

Public Water Supply  
Source Water Assessment  
for  
**Delaware Museum of Natural History**

**PWS ID: DE0000101**

New Castle County, Delaware



**Final Report: June 23, 2004**

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## **Summary**

The Delaware Department of Natural Resources and Environmental Control's (DNREC) Division of Water Resources has completed the Source Water Assessment for the public water supply wells for Delaware Museum of Natural History as required under the 1996 amendments to the Safe Drinking Water Act. This assessment has been performed using the methods specified in the State of Delaware Source Water Assessment Plan (DNREC, 1999).

Delaware Museum of Natural History uses two wells to provide drinking water to the system. Both wells withdraw water from the Fractured Wissahickon aquifer. These wells have a medium vulnerability to contamination from surficial processes because they are withdrawing water from fractures in the crystalline bedrock. As fractured aquifer wells, the wellhead protection areas were delineated using a fixed radius of 300 feet based on New Castle County code.

This public water supply system provides water to an average daily population of 700 transient consumers from January 1 to December 31 through 1 commercial service connections.

There is one discrete source of potential contamination in the wellhead protection areas. This site has low contaminant potentials and it is unlikely that it would pose a significant threat to the drinking water resources.

An analysis of land use activities in the area show over 73 percent of the total wellhead protection area for the system contains various urban land uses. The next largest land use is residential land uses covering approximately 23 percent of the wellfield.

Although water samples may have been taken from within the distribution system, no raw water (well tap) sample data could be extracted from the Department of Public Health's Safe Drinking Water Information system Database for this Public Water Supply System.

Overall, Delaware Museum of Natural History has a low susceptibility to nutrients, a low susceptibility to pathogens, a moderate susceptibility to petroleum hydrocarbons, a moderate susceptibility to pesticides, a very low susceptibility to PCBs, a moderate susceptibility to other organic compounds, a very low susceptibility to metals and, a moderate susceptibility to other inorganic compounds.



## ***Introduction***

The 1996 amendments to the Safe Drinking Water Act (SDWA) require that source water assessments be performed for all sources of public drinking water in each state. Because of this, each state was required to develop a Source Water Assessment Plan (SWAP). The State of Delaware's SWAP was developed by a committee of scientists, water industry professionals, conservation groups, government agencies, and interested citizens in 1998 and approved by the United States Environmental Protection Agency in October, 1999.

This assessment for Delaware Museum of Natural History has been performed using the methods specified in the State of Delaware Source Water Assessment Plan (DNREC, 1999)

The assessment consists of these four critical steps:

- 1) Delineation of source water areas;
- 2) Determination of the vulnerability of a well or intake to contamination;
- 3) Identification of existing and potential sources of contamination; and
- 4) Determination of the susceptibility of the source water area to contamination.

Step 1 consists of mapping the land surface area that contributes to the water supply. For ground water systems, this is called the wellhead protection area. Delaware Museum of Natural History uses two wells to provide drinking water to the system. Both wells withdraw water from the Fractured Wissahickon aquifer. These wells have a medium vulnerability to contamination from surficial processes because they are withdrawing water from fractures in the crystalline bedrock. As fractured aquifer wells, the wellhead protection areas were delineated using a fixed radius of 300 feet based on New Castle County code.

Step 2 uses a step-by-step decision making process by which each well or surface water intake for a particular system is examined to determine its vulnerability to contamination. Vulnerability is the relative ease with which contaminants, if released into a source water area, could move and enter a public water supply well or intake at concentrations of concern. Vulnerability includes consideration of such factors as aquifer characteristics, well or surface water intake integrity, and wellscreen depth. A series of questions about the type of system (surface water or ground water), hydrologic setting, and well construction are used in the decision-making process.

Step 3 consists of creating an inventory of all existing and potential sources of contamination within the delineated source water protection areas. This was done utilizing DNREC's contaminant site inventories, 1997 land use maps, analytical data compiled by the Office of Drinking Water and through visual examination during site visits.

Step 4 consists of determining the susceptibility of the source water area to contamination. This process combines steps 1, 2, 3, water quality reports, and other information.

This information must be summarized into a report and made available to the public. It is the goal of the Division of Water Resources that the summaries provided from the source water assessment and protection program will help drinking-water systems better understand the potential threats to their drinking water supply and to work to protect these drinking water resources.

**Study Area**

Delaware Museum of Natural History is located on the west side of Kennett Pike (Route. 52) and is near Winterthur. This location is shown on Map 1 Base Map for Delaware Museum of Natural History. This public water supply system provides water to an average daily population of 700 transient consumers from January 1 to December 31 through 1 commercial service connections.

**Public Water Supply Well Data**

Information about the construction and operation of these wells is summarized in Table 1. This information was gathered from various sources (DNREC, Delaware Geological Survey, Department of Health and Social Services), and a letter requesting confirmation from the system.

**Table 1: Well Construction Data**

Well #	Permit #	Allocation #	Year Constructed	Well Capacity (gpm)	Diameter (inches)	Well Depth (fbgs)	Aquifer
1	10806	None	1969	18	6	165	Wissahickon
2	188883	None	2002	45	6	305	Wissahickon

\* fbgs = feet below ground surface

**Geology and Hydrogeology**

**Fractured**

Wissahickon

The Wissahickon Formation consists of predominantly sedimentary rocks (sandstones, mudstones and siltstones) and minor igneous lava flows that have been subjected to high temperatures and pressures known as metamorphism. Within the formation are coarse-grained igneous bodies known as pegmatites, composed of mica, feldspar and quartz; and metamorphosed iron-rich basaltic and serpentine bodies known as amphibolites and serpentinites respectively (Plank et al. 2000).

The Wissahickon Formation serves as a minor aquifer in the Piedmont province and is used primarily as a source for domestic wells (Talley et al. 1995). Wells in the Wissahickon Formation tend to pump volumes between 1 and 30 GPM (gallons per minute) at shallow depths, however larger volumes can be obtained from deeper wells located in areas such as fracture or fault zones (Talley, 1974).

**Source Water Protection Area Delineation**

The State of Delaware's Source Water Assessment Plan describes the methods to be used for the delineation of the areas that contribute water to public drinking water supplies. These source water areas are delineated by applying the methodology described in section 3.5 of the Delaware SWAP to an understanding of the geologic and hydrologic setting of the area coupled with a review of well logs and well construction information. The wellhead areas for this system were delineated using a fixed radius of 300 feet based on New Castle County code. The modeling methods are summarized in Table 2a.

New Castle County has had wellhead protection and water resource protection ordinances in place since the early 1990's. These ordinances recognized environmental quality problems that occurred due to land use decisions made up to many decades before. As part of these ordinances the zones of contribution to the water supply wells have been mapped and land use management practices have been put into place. The well(s) used by this system have been delineated using the Class A (300-foot radius) Water Resource Protection Areas (WRPAs).

Class A wellhead WRPAs have been delineated by the DGS and DNREC through the interpretation of geologic and hydrologic reports and maps, water table maps, and professional judgment. Class A wellhead WRPAs are the area within a 300 foot radius circle around all public water supply wells that are classified as community, non-transient non-community, or transient non-community wells. The New Castle County Class A WRPA map delineations are more conservative (larger) than the basic fixed radius delineations provided for under the Delaware SWAP and the State of Delaware Wellhead Protection Program (1990), and therefore the DNREC will adhere to the more protective delineation.

**Table 2a : Aquifer type and Delineation Method**

<b>Well #</b>	<b>Permit #</b>	<b>Aquifer</b>	<b>Aquifer Type</b>	<b>Delineation Method</b>
1	10806	Wissahickon	Fractured	Class A WRPA (300-Foot Fixed Radius)
2	188883	Wissahickon	Fractured	Class A WRPA (300-Foot Fixed Radius)

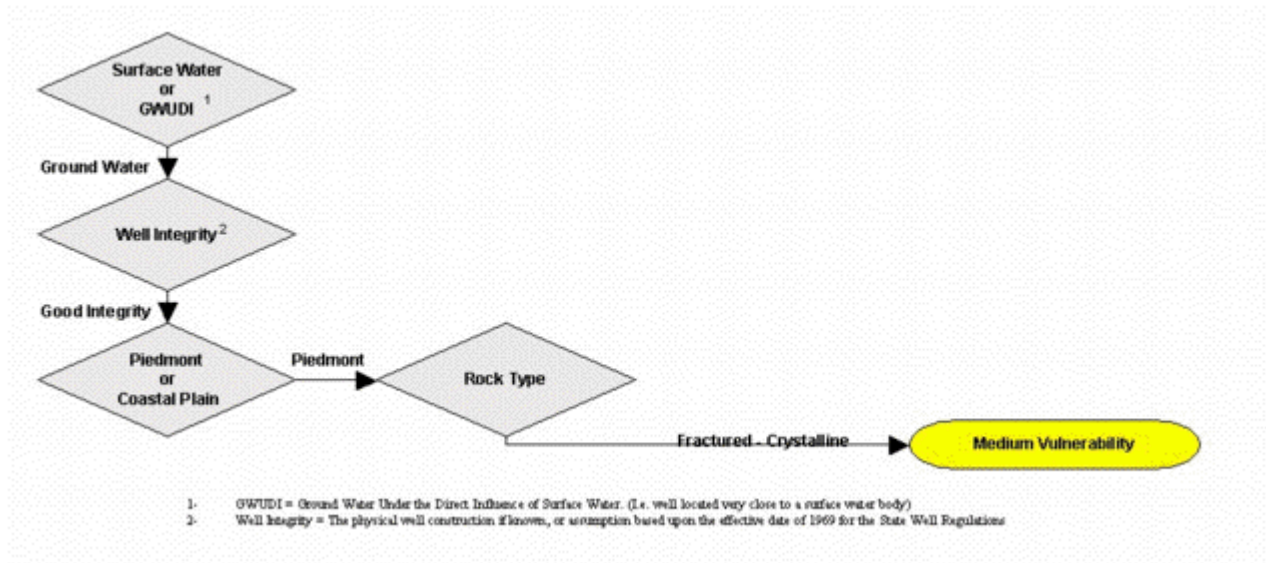
The areas delineated by this process are shown on Map 2 Delineation Map for Delaware Museum of Natural History. The 10806 wellfield contains one well (1 - 10806). The 188883 wellfield contains one well (2 - 188883). Table 2b below list any wellfields and their associated wells and acreages.

**Table 2b: Delineated Source Water Areas**

Wellfield	Wells	Acreage	Vulnerability
10806	10806 DMNH 1	6.45	Medium
188883	188883 DMNH 2	6.45	Medium

***Vulnerability Determination***

The vulnerability is the relative ease with which contaminants, if released into a source water area, could move and enter a public water supply well or surface water intake at concentrations of concern. Individual intakes or wells are ranked as having high, medium, or low vulnerability according to the process described in section 5.1 of the Delaware SWAP. The determination of this vulnerability is conducted through a series of questions about the type of intake (surface or ground water), hydrogeologic setting, and construction.



**Figure 1: Vulnerability Determination process**

Delaware Museum of Natural History uses two wells to provide drinking water to the system. Both wells withdraw water from the Fractured Wissahickon aquifer. These wells have a medium vulnerability to contamination from surficial processes because they are withdrawing water from fractures in the crystalline bedrock. As fractured aquifer wells, the wellhead protection areas were delineated using a fixed radius of 300 feet based on New Castle County code.

***Existing and Potential Sources of Contamination***

There are a multitude of potential contaminant sources that, if present, could degrade drinking water quality. Most of these sources are anthropogenic, however, natural

'contaminants' such as salt water or iron deposits can also impact water supplies. Most human impacts occur at or just below the ground surface and therefore are much more of a concern for shallow water supplies that lack a protective confining layer.

### **Discrete Sources**

Discrete sources are defined as existing or potential sources of pollution to surface or ground water supplies at well defined, usually manufactured 'points' or locations. The Source Water Program has divided the discrete sources into the following categories:

Underground Storage Tanks	Large On-Site Septic
Landfills / Dumps	Wastewater Spray Irrigation
National Pollutant Discharge Elimination Sys.	Waste Sludge Application
Tire Piles	Animal Feedlot Operations
Hazardous Waste Generators	Combined Sewer Overflows
Toxic Release Inventory	Dredge Spoils
Salvage Yards	Golf Courses
Pesticide Loading, Mixing, & Storage Facility	Domestic Septic Systems
State and Federal Superfund Sites	

These discrete sources can contaminate source waters depending upon their location, the severity of a release, and other factors. For example, golf courses may contribute both pesticides and nutrients to the surface and ground waters by means of surface application for landscaping purposes, whereas tire piles generally do not pose a threat to the waters of the state unless they begin to burn. There is one discrete source of potential contamination in the wellhead protection areas. This site has low contaminant potentials and it is unlikely that it would pose a significant threat to the drinking water resources. A brief description of each of these sites and their associated contaminant potentials follows.

### **10806 DMNH 1 and 188883 DMNH 2**

Domestic Septic System (MAPID: 1 Systems - 0.15 per Acre)

Domestic septic systems may exist in the source water area. This site has a low contaminant potential for nutrients, and a negligible contaminant potential for pathogens, petroleum hydrocarbons, pesticides, PCBs, other organic compounds, metals, and other inorganic compounds.

Additional information for other contaminant sources can be found on the state web site (<http://www.dnrec.state.de.us/>) using the Environmental Navigator. The inventory contains categorized data for multiple forms of media (surface water, ground water, etc).

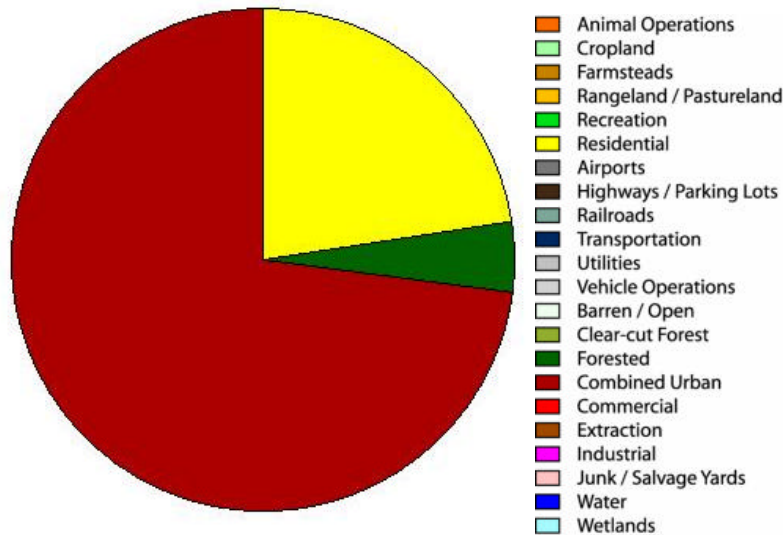
### **Land Use / Land Cover**

Anthropogenic activities associated with various land uses have the potential to contribute to ground-water quality problems, particularly when examining potential 'non-point' source contamination. There is, however, some overlap between discrete sources of contamination and some land use categories. For instance, individual domestic septic

systems may be considered discrete sources, however, the regional impact of a number of systems in a large development might also be considered as 'non-point'.

Map 4 Land Use Map for Delaware Museum of Natural History shows the land use within the delineated area. The table on Map 4 summarizes the system-wide land use that is the percent of the entire system's source water area overlain by that particular land use. Based upon the SWAP, the contaminant potential could be adjusted depending on the percentage of land use within the WHPA, with land uses occupying the greatest portion of the wellhead areas having a more significant potential impact.

Using the most recent GIS information, over 73 percent of the total wellhead protection area for the system contains various urban land uses. The next largest land use is residential land uses covering approximately 23 percent of the wellfield.



**Figure 2: System-Wide Land Use**

**Roads and Railroads**

Roads and railroads represent potential conduits for the entry of contaminants into soils and ground water. The possibility exists that an accident, such as a spill, could impact water quality. Furthermore, certain upkeep and maintenance practices such as road salting, or pesticides applications could also introduce contaminants along these transportation pathways. Table 3 summarizes the lengths and types of conduits that run through the various wellhead areas. These are the highlighted roads and railroads shown on Map 3 Discrete Sources Map for Delaware Museum of Natural History and Map 4 Land Use Map for Delaware Museum of Natural History. Smaller (tertiary), or private roads are not included in the assessment because of the lack of consistent data across the State.

**Table 3: Roads and Railways found within WHPA**

Wellfield	Conduit	Mileage	Type
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**There are no roads or railways located in the WHPAs**

### ***Water Quality Data***

This portion of the source water assessment evaluates the water quality of raw water *before* it enters into any treatment process (i.e. filtration, disinfection, fluoridation, softening, etc.) and/or the distribution system. However, it should be noted that many water supply systems utilize certain treatment methods that remove contaminants or impurities from the drinking water before it is delivered to the public.

The Delaware SWAP classifies contaminants into eight (8) categories. Examples of contaminants within each of the eight categories are as follows:

Other Inorganic:	Fluoride, Chloride, pH, Sulfate, Radon, Radium, Strontium,
Metals:	Copper, Arsenic, Iron, Manganese
Nutrients:	Nitrate, Nitrite
Other Organics:	Vinyl Chloride, PCE, TCE
Pathogens:	Coliform Bacteria, Cryptosporidium, Giardia lamblia
Pesticides:	Alachlor, Atrazine, Glyphosate
Petroleum Hydrocarbons:	Gasoline, Heating Oil, Benzene, Toluene
Polychlorinated Biphenyls:	PCB

The Source Water Assessment and Protection Program has reviewed the available analytical data for this system for the previous five years. While this report may show that a drinking water standard was exceeded for a particular contaminant at one instance, the Department of Health and Social Services, Division of Public Health, Office of Drinking Water, which regulates drinking water quality, may not consider it a violation based upon more detailed procedures detailed within their regulations (DHSS, 2002). In the event that a contaminant, which is not naturally found in the source water, has been detected as a result of maintenance to the water distribution system, its results will be noted and explained within the text. These results may not be considered when determining the final susceptibility for a well and/or public water system.

### **Naturally Occurring Contaminants**

There are several naturally occurring potential contaminants that will be identified as part of the assessments of public water supplies. These include iron, chloride, sodium, radon, radium, manganese, sulfate and others. These will be identified as part of the susceptibility determination for each well and listed as being naturally occurring if detected.

## **Analytical Data**

Data from the Department of Health and Social Services' Division of Public Health's Office of Drinking Water's (DPH-ODW) analytical database was reviewed for raw/untreated water quality data for the past five years.

Although water samples may have been taken from within the distribution system, no raw water (well tap) samples have been recorded for this Public Water Supply System.

## ***Water Treatment Methods***

The Delaware Museum of Natural History chlorinates the water that enters the drinking water system to eliminate natural bacteria that is in the natural water.

For more information about the water treatment used please contact Delaware Museum of Natural History or the Division of Public Health's Office of Drinking Water at (302) 739-5410.

## ***Susceptibility Determination***

The key part of a source water assessment is the determination of the likelihood that a particular public water supply system will capture contaminants at concentrations of concern. This analysis, termed susceptibility determination, combines the source water protection area delineation, the vulnerability determination for the wells, the contaminant source inventory, and the water quality information to yield a relative susceptibility for the public water system. Each individual water source is rated for each of the eight-contaminant categories on a scale ranging from no susceptibility to having been documented as having exceeded drinking-water standards.

## **Vulnerability**

Delaware Museum of Natural History uses two wells to provide drinking water to the system. Both wells withdraw water from the Fractured Wissahickon aquifer. These wells have a medium vulnerability to contamination from surficial processes because they are withdrawing water from fractures in the crystalline bedrock. As fractured aquifer wells, the wellhead protection areas were delineated using a fixed radius of 300 feet based on New Castle County code.

## **Contaminant Inventory**

There are two discrete sources of potential contamination in the wellhead protection areas. These sites have low contaminant potentials and it is unlikely that these pose a significant threat to the drinking water resources.

The contaminant potential from all discrete sources is as follows:

Low Contaminant Potential for Nutrients  
Negligible Contaminant Potential for Pathogens  
Negligible Contaminant Potential for Petroleum  
Negligible Contaminant Potential for Pesticides  
Negligible Contaminant Potential for PCBs  
Negligible Contaminant Potential for Other Organic  
Negligible Contaminant Potential for Metals  
Negligible Contaminant Potential for Other Inorganic

As stated previously, over 73 percent of the total wellhead protection area for the system contains various urban land uses. The next largest land use is residential land uses covering approximately 23 percent of the wellfield.

The contaminant potential from all land uses is as follows:

Low Contaminant Potential for Nutrients  
Low Contaminant Potential for Pathogens  
Medium Contaminant Potential for Petroleum  
Medium Contaminant Potential for Pesticides  
Negligible Contaminant Potential for PCBs  
Medium Contaminant Potential for Other Organic  
Negligible Contaminant Potential for Metals  
Medium Contaminant Potential for Other Inorganic

### **Water Quality**

No analytical data were available to be used to adjust the susceptibility ratings for this system.

### **Individual Source Susceptibility**

All of the wells for Delaware Museum of Natural History have unique properties, such as depth, location, date drilled, and pumping rate. These influence the delineated area, the vulnerability determination, and the contaminant inventory. This water system has two unique wellhead areas for the entire system. A Susceptibility Assessment must be performed for each individual wellhead area/wellfield. A brief discussion for each wellfield follows and the results are further summarized in Appendix B Table 7: Well Specific Susceptibility.

The 10806 DMNH 1 wellfield has a low susceptibility to nutrients due to both discrete sources and land use activities, a low susceptibility to pathogens due to land use activities, a moderate susceptibility to petroleum hydrocarbons due to land use activities,

a moderate susceptibility to pesticides due to land use activities, a very low susceptibility to PCBs due to both discrete sources and land use activities, a moderate susceptibility to other organic compounds due to land use activities, a very low susceptibility to metals due to both discrete sources and land use activities and, a moderate susceptibility to other inorganic compounds due to land use activities.

The 188883 DMNH 2 wellfield has a low susceptibility to nutrients due to both discrete sources and land use activities, a low susceptibility to pathogens due to land use activities, a moderate susceptibility to petroleum hydrocarbons due to land use activities, a moderate susceptibility to pesticides due to land use activities, a very low susceptibility to PCBs due to both discrete sources and land use activities, a moderate susceptibility to other organic compounds due to land use activities, a very low susceptibility to metals due to both discrete sources and land use activities and, a moderate susceptibility to other inorganic compounds due to land use activities.

### **System Wide Susceptibility**

The individual susceptibilities of each of this system's wells are detailed in the previous section. On a source-by-source basis these wells could have very different susceptibility ratings. When looked at as a group for the entire system some generalized, conservative statements can be made. For instance, if one assumes that the system is only as protected as it's weakest link, then the system-wide susceptibility to any given contaminant category is determined by the most susceptible water source. Using this methodology, a drinking water system with five wells that have a low susceptibility to metals, and one well that is highly susceptible to metals would be rated as having a high susceptibility to that contaminant category. In many instances this could mean that a particular land use overlying an unconfined well could drive the system-wide susceptibility higher. However, it is also possible that a confined-aquifer well that withdraws iron-rich water could dramatically raise this system's susceptibility rating for metals.

As stated, this system-wide susceptibility is a conservative rating that summarizes the most susceptible portions of any system. This susceptibility is the relative likelihood that a public water supply might draw water contaminated at concentrations of concern to public health. This Susceptibility Assessment is a summary of the vulnerability and contaminant potential to raw water supplies. The actual water quality delivered to the consumer is monitored by Public Health's Office of Drinking Water (and for community systems is reported in the Consumer Confidence Reports) and is not part of this assessment.

Overall, Delaware Museum of Natural History has a low susceptibility to nutrients, a low susceptibility to pathogens, a moderate susceptibility to petroleum hydrocarbons, a moderate susceptibility to pesticides, a very low susceptibility to PCBs, a moderate susceptibility to other organic compounds, a very low susceptibility to metals and, a moderate susceptibility to other inorganic compounds. The individual well contributions to the system-wide susceptibility are explained below with a further summary provided in Appendix B Table 8: Overall System Susceptibility.

**Table 4: Overall Susceptibility Rating**

<b>Susceptibility</b>	<b>Contaminant Category</b>
Moderate	Petroleum Hydrocarbons Pesticides Other Organics Other Inorganics
Low	Nutrients Pathogens
Very Low	PCBs Metals

## **References**

Delaware Department of Health and Social Services, Division of Public Health, 2002 (Revised), State of Delaware Regulations Governing Public Drinking Water Systems.

Delaware Department of Natural Resources and Environmental Control, 1999, The Delaware Source Water Assessment Plan.

Plank, Margaret O., Schenck, W. S., and Srogi, L., 2000, Bedrock Geology of the Piedmont of Delaware and Adjacent Pennsylvania: Delaware Geological Survey Report of Investigations No. 59.

Talley, John H. (ed.), Woodruff, K. D., Plank, M.O., and Werkheiser, W.H., 1995, Geology and Hydrology of the Cockeysville Formation Northern New Castle County, Delaware: Delaware Geological Survey Bulletin No. 19.

Talley, John H., 1974, Hydrogeology of Selected Sites in the Greater Newark Area, Delaware: Delaware Geological Survey Report of Investigations No. 22.

## **Appendix A: Maps**

**Map 1: Base Map for Wellhead Areas**

## Map 1: Base Map

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Please contact the Source Water Assessment and Protection  
Program at Phone: (302) 739-4793 or Fax: (302) 739-2296  
to request more information regarding this map.

**Map 2: Delineation Map for Wellhead Areas**

## Map 2: Delineation Map

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Please contact the Source Water Assessment and Protection

Program at Phone: (302) 739-4793 or Fax: (302) 739-2296

to request more information regarding this map.

**Map 3: Discrete Sources Within Wellhead Areas**

### Map 3: Discrete Source Map

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Program at Phone: (302) 739-4793 or Fax: (302) 739-2296

to request more information regarding this map.

**Map 4: Land Use Within Wellhead Areas**

Map 4: Land Use Map

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Please contact the Source Water Assessment and Protection

Program at Phone: (302) 739-4793 or Fax: (302) 739-2296

to request more information regarding this map.

## **Appendix B: Tables**

**Table 5: Discrete Sources Within Wellhead Areas**

<b>Wellfield</b>	<b>SiteType</b>	<b>SiteID</b>	<b>Nutrients</b>	<b>Pathogens</b>	<b>Petroleum</b>	<b>Pesticides</b>	<b>PCBs</b>	<b>Other Organic</b>	<b>Metals</b>	<b>Other Inorganic</b>
10806 DMNH 1	Domestic Septic System		L	N	N	N	N	N	N	N
188883 DMNH 2	Domestic Septic System		L	N	N	N	N	N	N	N

<b>Wellfield Summary</b>	<b>SiteType</b>	<b>SiteID</b>	<b>Nutrients</b>	<b>Pathogens</b>	<b>Petroleum</b>	<b>Pesticides</b>	<b>PCBs</b>	<b>Other Organic</b>	<b>Metals</b>	<b>Other Inorganic</b>
10806 DMNH 1	All Site Types	All Sites	L	N	N	N	N	N	N	N
188883 DMNH 2	All Site Types	All Sites	L	N	N	N	N	N	N	N

<b>System Summary</b>	<b>Nutrients</b>	<b>Pathogens</b>	<b>Petroleum</b>	<b>Pesticides</b>	<b>PCBs</b>	<b>Other Organic</b>	<b>Metals</b>	<b>Other Inorganic</b>
Overall	L	N	N	N	N	N	N	N

**Table 6: Land Use Within Wellhead Area**

<b>Wellfield</b>	<b>Land Use</b>	<b>Area (acres)</b>	<b>Percent</b>	<b>Nutrients</b>	<b>Pathogens</b>	<b>Petroleum</b>	<b>Pesticides</b>	<b>PCBs</b>	<b>Other Organic</b>	<b>Metals</b>	<b>Other Inorganic</b>
10806 DMNH 1	Combined Urban	6.43	99.63	N	N	M	M	N	M	N	M
10806 DMNH 1	Residential	0.02	0.37	L	L	L	L	N	N	N	N
188883 DMNH 2	Combined Urban	3.87	59.95	N	N	M	M	N	M	N	M
188883 DMNH 2	Residential	2.15	33.31	L	L	L	L	N	N	N	N
188883 DMNH 2	Forested	0.43	6.74	N	N	N	L	N	N	N	N

<b>Wellfield Summary</b>	<b>Land Use</b>	<b>Area (acres)</b>	<b>Nutrients</b>	<b>Pathogens</b>	<b>Petroleum</b>	<b>Pesticides</b>	<b>PCBs</b>	<b>Other Organic</b>	<b>Metals</b>	<b>Other Inorganic</b>
10806 DMNH 1	All Land Uses	12.9	L	L	M	M	N	M	N	M
188883 DMNH 2	All Land Uses	19.35	L	L	M	M	N	M	N	M

<b>System Summary</b>	<b>Nutrients</b>	<b>Pathogens</b>	<b>Petroleum</b>	<b>Pesticides</b>	<b>PCBs</b>	<b>Other Organic</b>	<b>Metals</b>	<b>Other Inorganic</b>
Overall	L	L	M	M	N	M	N	M

**Table 7: Individual Well Susceptibility**

Wellfield	DNREC ID	Based On	Vulnerability	Nutrients	Pathogens	Petroleum	Pesticides	PCBs	Other Organic	Metals	Other Inorganic
10806 DMNH 1	10806	Discrete Sources	Medium	Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility
10806 DMNH 1	10806	Land Use	Medium	Low Susceptibility	Low Susceptibility	Moderate Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility
10806 DMNH 1	10806	Overall	Medium	Low Susceptibility	Low Susceptibility	Moderate Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility
188883 DMNH 2	188883	Discrete Sources	Medium	Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility
188883 DMNH 2	188883	Land Use	Medium	Low Susceptibility	Low Susceptibility	Moderate Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility
188883 DMNH 2	188883	Overall	Medium	Low Susceptibility	Low Susceptibility	Moderate Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility

Wellfield	Based On	Vulnerability	Nutrients	Pathogens	Petroleum	Pesticides	PCBs	Other Organic	Metals	Other Inorganic
10806 DMNH 1	Discrete Sources	Medium	Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility
10806 DMNH 1	Land Use	Medium	Low Susceptibility	Low Susceptibility	Moderate Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility
10806 DMNH 1	Overall	Medium	Low Susceptibility	Low Susceptibility	Moderate Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility
188883 DMNH 2	Discrete Sources	Medium	Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility
188883 DMNH 2	Land Use	Medium	Low Susceptibility	Low Susceptibility	Moderate Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility
188883 DMNH 2	Overall	Medium	Low Susceptibility	Low Susceptibility	Moderate Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility

**Table 8: Overall System Susceptibility**

<b>Based On</b>	<b>Vulnerability</b>	<b>Nutrients</b>	<b>Pathogens</b>	<b>Petroleum</b>	<b>Pesticides</b>	<b>PCBs</b>	<b>Other Organic</b>	<b>Metals</b>	<b>Other Inorganic</b>
Discrete Sources	Medium	Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility	Very Low Susceptibility
Land Use	Medium	Low Susceptibility	Low Susceptibility	Moderate Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility
Overall	Medium	Low Susceptibility	Low Susceptibility	Moderate Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility	Very Low Susceptibility	Moderate Susceptibility

## **Appendix C: Analytical Data**

No Available Analytical Data

## **Appendix D: Data Sources**

## Data Sources Used in Source Water Assessments

Type	Organization	Section	Phone Number
Public Water Supply Well Data	Department of Natural Resources and Environmental Control	Water Supply Section	(302) 739-4793
Public Water Supply Well Data	Delaware Geological Survey		(302) 831-2833
Water Quality Data	Department of Health and Social Services	Division of Public Health Office of Drinking Water	(302) 739-5410
Land Use / Land Cover GIS Coverage	Delaware Office of State Planning Coordination		(302) 739-3090
Animal Feedlot Operations	County Conservation Districts	Kent	(302) 697-2600
Animal Feedlot Operations	County Conservation Districts	New Castle	(302) 832-3100
Animal Feedlot Operations	County Conservation Districts	Sussex	(302) 856-3990
Combined Sewer Overflows (CSOs)	Department of Natural Resources and Environmental Control	Surface Water Discharges Section	(302) 739-5731
Dredge Spoil Disposal Areas	Department of Natural Resources and Environmental Control	Soil and Water Conservation	(302) 739-4411
Hazardous Waste Generator Sites	Department of Natural Resources and Environmental Control	Solid and Hazardous Waste Management Branch	(302) 739-3689
Landfills and Dumps	Department of Natural Resources and Environmental Control	Solid and Hazardous Waste Management Branch	(302) 739-3689
Large On-site Septic Systems	Department of Natural Resources and Environmental Control	Ground Water Discharges Section	(302) 739-4762
NPDES Wastewater Outfalls	Department of Natural Resources and Environmental Control	Surface Water Discharges Section	(302) 739-5731
Pesticide Loading, Mixing, and Storage Facilities	Delaware Department of Agriculture	Pesticide Management Section	(302) 739-4811
Salvage Yards	Department of Natural Resources and Environmental Control	Solid and Hazardous Waste Management Branch	(302) 739-3689
Site Investigation and Restoration Branch (SIRB) [Superfund] Sites	Department of Natural Resources and Environmental Control	Site Investigation and Restoration Branch	(302) 395-2600
Sludge Application Sites	Department of Natural Resources and Environmental Control	Surface Water Discharges Section	(302) 739-5731
Spray Irrigation Sites	Department of Natural Resources and Environmental Control	Ground Water Discharges Section	(302) 739-4762
Tire Piles	Department of Natural Resources and Environmental Control	Solid and Hazardous Waste Management Branch	(302) 739-3820
Toxic Release Inventory Sites	Department of Natural Resources and Environmental Control	Air Quality Management Section	(302) 739-4791
Underground Storage Tanks	Department of Natural Resources and Environmental Control	Underground Storage Tank Branch	(302) 395-2500

