map of Aberdeen Wellhead Protection Area

LEGEND

Land Use

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Commercial
- Industrial
- Extractive
- Open Urban Land
- Cropland
- Pasture
- Orchards
- Forest
- Water
- Wetlands
- Feeding Operations

WHPA Zones

- Zone 1
- Zone 2
- Supply Wells

2000 0 2000 Feet

N

Source: MD Office of Planning 1997 Harford County Land Use Map

Well 11
Wells !R - 4R
Well 6R
Well 5
Well 10
Well 9
Well 8
Well 7

Figure 4. Sewer Service Area Map of Aberdeen Wellhead Protection Area

LEGEND

Sewerage Coverage
- No Planned Service Area
- Existing Service Area
- Existing or Planned Service Area

WHPA Zones
- Zone 1
- Zone 2
- Supply Wells

2000 0 2000 Feet

N

Source: MD Office of Planning 1994 Harford County Sewerage Coverage Map