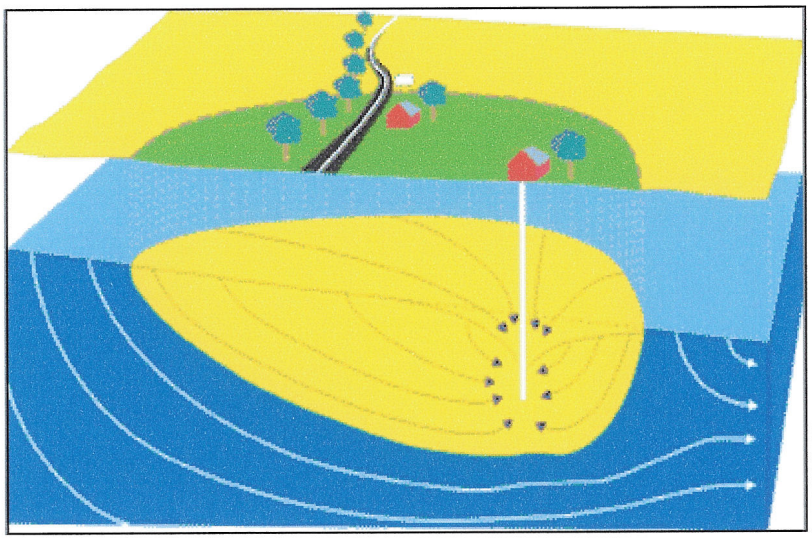
SOURCE WATER ASSESSMENT
for
DICKERSON GENERATING STATION
MONTGOMERY COUNTY, MD



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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for the Dickerson Generating Station. 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 of Dickerson Generating Station's water supply is an unconfined fractured rock aquifer, known as the New Oxford Formation. The system currently uses two wells to obtain its drinking water. The Source Water Assessment Area was delineated by the Water Supply Program using U.S. EPA approved methods specifically designed for each source.

Potential sources of contamination within the assessment area were identified based on site visits, database reviews 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 Dickerson Generating Station'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 Dickerson Generating Station's water supply is susceptible to organic compounds. It is not susceptible to inorganic compounds, or microbiological contaminants.

INTRODUCTION

The Water Supply Program has conducted a source water assessment for the Dickerson Generating Station water supply located in Dickerson, northwest Montgomery County (figure 1). The Dickerson Generating Station water supply is considered a nontransient noncommunity (NTNC) water system, which is defined as a public water system that regularly serves at least 25 of the same individuals over six months per year. The Dickerson Generating Station water supply is owned and operated by Mirant Mid-Atlantic, LLC. The system has two wells each with a treatment plant and serves water to 132 employees.

WELL INFORMATION

Dickerson Generating Station is supplied water by two wells (D and H). Well information was researched from the Water Supply Program's database, site visits, well completion reports, sanitary survey inspection reports and published reports. Both wells were drilled after 1973, when the State's well construction regulations went into effect, should be compliance with current standards for grouting. Well information is shown in Table 1 below.

SOURCE ID	SOURCE NAME	PERMIT NO	TOTAL DEPTH (ft)	CASING DEPTH (ft)	YEAR DRILLED
01	Well D	MO880386	475	64	1989
02	Well H	MO940264	425	65	1997

Table 1. Dickerson Generating Station's Well Information

Dickerson Generating Station has two Water Appropriation Permits one for each well for potable supply and sanitation. Permit MO1998G018 allows the facility to use an average of 40,000 gallons per day (gpd) and 50,000 gpd in the month of maximum use of ground water from Well D. Permit MO1991G004 allows the facility to use an average of 2,000 gpd and 3,000 gpd in the month of maximum use of ground water from Well H. Based on pumpage reports submitted for Well D to MDE the daily average for the past four years is 13,834 gpd. The facility also has a Water Appropriation Permit that allows it to use surface water from the Mirant Discharge Channel for uses related to the operation of the generating station.

HYDROGEOLOGY

Dickerson Generating Station is located in the Piedmont physiographic province and is underlain by the New Oxford Formation. The New Oxford Formation is an unconfined, fractured rock aquifer and is composed of interbedded red to maroon shale, siltstone and sandstone. (Otton, 1981). In this type of setting, the underlying rocks have minor primary porosity and permeability and ground water primarily occurs in and is stored bedding plane joints, faults and crevices.

Ground water flow rates depend upon the openness of the fractures and their degree of interconnection. Unconsolidated overburden (saprolite) above the bedrock frequently has much greater primary porosity and permeability than the rock has, allowing additional ground water to be stored (Duigon, 1994)

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 source water assessment area for public water systems with an average appropriation amount of greater than 10,000 gpd is the watershed drainage area that contributes to the well. This area is modified by geological boundaries, ground water divides, and by annual average needed to supply the well (MD SWAP, 1999). This method was used to delineate the WHPA for Well D. Since Well H has an average appropriation amount of less than 10,000 gpd, delineated area was a circle with a radius of 1,000 feet around the well. The radius is based on calculating the land area needed to provide a yield of 10,000 gpd assuming a 400 gpd/acre recharge (drought year recharge conditions), and a safety factor. Since the delineated WHPAs for the two wells overlapped the two areas were combined to form one WHPA for the system. The area of the larger WHPA is 182.3 acres, which is more than adequate to support the supply even during a drought year.

POTENTIAL SOURCES OF CONTAMINATION

Potential sources of contamination are classified as either point or non-point sources. Examples of point sources of contamination are leaking underground storage tanks, landfills, ground water discharge permits, large scale feeding operations and Superfund sites. These sites are generally associated with commercial or industrial facilities that use chemical substances that may, if inappropriately handled, contaminate ground water via discrete point location. Non-point sources of contamination are associated with certain types of land use practices such as the use of pesticides, application of fertilizers or animal wastes, or septic systems that may lead to ground water contamination over a larger area.

Point Sources

A review of MDE contaminant databases as well as a field survey revealed two point sources of contamination within the WHPA. Figure 2 identifies these as an Underground Storage Tank (UST) site and a coal storage site. The storage and use of coal for the power plant is a potential source of metals and heavy metals. Table 2 lists these sites. Potential contaminants are grouped as Volatile Organic Compounds (VOC), Metal (M) and Heavy Metals (HM).

ID	Type	Site Name	Address	Potential Contaminant	Comments
2	UST	Dickerson Generating Station	21200 Martinsburg Rd	VOC	4 Tanks
5	COAL	Diickerson Generating Station	21200 Martinsburg Rd	M, HM	Open Storage

Table 2. Potential Contaminant Sources within Dickerson Generating Station's WHPA

Non-Point Sources

The Maryland Department of Planning's 2002 digital land use map for Montgomery County was used to determine the predominant types of land use in the WHPA (figure 3). Based on this land use map, 69% of the WHPA is industrial land, with the remaining 31% being forested land. Table 2 summaries the land use categories in the WHPA.

LAND USE CATEGORIES	TOTAL AREA (acres)	PERCENTAGE OF WHPA
Industrial	126.21	69.3
Forest	56.12	30.7
Total	55.80	100.00

Table 3. Land Use Summary for Dickerson Generating Station's WHPA.

Maryland Department of Planning's 2004 digital Montgomery County Sewer Map was used to determine the sewer service area categories in the WHPA. Based on this map, it was determined that the entire WHPA is not planned for sewer service. Wastes generated by the facility are treated at a wastewater treatment plant located downgradient the wells. Dickerson Generating Station had a surface water discharge permit to discharge the treated wastewater into the Potomac River. .

WATER QUALITY DATA

Water Quality data was reviewed from the Water Supply Program's database and system files for Safe Drinking Water Act contaminants. The State's SWAP defines a threshold for reporting water quality data as 50% of the Maximum Contaminant Level (MCL). If a monitoring result is at or greater than 50% of a MCL, this assessment will describe the sources of such a contaminant and, if possible, locate the specific sources which may be the cause of the elevated contaminant level. The Dickerson Generating Station water system treats its raw water before distribution. Both plants use hypochlorination for disinfection. In addition the treatment plant for Well D uses granular activated carbon for removal of ethylene dibromide.

A review of the finished water monitoring data since 1992 for Dickerson Generating Station' water supply indicates that it meets the current drinking water standards. The water quality sampling results are summarized in Table 3.

	Nitrate		SOCs		VOCs		IOCs (except nitrate)	
PLANT NO	No. of Samples Collected	No. of samples > 50% MCL	No. of Samples Collected	No. of samples > 50% MCL	No. of Samples Collected	No. of samples > 50% MCL	No. of Samples Collected	No. of samples > 50% MCL
01	23	0	14	6	18	0	7	0
02	17	0	3	0	11	0	4	0

Table 4. Summary of Water Quality Samples for Dickerson Generating Station' Water Supply.

Inorganic Compounds (IOCs)

No IOCs above 50% of the MCL have been detected in the Dickerson Generating Station water supply. Nitrate has been detected in the water supply at levels between 0.6 and 2.6 ppm. The MCL for nitrate is 10 ppm. Barium, which has an MCL of 2 ppm has been detected at levels between 0.045 to 0.17 ppm. Chromium, which has an MCL of 0.1 ppb was detected at levels between 0.0027 to 0.0048 ppm. In addition, sodium, which does not have an MCL, was detected at levels between 8 and 40.4 ppm. EPA recommends 20 ppm for people on sodium-restricted diets. Also detected was sulfate at levels between 21 and 350 ppm. Sulfate does not have an MCL but a secondary standard of 250 ppm based on taste and odor.

Volatile Organic Compounds (VOCs)

No VOCs above 50% of the MCL have been detected in the Dickerson Generating Station water supply. VOCs that have been detected are trihalomethanes (THMs). THMs are disinfection by-products that are the result of a reaction between chlorine used for disinfection and organic material found in the aquifer. The MCL for THMs is 80 ppb and is based on the total detections of four THMs. The total of the THMS detected in the water supply range from 1.7 to 10.8 ppb. In addition, methylene chloride has been detected at levels between 0.6 to 2.4 ppb. The MCL for methylene chloride is 5 ppb.

Synthetic Organic Compounds (SOCs)

Ethylene dibromide (EDB), which has an MCL of 0.05 ppb, and was detected above the MCL in the Dickerson Generating Station water supply. Granulated activated carbon was installed in 1994 to remove ethylene dibromide. Also detected on time at each plant, at levels above the MCL, was di(2-ethylhexyl) phthalate. The MCL for the phthalate is 6 ppb. Phthalate was also found in the laboratory blanks for samples collected on the same date. Hence the phthalate is not believed to represent the water quality at Dickerson Generating Station. Atrazine was also found at levels well below 50% of the MCl, in samples collected in July 1992 and July 1993. Table 4 shows the SOCs detected above 50% of MCLs

PLANT ID	CONTAMINANT NAME	MCL (ppb)	SAMPLE DATE	RESULT (PPB)
01	ETHYLENE DIBROMIDE (EDB)	0.05	28-Jun-92	0.6
01	ETHYLENE DIBROMIDE (EDB)	0.05	28-Jul-92	0.6
01	ETHYLENE DIBROMIDE (EDB)	0.05	13-Sep-92	0.4
01	ETHYLENE DIBROMIDE (EDB)	0.05	23-Nov-92	0.6
01	ETHYLENE DIBROMIDE (EDB)	0.05	4-Feb-93	0.6
01	ETHYLENE DIBROMIDE (EDB)	0.05	22-Apr-93	1.2
01	ETHYLENE DIBROMIDE (EDB)	0.05	8-Jul-93	0.5
01	DI(2-ETHYLHEXYL)PHTHALATE	6	13-Sep-03	14.4
02	DI(2-ETHYLHEXYL)PHTHALATE	6	13-Sep-03	9.3

Table 5. Synthetic Organic Compounds detected above 50% of the MCL

Microbiological Contaminants

Ground water under the influence of surface water (GWUDI) testing was conducted for the Dickerson Generating Station wells. The wells were classified as moderate risk to sources to surface water influence. As a result the system was required to collect raw water samples for bacteria (total and fecal coliform) 24 hours after at least 0.5 inches of rainfall. No coliform bacteria were detected in the raw water samples for any of the wells. All nontransient noncommunity systems are required to conduct quarterly routine bacteriological sampling for their water supply as required by the Safe Drinking Water Act. These samples are generally collected from finished (treated) water, which may not be indicative of the source water conditions. None of the forty-four routine bacteriological samples collected for the Dickerson Generating Station water supply have shown any coliform detection.

SUSCEPTIBILITY ANALYSIS

Dickerson Generating Station' wells obtain water from an unconfined fractured-rock aquifer. Wells in unconfined aquifers are generally vulnerable to any activity on the land surface that occurs within the WHPA. Therefore, managing this area to minimize the risk to the supply and continued routine monitoring of contaminants is essential in assuring a safe drinking water supply. The susceptibility of the wells to contamination is determined for each group of contaminants based on the following criteria: (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.

In the non-carbonate rocks of the Piedmont region, if a well is constructed properly with the casing extended to competent rock and with sufficient grout, the saprolite serves as a natural filter and protective barrier from microbial contamination. Properly constructed wells with no potential sources of contamination in their WHPA should be well protected from contamination. The susceptibility of the water supply to the various types of contaminants is summarized in Table 5.

Inorganic Compounds (IOCs)

No IOCs above 50% of MCLs have been detected in the Dickerson Generating Station water supply. A review of the IOC data shows that nitrate has been detected at levels below 50% of the MCL. These levels may be background levels in the area. Sources of nitrate can generally be traced to land use. Fertilizer applied on the property may be a source of nitrate loading in ground water. Chromium has been detected at levels below 50% of the MCL. The source of chromium may be its use in the cooling tower to reduce the acidity. Barium, which has been detected at levels below 50% of the MCL, may be naturally occurring in the aquifer. The source of sodium, which does not have an MCL, may be salt storage or application on the property. The source of e sulfate, which also does not have an MCL, may be the coal used for power generation.

Based on above analysis the Dickerson Generating Station water supply **is** currently not susceptible to contamination by inorganic compounds.

Volatile Organic Compounds (VOCs)

No VOCs have been detected above 50% of the MCL in the water supply. There is a potential source of VOC contamination within the WHPA (figure 2). No raw water quality data is available for review.

Based on the above discussion, the Dickerson Generating station water supply **is** susceptible to VOC contamination.

Synthetic Organic Compounds (SOCs)

Ethylene dibromide(EDB) has been above 50% of the MCL is the Dickerson Generating Station water supply. Since treatment for removal of EDB was installed there have been no detects of EDB or any other SOCs except for phthalate. The possible source of EDB is as an additive for leaded gasoline, or its former use as a pesticide. Addition sources are wastewater and emissions from processes and waster waters of the chemical industries that use it. Very low levels of atrazine were also detected in 1992 and 1993. Atrazine is a used as an herbicide for crops.

Based on the above analysis, the Dickerson Generating Station water supply **is** currently susceptible to SOC contamination.

Based on the above analysis, the Dickerson Generating Station water supply **maybe** susceptible radionuclides. Water quality samples for radionuclides will be needed to verify the susceptibility of the water supply to these compounds.

Microbiological Contaminants

Based on raw water bacteriological data the Dickerson Generating Station wells were determined not to be GWUDI. In addition, no bacteria have been detected

in any of the routine bacteriological samples collected for the Dickerson Generating Station water supply.

Based on the above discussion, the Dickerson Generating Station water supply **is not** susceptible to microbiological contaminants.

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

Table 6. Susceptibility Summary for the Dickerson Generating Station water supply.
*Treatment for removal of organic compounds

MANAGEMENT OF THE WHPA

Contaminant Source Inventory/Well Inspection

- The system owners should review the potential sources of contaminants within the WHPA and update them if necessary, including a consideration of historical uses.
- Periodic inspections and a regular maintenance program for the supply wells will ensure their integrity and protect the aquifer from contamination.
- Ensure best management practices are implemented when storing and handling coal and byproducts of the power generation.
- Consider storing the coal under cover and on a concrete pad and design a system for collection of runoff from the storage area to prevent contamination of the aquifer.

Monitoring

- Continue to monitor for all Safe Drinking Water Act contaminants as required by MDE.
- Carefully monitor the metals to determine whether there is any increase in levels in the water supply.

Changes in Use

- Any increase in pumpage or addition of new wells to the system may require revision of the WHPA. The system is required to contact the Water Supply Program when an increase pumpage is applied for or when new wells are being considered.

REFERENCES

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Dingman, R. J., and Meyer G. M., 1954, The Water Resources of Howard and Montgomery Counties: Maryland Department of Geology, Mines and Water Resources Bulletin 14, 260p.

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Otton, E.G., 1981, The Availability of Ground Water Occurrence in Western Montgomery County, Maryland: Maryand Geological Survey Report of Investigations No. 10, 56 p

Nutter, L.J., and Otton, E.G., 1969, Ground-Water Occurrence in the Maryland Piedmont: Maryland Geological Survey Report of Investigations No. 10,

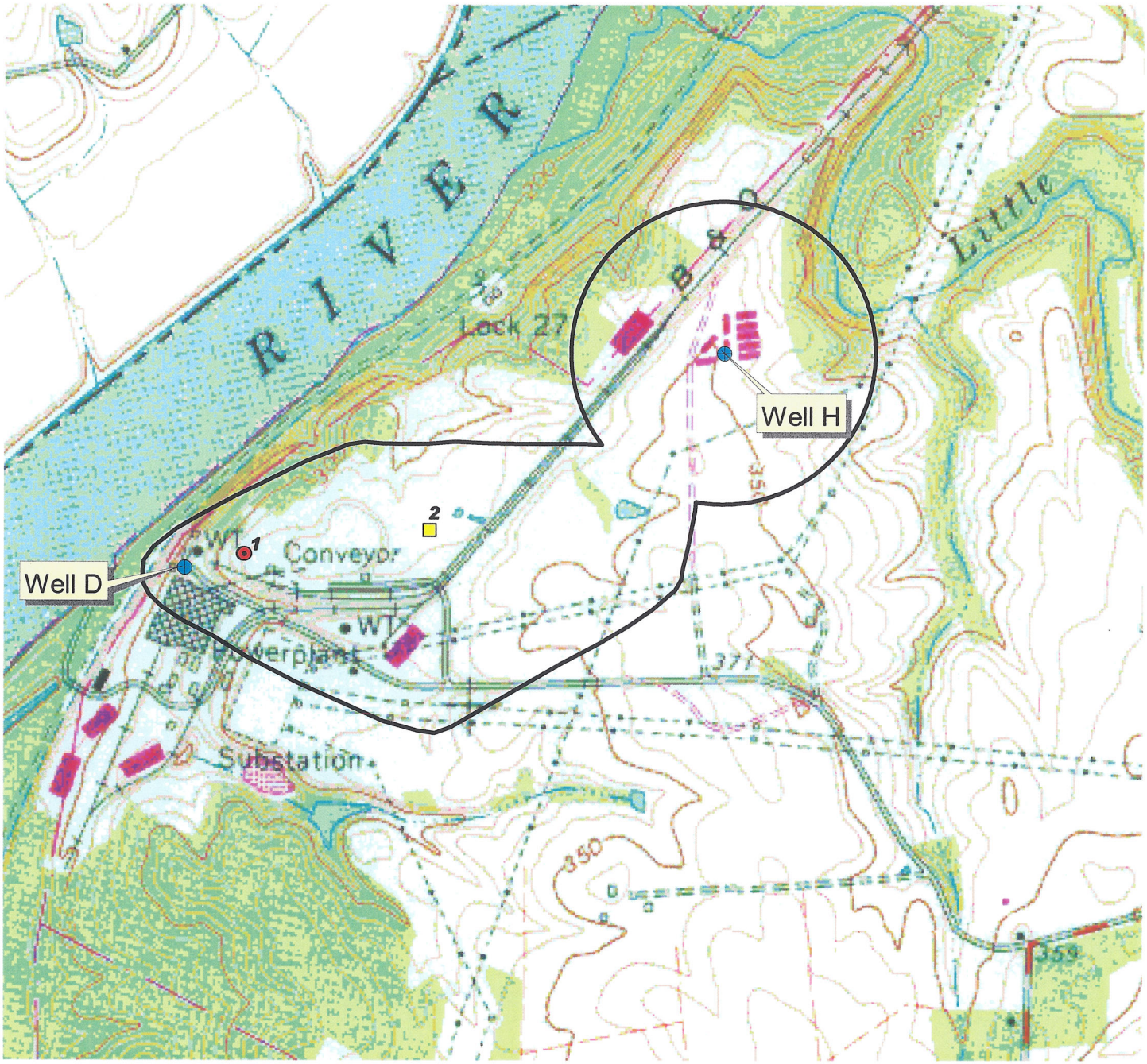
U.S. Environmental Protection Agency, 1991, Delineation of Wellhead Protection Areas in Fractured Rocks: Office of Water and Drinking Water, EPA/570/9-91-009, 144 p.

U. S. Geological Survey, 1997, Radioactive Elements in Coal and Fly Ash: Abundance, Forms, and Environmental Significance, Fact Sheet FS-163-97.

OTHER SOURCES OF DATA

Water Appropriation and Use Permit: MO1988G018, MO1991G004
Public Water Supply Inspection Reports
MDE Water Supply Program Oracle Database
MDE Waste Management Sites Database
Department of Natural Resources Digital Orthophoto Quarter Quadrangles: Poolesville-NW (1993)
USGS Topographic 7.5-Minute Seneca Quadrangle
Maryland Department of Planning 2002 MontgomeryCounty Land Use Map
Maryland Department of Planning 2004 Montgomery County Sewer Map

FIGURES



gure 2. Wellhead Protection Area for Dickerson Generating Station with Potential Contaminant Sources

LEGEND

- Underground Storage Tank
- Coal Storage
- Supply Well
- Wellhead Protection Area

1000 0 1000 Feet

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Base Map: USGS 7.5 minute Toporgraphic Quadrangle- Poolesville

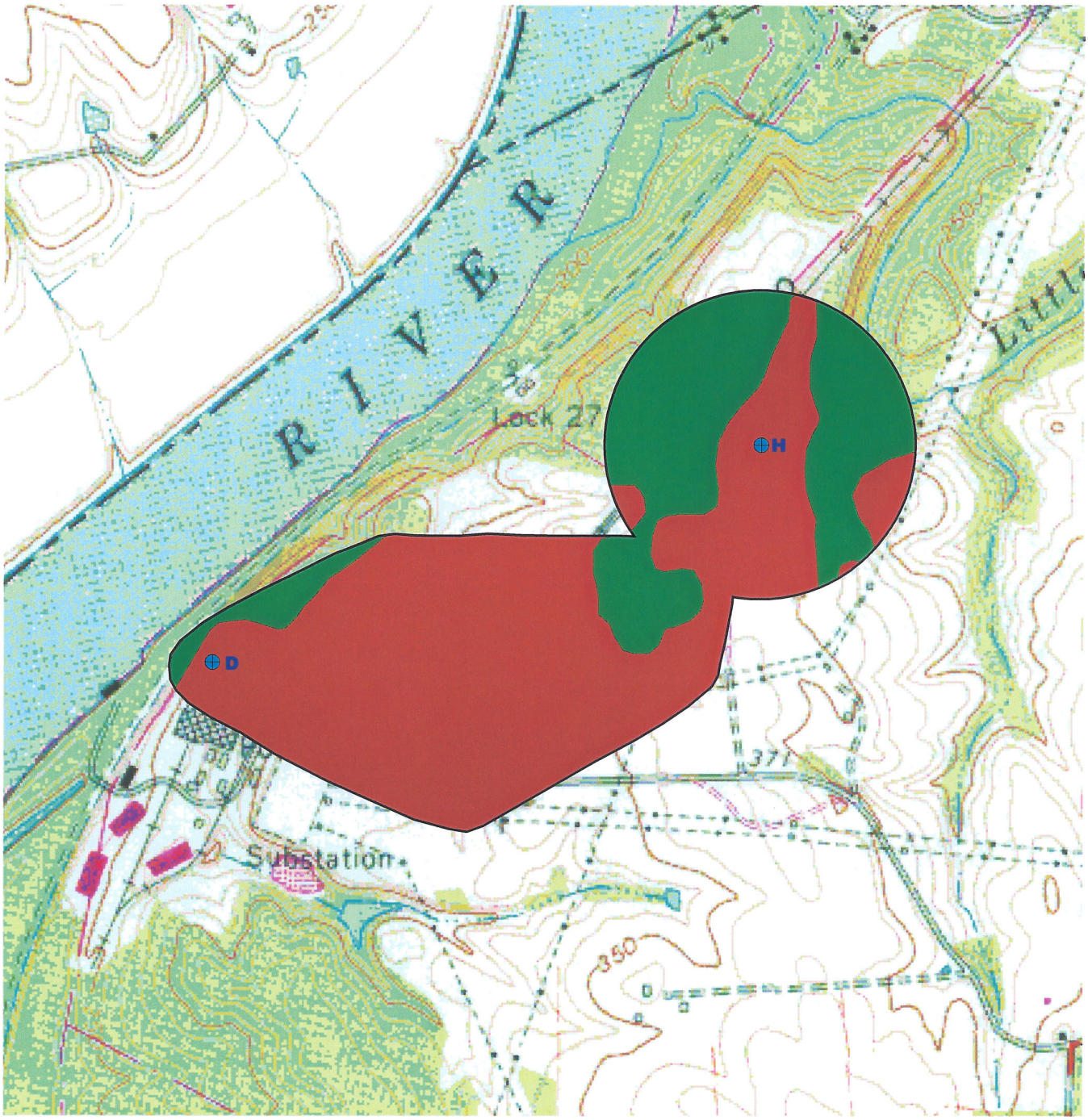

Figure 3. Land Use within the Dickerson Generating Station Wellhead Protection Area

LEGEND

Land Use Categories

- Industrial
- Forest
- Wellhead Protection Area
- Supply Well

1000 0 1000 Feet

N

Base Map: USGS 7.5 minuter Topographic Quadrange - Poolesville.
Source: MD Dept. of Planning Land Use Map (2002)