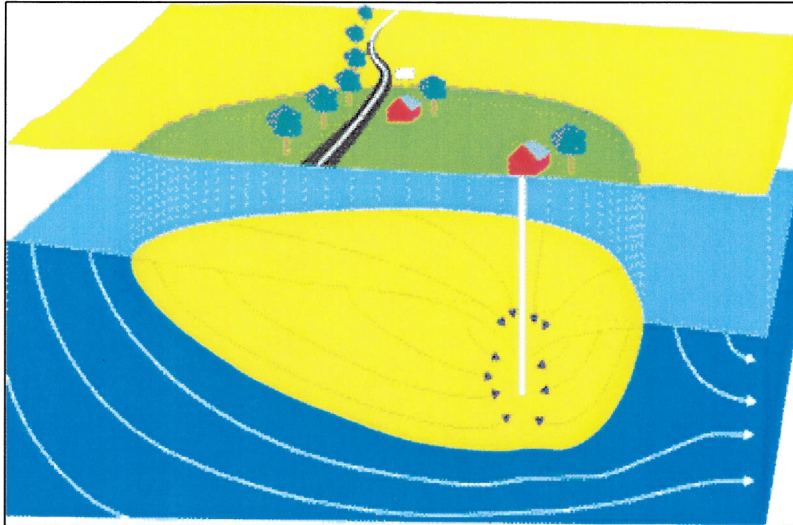


SOURCE WATER ASSESSMENT
FOR ALLIANT TECHSYSTEMS, INC.- ATK ELKTON DIV
CECIL COUNTY, MD



Prepared By
Water Management Administration
Water Supply Program
January 2006



Robert L. Ehrlich, Jr.
Governor

Kendl P. Philbrick
Secretary

Michael S. Steele
Lt. Governor

Jonas A. Jacobson
Deputy Secretary

TABLE OF CONTENTS

SUMMARY	ii
INTRODUCTION	1
HYDROGEOLOGY	1
WELL INFORMATION	1
Table 1. Well Inventory	2
SOURCE WATER ASSESSMENT AREA DELINEATION	2
POTENTIAL SOURCES OF CONTAMINATION	2
WATER QUALITY DATA	3
Inorganic Compounds (IOC's)	3
Volatile Organic Compounds (VOCs).....	4
Synthetic Organic Compounds (SOCs)	4
Microbiological Contaminants.....	4
SUSCEPTIBILITY ANALYSIS	4
Inorganic Compounds (IOC's)	4
Volatile Organic Compounds (VOC's)	5
Synthetic Organic Compounds (SOC's)	5
Radionuclides	5
Microbiological Contaminants.....	5
Table 2. Susceptibility Chart	5
MANAGEMENT OF SOURCE WATER ASSESSMENT AREA	6
REFERENCES	7
FIGURES	
Figure 1. Location Map	
Figure 2. Wellhead Protection Area	
Figure 3. Land Use Map	
Figure 4. Sewer Service Map	
APPENDIX	
Well Completion Report	

SUMMARY

The Maryland Department of the Environment's (MDE's) Water Supply Program (WSP) has conducted a Source Water Assessment for Alliant Techsystems, Inc., ATK Elkton Division (ATK) located near Elkton in Cecil County, Maryland. This report delineates the area that contributes water to the drinking water wells, identifies potential sources of contamination within the area and determines the susceptibility of the water supply sources to contamination. Recommendations for protecting the water supply sources conclude the report.

The source of the plant's potable water supply is the Potomac aquifer. ATK's wells are completed in an unconfined to partially confined portion of the aquifer. The system uses two wells to obtain its drinking water supply. The Wellhead Protection Area was delineated using by the WSP using EPA-approved methods.

Point sources of contamination were identified within and near the assessment area from field inspections and MDE databases. The Maryland Department of Planning's 2002 land use map for Cecil County was used to identify non-point sources of contamination. Maps showing location of the wells, potential sources of contamination, and land use are included at the end of this report.

The susceptibility analysis is based on a review of existing water quality data for the water system, the presence of potential sources of contamination, in the assessment area, well integrity and the inherent vulnerability of the aquifer. The ATK property and many of the surrounding properties have histories of industrial use since the 1930's. Trichloroethylene (TCE) and perchlorate have been found in ATK's production wells. The finished water is currently treated to remove both substances. From 1999 to 2005, ATK purchased bottled water for drinking water. The water currently tests as potable, however, bottled water is still available to employees. It was determined that ATK's water supply is susceptible to perchlorate and volatile organic compounds.

INTRODUCTION

The Water Supply Program has conducted a Source Water Assessment for Alliant Techsystems, Inc., ATK Elkton Division (ATK) near Elkton in Cecil County, Maryland. The facility operates its own water treatment plant and uses two wells, which supply the water treatment plant.

As defined as part of Maryland's Source Water Assessment Plan (SWAP), "large systems" are community and non-community water systems that have water appropriation and use permits with average annual appropriation permit exceeding 10,000 gpd. ATK's water appropriation and use permit allows for an average annual water use of 40,000 gpd, however, most of the water is used for cooling water and process water. The plant has about 500 employees and average annual water use for potable and sanitary uses is estimated to be about 10,000 gpd.

HYDROGEOLOGY

ATK is located in the Coastal Plain Physiographic Province. This region is underlain by unconsolidated gravel, sand, silt and clay. The strata, such as those that are composed primarily of sand and gravel, yield substantial quantities of water to wells and are termed aquifers. Confining beds are usually composed primarily of silt and clay. In areas like the Atlantic Coastal Plain, where alternating layers of sand and clay occur, water becomes stored at great depths by over and underlying impermeable layers. The hydrostatic pressure of the water in these layers is greater than atmospheric pressure. In a well drilled to these layers the high hydrostatic pressure forces water in the well above the top of the sand layer. Such a well is known as an artesian well and the strata that the well is completed in is known as a confined or an artesian aquifer. The clays that confine the aquifer also protect the aquifer from contamination from surface sources.

ATK obtains its water supply from the Potomac Group of aquifers. The sediments of the Potomac Group are predominantly fine-grained sands, silt and clay with irregular sections of coarse sands and gravels. The coarser materials, which transmit water in the aquifer, tend to be white to orange-brown, crossbedded, moderately well sorted and composed mostly of quartz. The surrounding finer materials may partially to fully confine the aquifer. Sometimes a leaky connection occurs between aquifers that are connected directly or if separated by thin or silty layers. ATK's wells are completed in an unconfined aquifer that is not well protected from surface contamination by clayey strata.

WELL INFORMATION

Well information for the system was obtained from the Water Supply Program's database, site visits, well completion reports and sanitary survey inspection reports. The plant is served by two potable supply wells that are listed in Table 1. The Appendix consists a copy the application to drill well Thiokol A4 and its well completion report. A completion report is not available for Thiokol G1. There are also remediation wells, observation wells

and wells used for cooling and process water on the on the property. Since their water is not used for drinking water source waters for those wells have not been included in this report.

TABLE 1. WELL INVENTORY

WELL #	PERMIT #	TOTAL DEPTH	CASING DEPTH	YEAR DRILLED	COMMENTS
Thiokol A4	CE028004	129'	123'	1957	production well, located in a well house
Thiokol G1		96'	86'	1940's ?	standby well, located in a pit

SOURCE WATER ASSESSMENT AREA DELINEATION

For ground water systems, a Wellhead Protection Area (WHPA) is considered to be the source water assessment for the system. WHPAs were delineated for the ATK wells using EPA's WHPA Code version 2.0, a two-dimensional ground water flow model. ATK's water appropriation and use permit allows an annual average water use of 40,000 gpd. Two WHPAs were calculated. Thiokol A4 is the only well in use, so the model was run with 100% water use from that well. If Thiokol A-4 is out of service, Thiokol G-1 will provide full service, so it was also modeled for 100% use.

Delineation Zones

Zone1: 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 maximum survival times of microbial organisms in ground water. In Figure 2, two Zone 1 WHPAs were delineated, one for each well. The area of each WHPA is about two acres.

Zone 2: Zone 2 is the WHPA that was delineated using a 10-year TOT criterion. The delineation was adjusted to take local topography into account. 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 contamination before it could reach the well. The total acreage of Zone 2 is 24.4 acres.

POTENTIAL SOURCES OF CONTAMINATION

Potential sources of contamination can be classified as either point or non-point sources. Examples of point sources are underground storage tanks, ground and surface water discharges, landfills, animal feeding operations, and ground water contamination sites. These sites are usually associated with commercial or industrial facilities that use chemicals that may, if handled inappropriately, contaminate ground water via a discrete point location. Non-point sources are associated with land use practices, such as use of pesticides, fertilizer, animal wastes or septic systems, that lead to ground water contamination over a larger area.

Several point sources of contamination were identified within and near the assessment area from field inspections and from MDE Water and Waste Management databases. The closest sources are from ATK itself. The 500-acre industrial property has been used for research and manufacturing of fireworks, munitions, pesticide and solid rocket propellant since the 1930's. Neighboring properties have similar histories. Ground water contamination is documented on the facility property. Figure 2 shows potential sources of contamination within and near the WHPA. The ATK facility is listed as a CERCLA site due to its history of ground water contamination.

The Maryland Department of Planning's 2002 land use map for Cecil County was used to identify non-point sources of contamination (Figure 3). Industrial was the only land use category identified within the delineated WHPA.

A review of Maryland Department Planning's Cecil County 2004 Sewer Map (Figure 4) shows that the ATK is located entirely within an existing service area.

WATER QUALITY DATA

Water quality data from the Water Supply Program's (WSP) database was reviewed for Safe Water Drinking Act (SWDA) contaminants. In accordance with Maryland's SWAP, data submitted by the owner/operator of the system was compared with the Maximum Contaminant Levels (MCLs). If monitoring data is greater than 50% of the MCL, the assessment will describe the typical sources of that contaminant and locate the possible sources of the contaminant for this site. At ATK drinking water is treated with ultraviolet radiation, ion exchange-iron, ion exchange, activated carbon granules and aeration.

Inorganic Compounds (IOCs)

In 1998, a special MDE sampling program revealed that perchlorate was in ATK's drinking water. Both on and off-site sampling for perchlorate performed during the following year found perchlorate levels ranging from 507 ppb to 530 ppb. The most recent perchlorate measurement was 370 ppb in December 2005. While no existing MCL is adopted for perchlorate, MDE has recommended that water systems maintain less than 1 ppb in their finished water based on EPA's draft toxicity assessment.

The sources of perchlorate at ATK are believed to be the Closed Incinerator Feed Surface Impoundment and the Open Burning/Open Detonation Area (Art O'Connell, personal communication, 2005). Bottled water has been used for drinking water from 1999 to 2005. In April 2005, ATK began treating the water for perchlorate. Although it is no longer required for drinking, bottled water is still made available to employees. A sample collected from water leaving the treatment plant in July 2005 was measured to contain 0.21 ppm of lead, which exceeds EPA's action level of 0.015 ppm. Samples collected in distribution systems that included this time period had lead levels lower than 5 ppb for 90% of the collected samples. Additional paired samples of raw and treated water are recommended to further investigate the sources of lead.

Volatile Organic Compounds (VOCs)

A 2002 report by Arcadis related that in 1984, trichloroethene (TCE) was detected in ATK's wells, but no information was available on the levels detected. At that time the company was known as Thiokol. Given the history of ATK's property and the surrounding properties, it was difficult to determine the TCE source. An on-site plume was found and remediation systems have been installed. The 1995 Site-Wide Hydrogeologic Investigation, Still Bottoms Investigation and Little Elk Creek Investigation found no offsite plumes of contamination that might be migrating onto ATK's property. Finished water VOC levels have been measured seven times since 1996. Treatment with activated carbon will remove VOCs. The only detects have been total xylene in 1996 and methylene chloride (1.4 ppb) in 1995.

Synthetic Organic Contaminants (SOCs)

A review of the data indicates that no SOCs have been detected above 50% of the MCL in the finished water.

Microbiological Contaminants

Raw bacteriological testing was conducted to determine whether the supply wells are under the influence of surface water. No total coliform bacteria were detected in the water supply. Routine bacteriological monitoring, which measures total coliform bacteria, is conducted in the finished water for each community water system on a monthly basis. Total coliform bacteria are not pathogenic but are used as indicator-organisms for other disease-causing microorganisms. No microbiological contaminants were found in 34 samples from 1996 to 2005.

SUSCEPTIBILITY ANALYSIS

The wells serving ATK are completed in an unconfined coastal plain aquifer. Wells completed in unconfined aquifers are generally more susceptible to contamination from surface sources. Therefore, managing this area to minimize the risk to the supply and continued routine monitoring of the contaminants is essential in assuring a safe drinking water supply. The susceptibility of source water to contamination is based on the following criteria: 1) the presence of natural and anthropogenic contaminant sources within the WHPA; 2) water quality data; 3) well integrity and 4) aquifer conditions. The susceptibility of the ATK's water supply to various contaminants is shown in Table 4.

Inorganic Compounds (IOCs)

Perchlorate and lead were the only IOCs detected at ATK at levels of concern. Most of the WHPA is in an area served by a private sewer. Since perchlorate results have been confirmed and are related to disposal of perchlorate on site, the well is considered susceptible to contamination by perchlorate. Additional samples are needed from both raw and treated water to identify whether lead is present in the source water.

Volatile Organic Compounds (VOCs)

No VOC's above 50% of the MCL have been detected in samples of treated water at ATK. However, since TCE is known to be in the raw water and sources are present in process within the wellhead protection area, the wells are considered vulnerable to VOCs.

Synthetic Organic Compounds (SOC's)

Two samples have been collected for SOC's following treatment at ATK. No detections have been at levels of concern. Because the treatment includes activated carbon, which can remove most SOC's, there is insufficient data to determine if ATK's water supply sources are susceptible to SOC contamination.

Radionuclides

Nontransient, noncommunity systems are currently not regulated for radionuclides. No data is available about the presence of radionuclides in ATK's water supply.

Microbiological Contaminants

Based on raw water bacteriological data, the ATK's wells were determined not to be under the influence of surface water. In addition, no bacteria have been detected in any of the routine bacteriological samples that have been collected. ATK's water supply is not susceptible to microbiological contaminants.

TABLE 2. SUSCEPTIBILITY CHART

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?
Inorganic Compounds	YES	YES	NO	YES	YES
Volatile Organic Compounds	YES	YES	NO	YES	YES
Synthetic Organic Compounds	NO	NO	NO	YES	UNKNOWN
Microbiological Contaminants	YES	NO	NO	NO	NO

MANAGEMENT OF THE SOURCE WATER ASSESSMENT AREA

The wells serving ATK appear to be in good condition. Water quality testing indicated the presence of perchlorate and TCE in raw water. Recommendations for maintaining the integrity of this system are listed below:

- Continue maintenance and protection of the wells.
- Both production wells are over 50 years old and little is known about the construction of Thiokol G1. The integrity of the casings for both wells should be evaluated to reduce the risk of bacterial contamination.
- Ensure that all contaminated sites on ATK property are cleaned up to MDE standards.
- All production and monitoring wells that are not in use should be abandoned according to State regulations.
- Continue monitoring for VOCs, IOCs and SOCs in accordance with MDE's requirements.
- Annual sampling for microbiological contaminants is recommended. It is a good indicator of the integrity of the wellhead.
- Any increase in pumpage or addition of new wells to the system may require extension of the WHPA. The system is required to contact the Water Supply Program when an increase in pumpage is applied for or when new wells are being considered.

REFERENCES

- Bartlett, C.L., K.P. Garon, and M.J. Liberati, 1993, Hydrogeologic Evaluation Report, W.L. Gore and Associates, Inc., Cherry Hill, Maryland; Dupont Environmental Remediation Services, Wilmington, DE, 26 p.
- Higgins, M.W. and L.B. Conant, 1990, The Geology Cecil County, Maryland, Maryland Geological Survey Bulletin 37, 183p.
- Kladias, M.P. and J.P. Sgambat, 2002, Revised Supplemental Site-Wide Investigation Plan, Arcadis G & M, Inc.
- Otton, E.G., R.E. Willey, R.A. McGregor, G. Achmad, S.N. Hiortdahl, and J.M. Gerhart, 1988, Water Resources and Estimated Effects of Ground-Water Development, Cecil County, Maryland, Maryland Geological Survey Bulletin 34, 133p.
- Maryland Department of the Environment, Water Supply Program, 1999, Maryland's Source Water Assessment Plan, 36p.

FIGURES

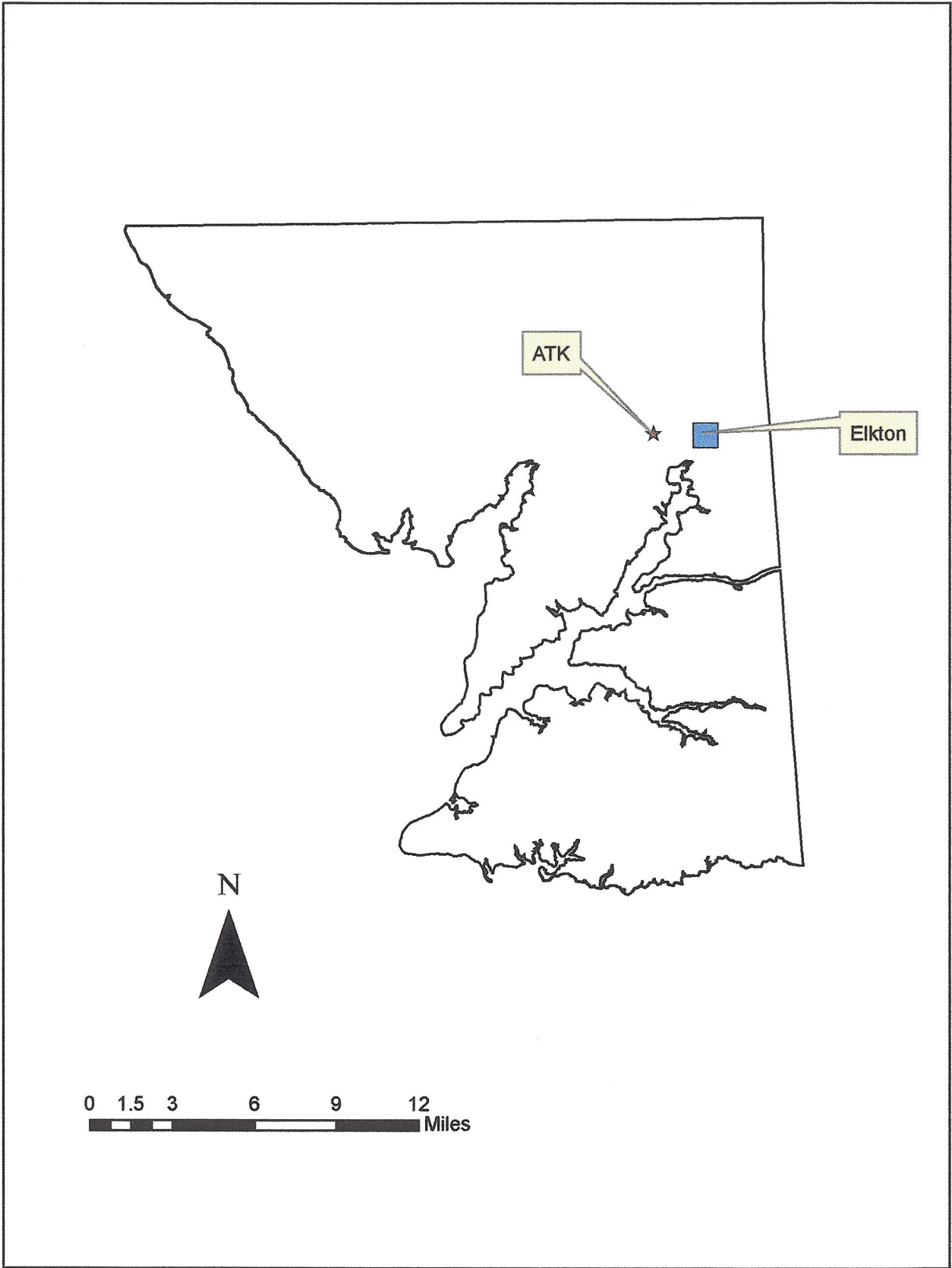


Figure 1. Location Map

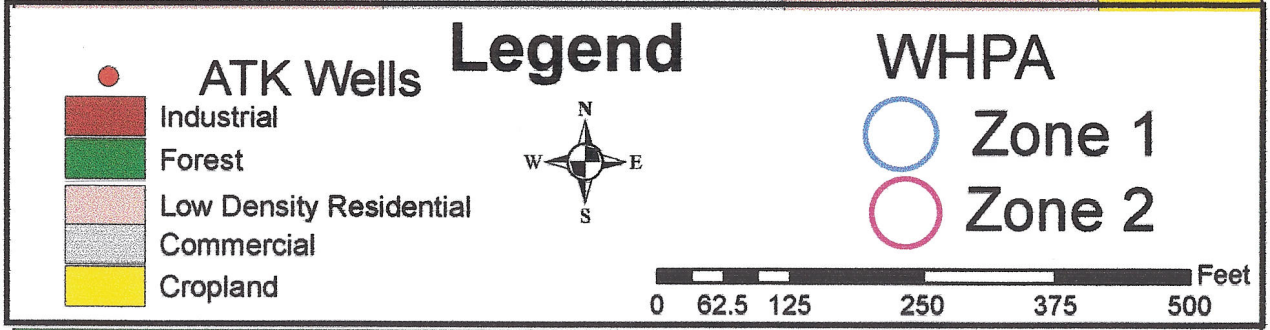
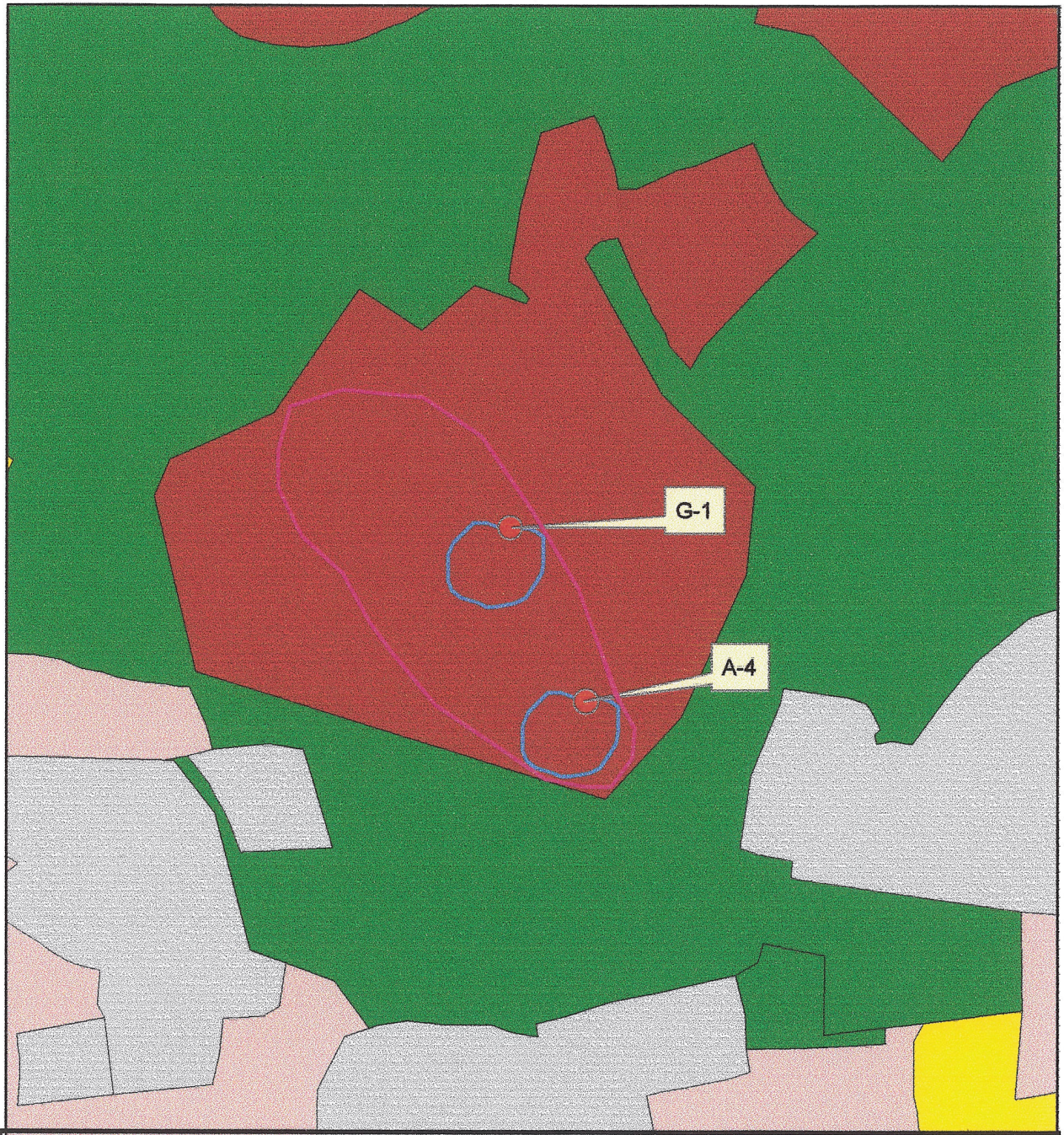


Figure 3. Land Use Map

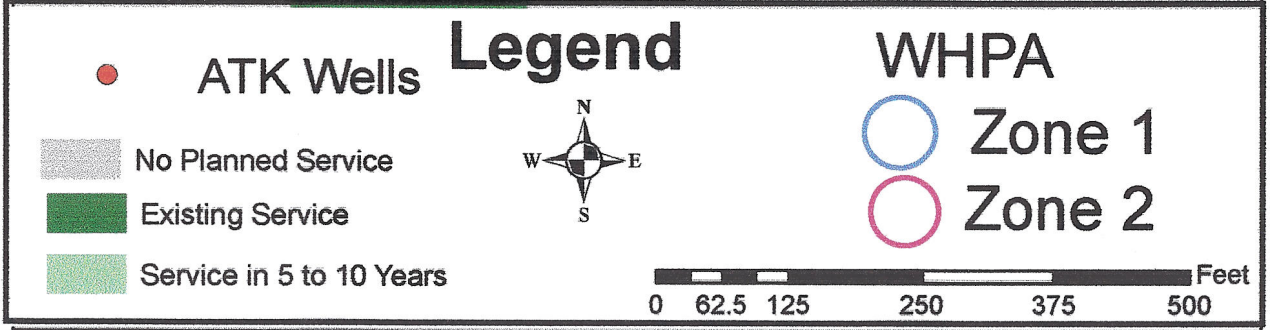
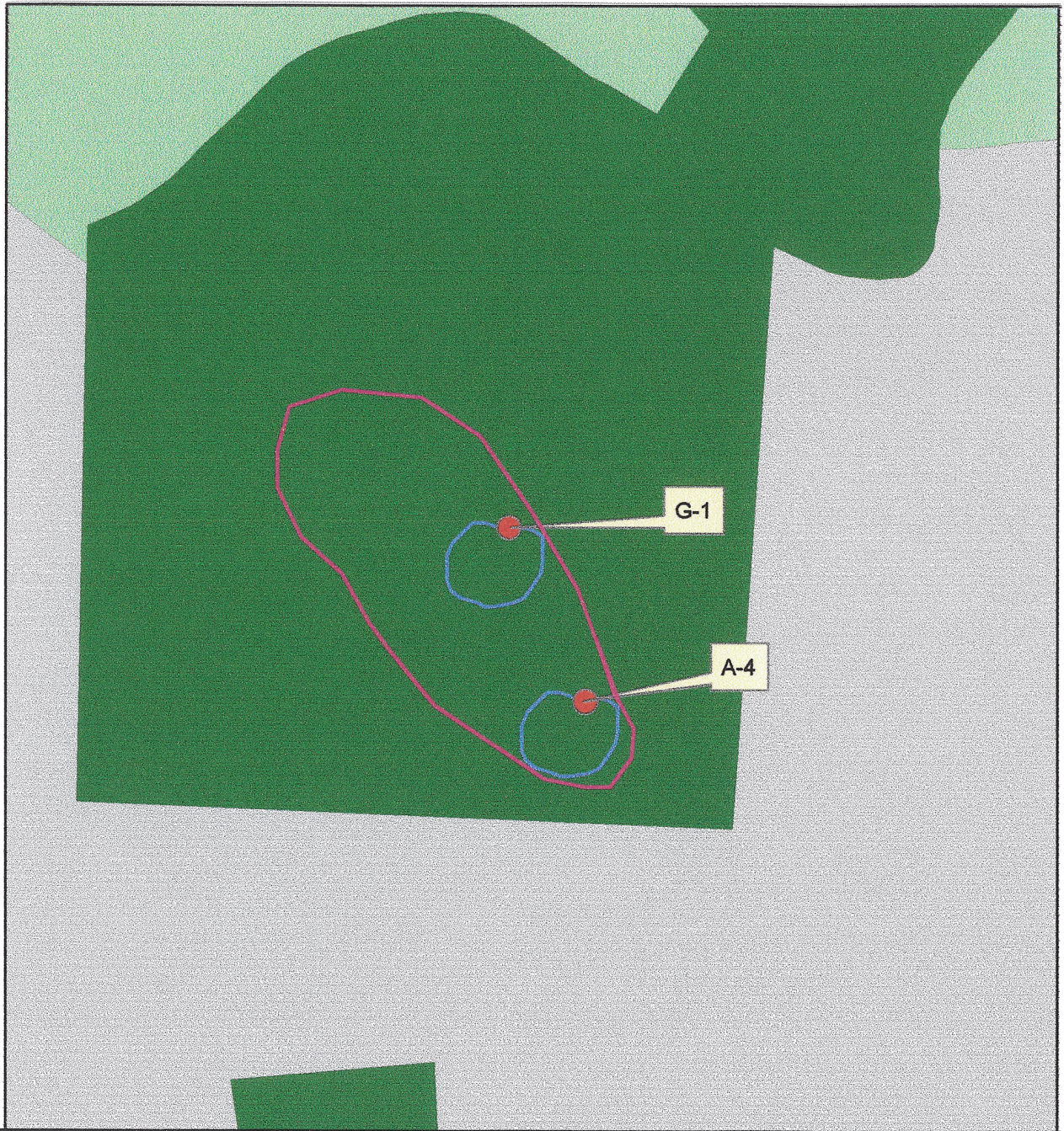


Figure 4. Sewer Service Area

APPENDIX

STATE OF MARYLAND
 DEPARTMENT OF GEOLOGY, MINES AND WATER RESOURCES
 The Johns Hopkins University
 BALTIMORE 18, MARYLAND

CEO 28004

Elkton

APPLICATION FOR PERMIT TO DRILL WELL

An application must be submitted and permit received before drilling a well

Owner Thiel Chemical Corp. Driller EMMIS BROTHERS
 Street or R. F. D. _____ Street or R. F. D. Odessa, Delaware
 Post Office Elkton, Maryland Post Office _____
 Date _____

Quantity of Water Needed (G. P. M.) 75 Location of Well _____
 Use for Water PLANT I County Cecil
 Approximate Depth of Well (feet) 129 ft Nearest Town ELKTON
 Method of Drilling to be used WASH O Distance from Town 2 mile
 Direction from Town WEST

PERMIT TO DRILL WELL

(Permit to be returned to Driller)

NOT TO BE FILLED IN BY DRILLER

Permit No. 28004

Samples of Cuttings Required by Department Yes No

Owner Requires Permit to Appropriate Water Yes No

Owner Has Permit to Appropriate Water Yes No

The applicant is herewith granted a permit to drill this well subject to the conditions stipulated.

John T. Sargis
Director

Date August 8, 1957

Special conditions that may apply: 080857

Owner must have permit before using well. Permit issued 9/12/57

copy mailed Cal County Health Dept.

8-22-57

Description of Location of Well

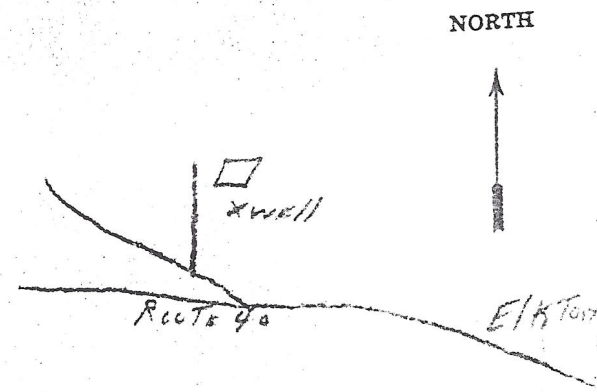
(This information should be definite enough to permit locating well on a county map)

Near what road ROUTE 40

On which side of road NORTH
(North, East, South, West)

Distance from road 1/4 mile

Draw a sketch below showing location of well in relation to nearby towns, roads and streams with north in the direction of the arrow.



(ORIGINAL)

081557

STATE OF MARYLAND
DEPARTMENT OF GEOLOGY, MINES AND WATER RESOURCES

The Johns Hopkins University
BALTIMORE 18, MARYLAND

WELL COMPLETION REPORT

This report must be submitted within 90 days after completion of the well

129

WELL LOG		CASING AND SCREEN RECORD		PUMPING TEST	
State the kind of formations penetrated, their depth, their thickness, and if water-bearing		State the kind and size of casing, liner, shoe, screen, and other accessories (if no casing used, give diameter of well)		Name of Owner	
WELL LOG		CASING AND SCREEN RECORD		Name of Owner	
State the kind of formations penetrated, their depth, their thickness, and if water-bearing		State the kind and size of casing, liner, shoe, screen, and other accessories (if no casing used, give diameter of well)		Name of Owner	
WELL LOG		CASING AND SCREEN RECORD		Name of Owner	
State the kind of formations penetrated, their depth, their thickness, and if water-bearing		State the kind and size of casing, liner, shoe, screen, and other accessories (if no casing used, give diameter of well)		Name of Owner	
129' deep		123' of 6" casing		Merkel Chemical Co.	
0-2 top soil		6' of Johnson 20-25 slot Eureka screen		Hours Pumped 39 1/2	
2-18 yellow sand and clay		(7 1/2" overall)		Type of Pump Used 12060	
18-45 red-yellow-gray clay				Pumping Rate 350 gpm	
45-61 red-gray clay - fine sand				Gallons per Minute 600 gal	
61-66 coarse white yellow sand				72 gpm	
66-79 coarse sand and clay				WATER LEVEL	
79-96 sand-clay-wood				Distance from land surface to water:	
96-112 coarse sand red-white clay				Before Pumping 55 Ft.	
112-122 fine yellow sand - red clay				When Pumping Ft.	
122-129 coarse yellow sand				APPEARANCE OF WATER	
				Clear	
				Cloudy	
				Taste None	
				Odor	
				Height of Casing Above Land Surface Ft.	
				PUMP INSTALLED	
				Type	
				Capacity	
				Gallons per Minute	
				Gallons per Hour	
				Pump Column Length Ft.	
				REMARKS	
				Well Was Completed	
				Date 8/15/57	
				Well Driller Eureka Bros.	
				D. S. Newberry	
				Signature	