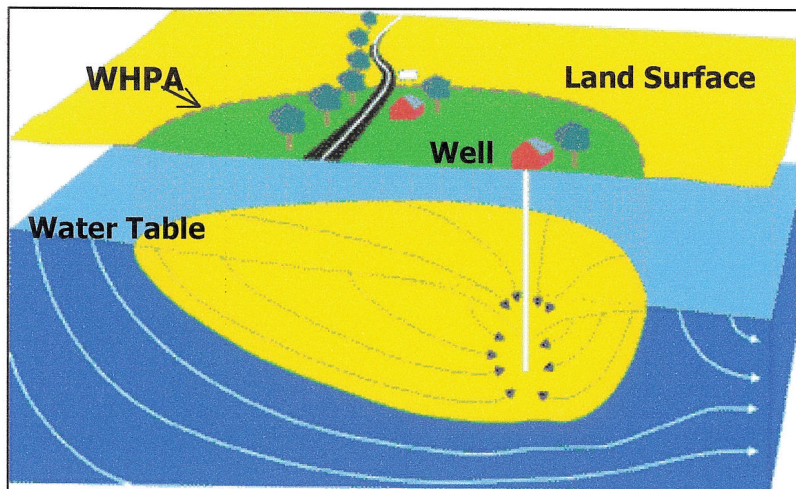


SOURCE WATER ASSESSMENT

FOR KENT SCHOOL

KENT COUNTY, MD



Prepared By
Water Management Administration
Water Supply Program
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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for Kent County School. 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) an inventory of potential sources of contamination, and (3) determining the susceptibility of the water supply to contamination. Recommendations for management of the assessment area conclude this report.

The source of Kent School's water supply is an unconfined aquifer in the Coastal Plain. One well is currently being used to draw the water out of the aquifer. The Source Water Assessment Area for Kent School's well was delineated by the WSP using a delineation method specifically designed for a source pumping an average of less than 10,000 gallons per day.

Potential sources of contamination within the assessment area were identified based on site visits, database review, and land use maps. Well information and water quality data were also reviewed. Figures showing land uses and potential contaminant sources within the Source Water Assessment Area and an aerial photograph of the well location are enclosed at the end of the report.

The susceptibility analysis of Kent School's water supply is based on a review of the water quality data, potential sources of contamination, aquifer characteristics, and well integrity. It was determined that Kent School's water supply is susceptible to contamination by volatile organic compounds. The water supply is not susceptible to inorganic compounds, synthetic organic compounds or microbiological contaminants.

INTRODUCTION

A review of the Water Supply Program's (WSP) database indicated that there are three active small systems in Kent County. Maryland's Source Water Assessment Plan (MDE, 1999), defines a "small system" as a community or a nontransient noncommunity system that has a water appropriation permit of less than 10,000 gallons per day (gpd). Since the three systems are located in different areas of the county (figure 1) individual source water assessments were conducted rather than a regional one. This source water assessment deals with Kent School.

Kent School is a privately owned school located about 4 miles southwest of Chestertown on the northern shore of the Chester River. It is classified as a nontransient noncommunity system. The school owns and operates its own water system that serves a population of 210. The water is supplied by one well. Two older wells were abandoned in the early 1990s due to water quality problems.

WELL INFORMATION

A review of the well data and sanitary surveys, indicates that the supply well (Permit No. KE-81-1027) was drilled in October 1988 in accordance with Maryland's well construction standards that were implemented in 1973. The well has a total depth of 123 feet, casing depth of 102 feet, and has been grouted to 70 feet with bentonite clay.

HYDROGEOLOGY

Kent School's well draws water from is a Coastal Plain aquifer known as the Aquia aquifer. Based on a review of the well completion report the Aquia is considered unconfined in this part of Kent County. The Kent School is located in an area where the Aquia subcrops beneath the Columbia. The Aquia aquifer is a fine to coarse, glauconitic quartz sand which locally contains clayey layers, shell beds, cemented zones, and highly weathered zones (Drummond, 1998). The top of the Aquia aquifer in the vicinity of the school is about 10 feet below sea level and the bottom about 200 feet below sea level. Based on a potentiometric surface map (Drummond, 1998), the main ground water flow direction in the Aquia aquifer in the Kent School area is south towards the Chester River.

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 SWAP, no delineation method was specified for systems in unconfined aquifer in the Coastal Plain using less than 10,000 gpd. The WSP developed delineation areas for these systems based on annual recharge of 1 ft. and predominant ground water flow direction. This method is pending approval by the SWAP Technical Committee and the EPA. The source water assessment area is a wedge shaped area oriented in the direction of ground water

flow. The upgradient and downgradient boundaries are 1000 feet and 100 feet respectively, from the well. The wedge has an angle of 60 degrees to account for the uncertainty in determining the main ground water flow direction (figure 2).

POTENTIAL SOURCES OF CONTAMINATION

For this assessment, MDE Waste and Water Management databases were reviewed and a field inspection conducted to identify potential sources of contamination in around the Kent School WHPA. In addition, Mr. Chris Marblo of Kent School, Inc. was contacted to provide any information on potential sources of contamination on school property.

The potential point sources of contamination that were identified are two underground storage tanks (USTs) and a septic tank (figure 2). The tanks are used to store heating oil for the school buildings. The septic tank is use to collect wastes from the school buildings.

Based on the Maryland Office of Planning 1997 Land Use Map, only two land use categories were identified in the WHPA (table 1). Figure 3 shows the land use in and around Kent School. It must be noted that the land use designated commercial is actually the school property.

LAND USE CATEGORIES	TOTAL AREA (acres)	PERCENTAGE OF WHPA
Commercial (School)	7.83	46.5
Cropland	9.00	53.5

Table 1. Land Use Summary for the Kent School WHPA.

A review of the Kent County Sewer Map (1995) shows that there is no planned sewer service in the WHPA. The school has a drainfield just outside the WHPA on the southeast side where the wastewater is discharged.

Non-point sources of contamination are usually associated with land use activities in the area. More than land use in the WHPA is cropland. Application of fertilizers and pesticides on cropland could result in potential source so synthetic organic compounds (SOCs). Wastes generated by livestock (horses) are potential sources of nitrates and microbial pathogens. Application of fertilizers and pesticides for landscaping the school property could result in potential sources of nitrates and SOCs.

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 finished water unless indicated otherwise. The treatment currently in use at Kent School is ion exchange for iron removal.

In accordance with Maryland's SWAP, data from the water supply was compared with the Maximum Contaminant Levels (MCLs). If the monitoring data is greater than 50% of the MCL, the written assessment will describe the source of such a contaminant, and, if possible, locate the specific sources, which are the cause of the elevated contaminant level. A review of the monitoring data since 1993 for Kent School indicates that the school's water supply meets the drinking water standards.

Inorganic Compounds (IOCs)

No IOCs above 50% of the MCL have been detected in Kent School's water supply since 1993. Nitrate was detected between 1993 and 1999 at levels ranging from 0.8 ppm to 1.7 ppm. No IOCs above 50% of the MCL were detected in Kent School's water supply since 1993. These detections are well below 50% of the MCL for nitrate which is 10 ppm. Other IOCs that do not have an MCL like sodium, iron and sulfate were also detected.

Volatile Organic Compounds (VOCs)

No VOCs have been detected in Kent School's water supply since 1993.

Synthetic Organic Compounds (SOCs)

The only SOC that has been detected in Kent School's water supply is di(ethylhexyl)phthalate at 0.5 ppb. The MCL for this SOC is 6 ppb. The phthalate was also found in the laboratory blank and can be attributed to a laboratory error and not to the water supply at Kent School.

Microbiological Contaminants

Total coliform bacteria were detected three times between 1996 and 1997 during routine sampling. Required repeat sampling for each detection showed no presence of total coliform. This indicates there may have been a sampling error or samples may have been taken at points in the distribution system where the water may not have been flowing through for a long period of time.

SUSCEPTIBILITY ANALYSIS

Kent School's well obtains 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) 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.

Inorganic Compounds (IOCs)

No IOCs above 50% of the MCL have been detected in Kent School's water supply. Nitrate has been detected at levels well below 50% of the MCL. Sources of nitrate can generally be traced to land use. Fertilization of cropland and school property are non-point sources of nitrate in ground water. Cropland and school properties make up 53.5% and 46.5% respectively of the WHPA. Animal (horses) wastes are sources of nitrate in ground water. Onsite septic systems are also sources of nitrate in ground water. The school's septic drainfields are outside the WHPA.

Based on the above analysis, Kent School's water supply is currently **not** susceptible to IOC contamination.

Volatile Organic Compounds (VOCs)

No VOCs have been detected in Kent School's water supply since 1993. Two heating oil USTs are located within the Kent School WHPA approximately 150 to 250 feet from the well. If the tanks leak or get overfilled there is a potential for VOCs to enter the ground water and contaminate the well. VOCs associated with heating oil are known to be mobile and do not degrade quickly.

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

Synthetic Organic Compounds (SOCs)

A large portion of the land use in and around the WHPA can be potential sources of SOC contamination if improper application of pesticide occurs. Sampling data since 1993 indicate that no SOC's have been detected in the water supply.

Based on the above analysis, Kent School's water supply is **not** susceptible to SOC contamination.

Microbiological Contaminants

Kent School's water supply does not have disinfection for treatment of its raw water, so bacteriological sampling results reflect the quality of raw water. The bacteriological samples taken quarterly since 1993 show an absence of fecal coliform and the three detections of total coliform were not related to the supply well.

Based on the coliform sampling date, the well is **not** susceptible to protozoans or bacteriological contaminants. The well 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.

MANAGEMENT OF THE WHPA

Public Awareness and Outreach

- Information from this report or pamphlets and flyers to school personnel, farmers and local residents will help educate them about Wellhead Protection.
- Placing road signs at WHPA boundaries are an effective way making the public aware of land use and water quality.
- Farmers located in the WHPA may request the assistance of the University of Maryland Agricultural Extension Service, the Soil Conservation Service to work with them to adopt Best Management Practices (BMPs) for farms located within the WHPA.

Monitoring

- Continue to monitor for all Safe Drinking Water Act contaminants are required by MDE.

Contaminant Source Inventory/Well Inspections

- Conduct annual inspections of the USTs in the WHPA to ensure their integrity, and also ensure that proper spill prevention techniques are used when filling the tanks.
- Periodic inspections and a regular maintenance program for the well will ensure its integrity and protect the aquifer from contamination.
- The school should consider the feasibility of placing tanks within secondary containment structures or in above ground locations.

Changes in Use

- Any increase in pumpage or addition of a new well to the system may require revision 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

- 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. KE1971G008
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 Quadrangles: Chestertown SE and SW 3-25-95
Maryland Office of Planning 1994 Land Use Map
Maryland Office of Planning 1995 Kent County Sewerage Coverage

FIGURES



Figure 1. Location of Small Systems in Kent County.

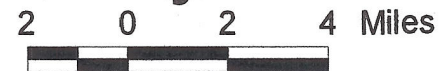
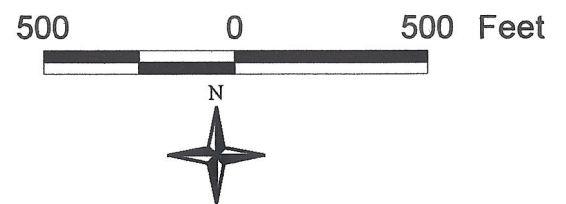
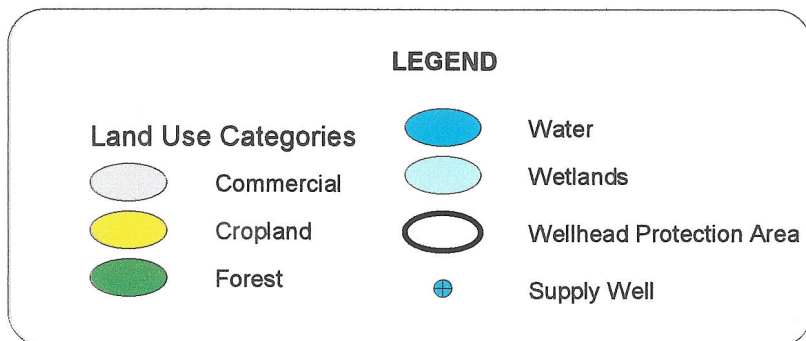




Figure 3. Land Use Map of the Kent School Wellhead Protection Area



Maryland Office of Planning 1997
Kent County Land Use Map