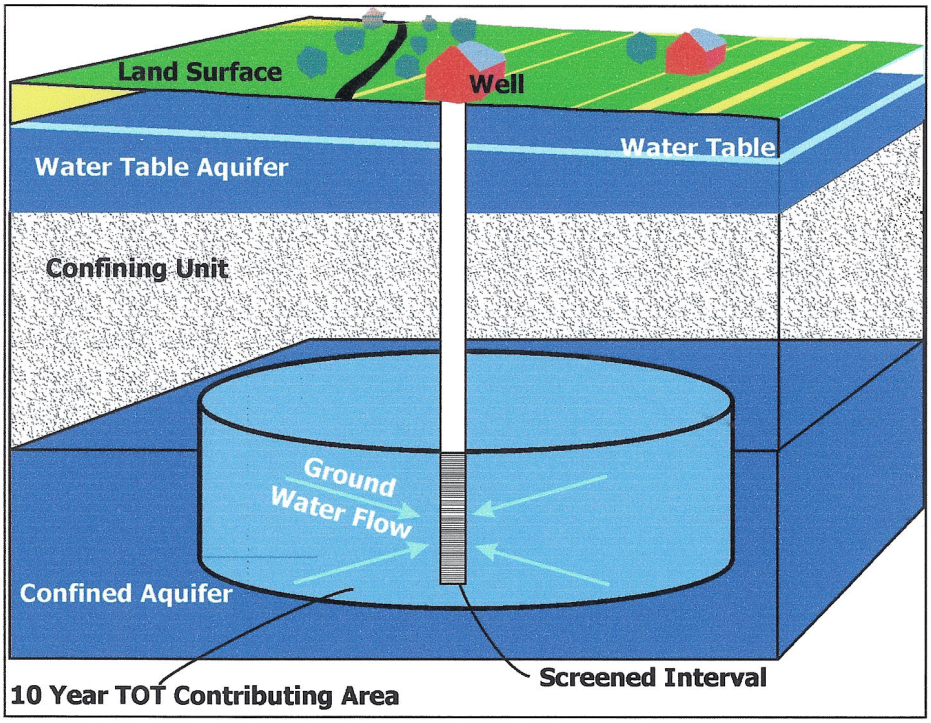
SOURCE WATER ASSESSMENT

FOR THE EDESVILLE WATER SYSTEM

KENT COUNTY, MD



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MDE

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SUMMARY

The Maryland Department of the Environment's (MDE) Water Supply Program has conducted a Source Water Assessment for the Edesville Water System. 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 the Edesville's water supply is a naturally protected confined aquifer in the Coastal Plain. One well is currently being used to pump the water out of the aquifer. The source water assessment area was delineated by the Water Supply Program using a method approved 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 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 for the Edesville 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 the Edesville water supply is not susceptible to inorganic compounds, volatile organic, compounds, synthetic organic compounds, radiological compounds or microbiological contaminants.

INTRODUCTION

The Edesville Water System serves the community of Edesville located approximately 2 miles northeast of Rock Hall in Kent County (figure1). The Edesville Water System is owned and operated by the Kent County Department of Water and Wastewater Services and serves a population of 296. The water is supplied by one well.

WELL INFORMATION

A review of the well data and sanitary surveys of the system indicates that the supply well was drilled in January 1990 in accordance with the State's current well construction standards, which were implemented in 1973. The well has total depth of 140 feet, casing depth of 100 feet, is grouted to 85feet and sealed with a bentonite plug from 85 to 90 feet. Results of a 24-hour pumping test indicate that the well was capable of yielding 60 gallons per minute (gpm). The well has a submersible pump capable of pumping 50 gpm.

HYDROGEOLOGY

The Edesville well draws water from a confined aquifer in the Coastal Plan known as the Monmouth aquifer. The Monmouth aquifer is fine-to medium-grained glauconitic quartz sand with clayey layers and calcareous beds. The sandy intervals are light olive-gray, and clayey layers are medium- to dark-greenish gray (Drummond, 1998). The Monmouth aquifer is overlain by the Severn confining unit which is a clayey, glauconitic, fine to very fine sand. At the Edesville well site the upper confining unit occurs between depths of about 65 to 90 feet and the Monmouth aquifer occurs between depths of 90 to 145 feet (Earth Data, 1990).

A site-specific aquifer test was conducted as part of the water appropriation permit requirements. Based on test results the transmissivity of the aquifer is 2915 gallons per day per feet and the storage coefficient is 0.0001.

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. The WHPA was delineated using the methodology described in Maryland's Source Water Assessment Plan (MDE, 1999). For systems using an average of >10,000 gallons per day, the WHPA is a 10 year time of travel (TOT) zone of transport (figure 1b) determined by using a volumetric equation (Florida Method):

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

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.)

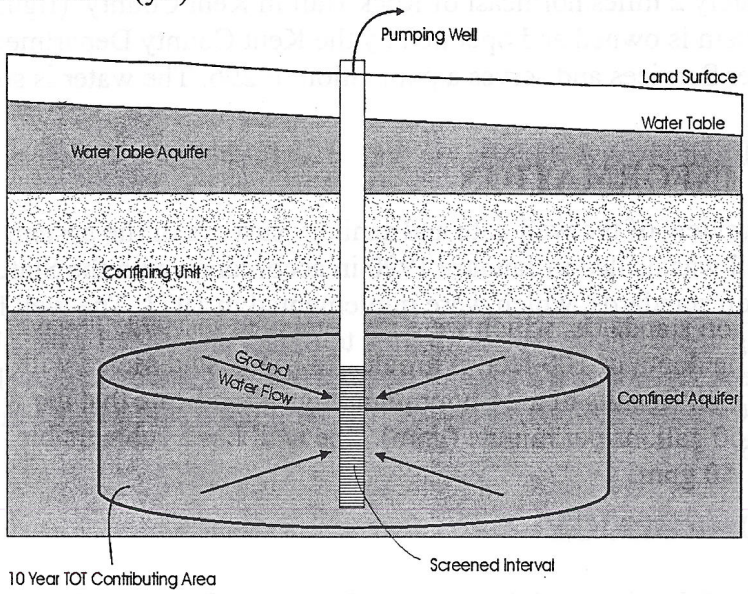


Figure 1b. Conceptual illustration of a zone of transport for a confined aquifer

The pumpage used for determining the WHPA was 24,000 gallons per day (1,171,123 ft^3/yr) which is the permitted daily average quantity. Based on the lithology of the aquifer, a porosity of 25% was assumed for it. The following parameters were used for the above mentioned equation:

Q = 1,171,123 ft^3/yr; n = 0.25; H = 40 ft; t = 10 yrs. The calculated fixed radius for a ten year time of travel resulted in r = 611 ft. This WHPA has an area of 27.07 acres.

POTENTIAL SOURCES OF CONTAMINATION

For this assessment, MDE Waste and Water Management databases were reviewed and a field inspection conducted to identify potential for any direct injection of contaminants into the aquifer in and around the Edesville WHPA. MDE Ground Water Permits Division staff also inspected the area to determine whether there were any unpermitted discharges into ground water in the area.

A site investigation and database review indicated no potential sources for direct injection of contaminants into the Monmouth aquifer in the Edesville WHPA. The only potential source of contamination identified was an old junkyard in the property adjacent to the well (figure 1). According to Mr. Robert Sipes, Chief Operator for the Edesville Water System, old truck trailers and farm equipment were deposited there. The site has now been cleaned up.

Based on the Maryland Office of Planning 1997 Land Use Map, four land use categories were identified in the WHPA (table 1). Figure 2 shows the land use in and around the Edesville WHPA.

LAND USE CATEGORIES	TOTAL AREA (acres)	PERCENTAGE OF WHPA
Low Density Residential	7.76	28.7
High Density Residential	6.47	23.9
Commercial	5.48	20.2
Cropland	7.36	27.2

Table 1. Land Use Summary for the Edesville WHPA.

A review of the 1995 Kent County Sewer Map shows that 90 % of the WHPA has sewer service with no planned service for the rest of the area (figure 3).

Non-point sources of contamination are usually associated with land use activities in the area. Since Edesville's source of water supply is a confined aquifer, the existing land use activities should not have an impact on its water quality.

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 for finished (treated) water unless otherwise noted. The treatment currently used at Edesville is disinfection, and coagulation, flocculation, rapid mix, sedimentation and filtration for iron removal.

MDE personnel discussed water quality issues and concerns with Mr. Robert Sipes who Mr. Sipes indicated that the only water quality concern that he had was the presence of iron in the raw water. A review of the monitoring or data since 1993 for Edesville's finished water indicates that the system's water supply currently meets the drinking water standards.

Inorganic Compounds (IOCs)

No IOCs above 50% of the MCL have been detected in the Edesville water supply since 1993. Table 3 lists the IOCs that have been detected in the water supply since 1993. MCLs have not been established for sodium, iron, chloride, and sulfate. Sulfate and chloride have a secondary standard of 250 ppm and iron has a secondary standard of 0.3 ppm. Secondary standards are levels established to indicate when taste. Odor or color of the water may be offensive. As can be noted from table 2 the detected levels of the regulated IOCs were well below 50% of the MCLs.

CONTAMINANT ID	CONTAMINANT NAME	MCL (ppm)	SAMPLE DATE	RESULT (ppm)
1040	NITRATE	10	25-Jan-94	1.35
1010	BARIUM	2	15-Aug-94	0.107
1025	FLUORIDE	4	15-Aug-94	0.28
1055	SULFATE	none	15-Aug-94	21
1025	FLUORIDE	4	17-Jan-96	0.12
1041	NITRITE	1	17-Jan-96	0.002
1055	SULFATE	none	17-Jan-96	8.6
1040	NITRATE	10	17-Jan-96	0.6
1017	CHLORIDE	none	30-Jan-97	0.7
1017	CHLORIDE	none	29-Apr-97	1.1
1017	CHLORIDE	none	10-Jul-97	0.7
1017	CHLORIDE	none	19-Nov-97	1.2
1025	FLUORIDE	4	9-Mar-99	0.69
1028	IRON	none	9-Mar-99	0.2
1052	SODIUM	none	9-Mar-99	54.9

Table 2. IOC results for the Edesville water supply.

Volatile Organic Compounds (VOCs)

The only VOC detected above 50% of the MCL in the Edesville water supply since 1993 was carbon tetrachloride at 3.3 ppb on 7/6/98. The MCL for carbon tetrachloride is 5 ppb. No carbon tetrachloride was detected in a sample taken to confirm its presence. The only other regulated VOC that was detected one time was ethylbenzene at 0.6 ppb. The MCL for ethylbenzene is 700 ppb.

Also detected in five samples taken between 1993 and 2000 were disinfection by-products known as trihalomethanes (THMs) – bromodichloromethane, bromoform, chloroform, and dibromochloromethane. THMs are currently regulated only for systems serving a population of over 10,000. The current MCL for regulated systems is 100 ppb for the total of the four above mentioned VOCs. The total concentrations of the four THMs in the Edesville water supply range from 9.6 ppb to 18.1 ppb. Disinfection by-products are the result of a reaction between chlorine used for disinfection and organic material in the water supply.

Synthetic Organic Compounds (SOCs)

No SOCs have been detected in the Edesville water supply since 1993.

Radionuclides

No radionuclides above 50% of the MCL have been detected in the Edesville water supply since 1993. Radionuclides that were detected in the water supply are listed in Table 3. Currently there is no MCL of radon-222, however EPA has proposed an MCL of 300 picoCuries per liter (pCi/L) or an alternate of 4000 pCi/L if the State has a program to address the more significant risk form radon in indoor air.

CONTAMINANT ID	CONTAMINANT NAME	MCL (pCi/L)	SAMPLE DATE	RESULT (pCi/L)
4100	GROSS BETA	50	30-Jan-97	1
4100	GROSS BETA	50	29-Apr-97	1
4100	GROSS BETA	50	10-Jul-97	1
4100	GROSS BETA	50	19-Nov-97	1
4004	RADON-222	300/4000 (proposed)	1-Feb-00	25
4100	GROSS BETA	50	26-Feb-01	3

Table 3. Radionuclide results for the Edesville water supply.

Microbiological Contaminants

No total or fecal coliform has been detected in Edesville's raw or finished water since 1993.

SUSCEPTIBILITY ANALYSIS

The aquifer that supplies Edesville's drinking water is confined and based on the well completion report two confining beds overlie it. These confining layers would prevent the flow of any surface contamination into the aquifer supplying Edsville. 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 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 Compound (IOCs)

No IOCs above 50% of the MCL have been detected in the Edesville water supply. Nitrate was only detected once and may represent the probably background levels found in the aquifer. Barium, sulfate, fluoride, chloride and iron are naturally occurring minerals in the aquifer material. The sodium may have been the result of the treatment process (ph adjustment) that is no longer being used now.

Based on the above analysis, the Edesville water supply is **not** susceptible to IOC contamination.

Volatile Organic Compounds (VOCs)

Carbon tetrachloride and ethylbenzene have been detected one time. Neither VOC has been detected again in other samples taken following the detections. No VOC sources have been identified in the WHPA.

Based on the above analysis, the Edesville water supply is **not** susceptible to VOC contamination.

Synthetic Organic Compounds (SOCs)

No SOCs have been detected in the Edesville water supply since 1993. There are no sources of SOC contamination in the WHPA that could impact the confined aquifer. Hence the Edesville water supply is **not** susceptible to SOC contamination.

Radionuclides

Gross beta radiation and radon-222 have been detected at 50% of the MCL (or proposed MCL in the Edesville water supply since 1993. The presence of these contaminants is attributed to decay of naturally occurring minerals like uranium in the aquifer sediments.

Based on the above analysis the Edesville water supply is **not** susceptible to radionuclides.

Microbiological Contaminants

Based on coliform sampling data and the aquifer characteristics, the Edesville water supply is **not** susceptible to microbiological contaminants.

MANAGEMENT OF THE WHPA

Form a Local Planning Team

- The team should represent all the interests in the community. The County Department of Water and Wastewater, the County Health Department, local planning agencies, local businesses, residents, developers and farmers within and near the WHPA should work to reach a consensus on how to protect the water supply.

Public Awareness and Outreach

- Pamphlets, flyers and bill stuffers sent to local residents, businesses, and farmers will help educate the general public about Wellhead Protection.
- Placing signs at the WHPA boundaries is a good way to make the public aware of protecting their source of water supply.

Monitoring

- Continue sampling as required by the Safer Drinking Water Act.
- Annual bacteriological sampling is a good check on well integrity.

Planning/New Development

- Continue to stress the importance of a Comprehensive Water and Sewer Plan to ensure that new development (residential and commercial) adjacent to the WHPA is sewered, and that there are no discharges into the aquifer.
- The County Department of Water and Wastewater should work with the County Planning Department to consider countywide wellhead protection implementation. Grants are available from MDE for wellhead protection projects.

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 Uses

- 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.

Contaminant Source Inventory Updates/ Well Inspections

- Conduct a detailed survey to ensure that there are no other potential sources of contamination within the WHPA. Updated records of new development within the WHPA should be maintained.
- Work with the County Health Department to ensure that there are no unused wells within the WHPA. An improperly abandoned well can be a potential source of contamination to the aquifer.
- 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.

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.

Earth Data Incorporated, 1990, Results of Exploratory Drilling and Testing/ Production Well Construction at Edesville, Kent County Sanitary District, Inc., 21 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 1989G003
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 Quad Rock Hall SW 4/8/94
USGS Topographic 7.5Minute Quadrangle – Rock Hall
Maryland Office of Planning 1997 Kent County Land Use Map
Maryland Office of Planning 1995 Kent County Sewer Map

FIGURES

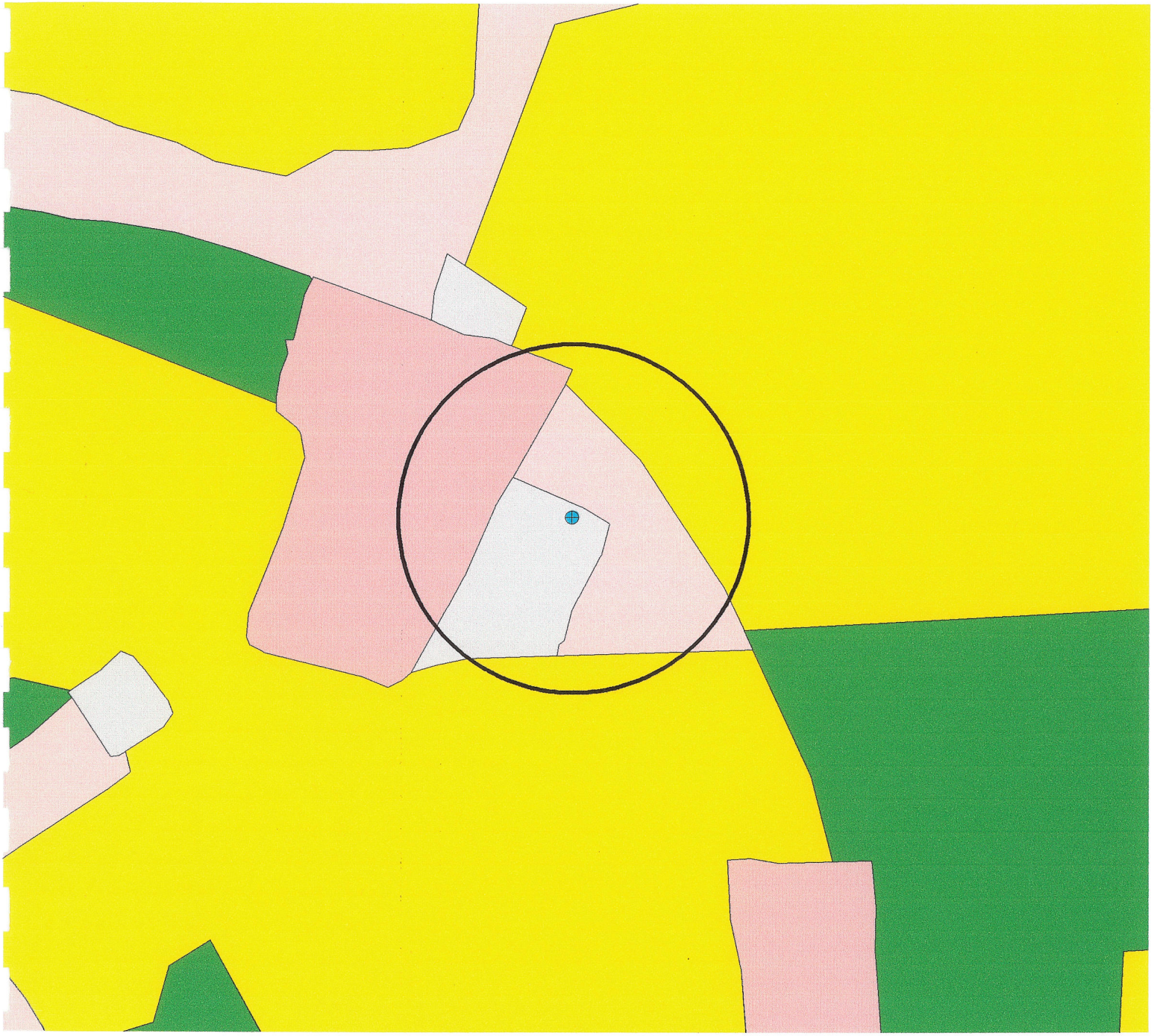


Figure 2. Land Use Map of the Edesville Wellhead Protection Area

Source: Maryland Office of Planning 1997 Kent County Land Use Map

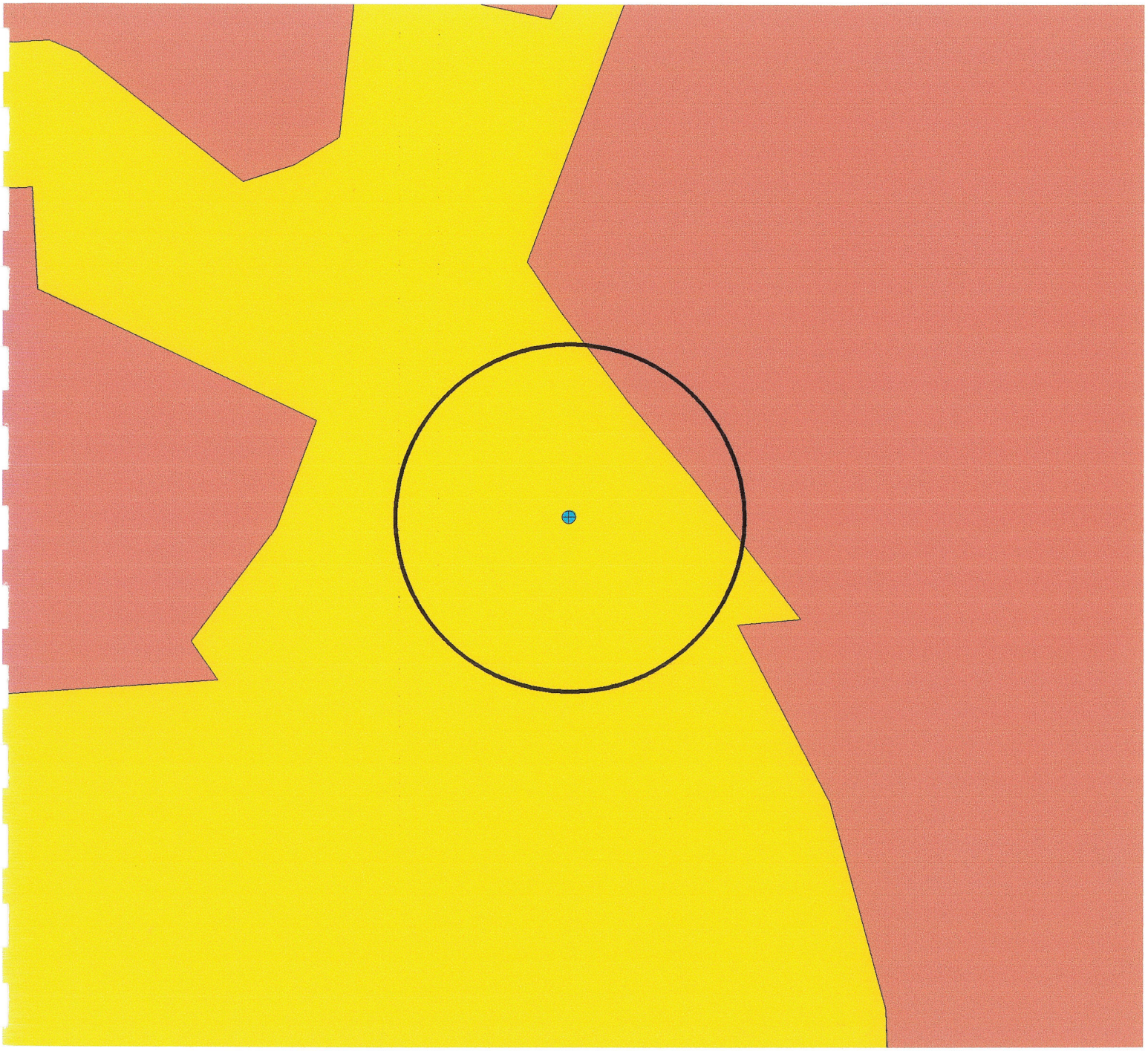
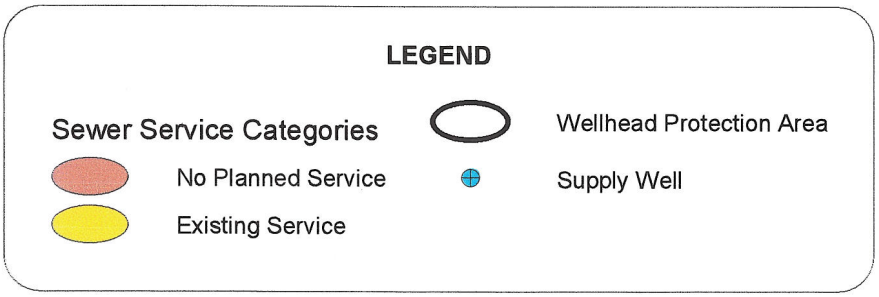


Figure 3. Sewer Service Map of the Edesville Wellhead Protection Area



Source: Maryland Office of Planning 1995 Kent County Sewer Map