SOURCE WATER ASSESSMENT

for

Town of North East

Water Treatment Plants
(Rolling Mill and Leslie)

Prepared By
Water Management Administration
Water Supply Program
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EXECUTIVE SUMMARY

The 1996 Safe Drinking Water Act Amendments require states to develop and implement source water assessment programs to evaluate the safety of all public drinking water systems. A Source Water Assessment (SWA) is a process of evaluation the vulnerability of a source of public drinking water supply to contaminants. This SWA was completed for the Northeast Creek which supplies water to two water treatment plants. The North East water system currently serves about 5,200 people in and around the Town of North East in Cecil County.

Northeast Creek with its tributary Little Northeast Creek flows south and east toward their confluence forming the Northeast River near the Town of North East. The intake structure for the Leslie Water Treatment Plant withdraws water from Northeast Creek upstream of the confluence with Little Northeast Creek. Water is pumped to a 1 million gallon raw water reservoir and then flows by gravity to the Leslie Water Treatment Plant. The intake structure for the Rolling Mill Treatment Plant is downstream of the confluence of the Little Northeast Creek and Northeast Creek. A third intake is being proposed for the tidal area of Northeast River near the Town Park on Walnut Street.

The source water protection area for the Town of North East's intakes encompasses approximately 46 square miles (29,804 acres) of mixed land use with over 60% of cropland and pasture. Approximately 20% of the watershed is extended into Pennsylvania.

Potential sources of contamination for Northeast Creek watershed include point and non point sources, including transportation, agriculture, on-site septic systems and runoff from developed areas. Non point sources (agricultural and urban runoff) are the largesst source of contaminants in this watershed. There are several minor municipal and industrial dischargers in Pennsylvania, and a quarry and a superfund remediation site at the Mechanic Valley Trade Center in Maryland's portion of the source water assessment area. Cecil County landfill (Hog Hill) is also located within the watershed of the new emergency intake in the tidal portion of Northeast River. The relatively low percentage of forested land within the watershed (currently estimated at about 30%), and its continued loss to development presents treatment and management challenges for producing safe water.

The susceptibility analysis indicates that turbidity, disinfection by product precursors and pathogenic microorganisms are the contaminants of most concern. Nutrient enrichment, algal blooms and natural organic matters all contribute to reactive nature of disinfection by product precursors. High turbidity levels are associated with erosion and transport of sediment during storm flows. The network of major roads (I-95 and Route 40) and rail lines in close proximity to the Town's intakes make this water supply at a significant risk to being impacted by a spill of hazardous materials.

Section 8.0 of this report lists specific recommendations for consideration in developing a source water protection plan. Providing critical information for implementing a source water protection for Northeast Creek is the ultimate goal of this assessment.

1.0 BACKGROUND

The 1996 Safe Drinking Water Act Amendments require states to develop and implement source water assessment programs to evaluate the potential for contaminants to affect the sources of all public drinking water systems. A Source Water Assessment (SWA) follows a process for evaluating the susceptibility of a public drinking water supply to contamination. The assessment does not address the treatment processes or the storage and distribution of the water system, which are covered under separate provisions of the Safe Drinking Water Act. The Maryland Department of the Environment (MDE) is the lead state agency in this SWA effort.

There are three main steps in the assessment process: (1) *delineating* the watershed drainage area that is likely to contribute to the drinking water supply, (2) *identifying* potential contaminants within that area and (3) *assessing* the vulnerability of the system to those contaminants. This document reflects all of the information gathered and analyzed required by those three steps. MDE looked at many factors to determine the susceptibility of this water supply to contamination, including the size and type of water system, available water quality data, the characteristics of the potential contaminants, and the capacity of the natural environment to attenuate any risk.

Maryland has more than 3,800 public drinking water systems. Approximately 50 of Maryland's public drinking water systems obtain their water from surface supplies, either from a reservoir or directly from a river. The remaining systems use ground water sources. Maryland's Source Water Assessment Plan was submitted to the Environmental Protection Agency (EPA) in February 1999, and received final acceptance by the EPA in November 1999. A copy of the plan can be obtained at MDE's website, www.mde.state.md.us, or by calling the Water Supply Program at 410 537-3714.

2.0 INTRODUCTION

The Town of North East is located at the head of the Chesapeake Bay on the Northeast River in Cecil County. North of the Town are two major roads, Route 40 and I-95 which have contributed to the rapid growth in the Town's water service area. The Town of North East presently operates two surface water treatment plants with a combined capacity of 1.2 mgd maximum daily flow. The system currently serves approximately 5,200 people and the Maryland Transit Authority Rest Stop on I-95.

The Town's surface water source is Northeast Creek. There are two existing intakes which are located at the Leslie and Rolling Mill Water Treatment Plants (WTPs) and a new intake will be constructed in the tidal portion of Northeast River. The Leslie intake is furthest upstream and is located south of I-95, just north of the CSX rail lines and upstream of where Little Northeast Creek joins Northeast Creek. The Rolling Mill intake is located south of Route 40 and just north of the Penn Central Railroad line, but downstream of where Little Northeast Creek joins Northeast Creek. The tidal intake will be located in the Town Park about 1 mile south of the Rolling Mill intake, just north of Walnut Street. The new intake

will withdraw water during periods of low flow, when flow in Northeast Creek is at or below the required minimum passing flow (7Q10). The table below lists the Town's water appropriation and use permits:

Permit No.	Location	Daily Average on a Yearly Basis (gallons)	Maximum Daily Withdrawal (gallons)
CE1973S005(04)	Leslie WTP	325,000	620,000
CE1976S092(04)	Rolling Mill WTP	1,383,000	3,200,000
CE2002S030(01)	Town's Park near Walnut St. (Tidal Area)	559,000	3,862,000

A. Description of Surface Water Source

Northeast Creek with its tributary Little Northeast Creek flows generally south and east forming the Northeast River near the Town of North East. The majority of the Northeast River Watershed is located in Cecil County and is bounded by the Principio Creek Watershed to the west and the Little Elk Creek to the east. Northeast River is a tidal (fresh) as far north as the Town of North East where the head of tide intersects the fall line below the confluence of two major streams, the Northeast Creek and the Little Northeast Creek. The headwaters of Northeast Creek originate in Pennsylvania, south of the Town of Oxford.

The upper Northeast Creek Watershed is located in Piedmont Physiographic Province. This province is characterized by rolling upland, cut by many streams and small tributaries. The underlying geologic formations in this portion of the watershed are primarily metamorphosed igneous and sedimentary rocks. Coastal Plain deposits extend as far to the north as Interstate 95 along Northeast Creek. The soil survey reports in Cecil County indicate that the soils in the Town of North East area and the vicinity of the existing intakes are consist mainly of Mathtapex-Elsinboro-Othello Association. The Mattapex series contain deep, nearly level to moderately sloping, moderately well-drained, loamy soils that formed in silty material, laid down on older coarser sediment. The Elsinboro series consist of dep, well-drained, nearly level to moderately sloping soils on terraces above the flood plains for some major streams of the county. These soils are in the Piedmont part of the county and along major waterways in the Coastal Plain. They formed in old alluvium, and they generally contain considerable fine mica flakes. Othello series consists of nearly level to gently sloping, poorly drained, loamy soils on upland flats in the Coastal Plain part of the county. These soils formed in silty material underlain by coarser sediment.

Cecil County has a humid, continental climate with well defined seasons. The warmest period of the year is the last half of July with temperatures near 90°F and the coldest period is the last of January and beginning of February with average temperature ranging from 22°F to 32°F. The average annual precipitation is 45.35 inches; the months of July and August are typically are the wettest and the month of February is the driest (Cecil County, Soil Survey).

B. Water Supply Development

The original North East Rolling Mill Water Treatment Plant was constructed in the early 1960's. In the late 1970's and early 1980's, the plant underwent major improvements. The

current Rolling Mill Plant is a conventional treatment plant consisting of coagulation, flocculation, sedimentation, filtration and disinfection. The design capacity of the plant is 0.6 million gallons per day (mgd). The raw water from the creek enters a newly constructed intake and flows through a 48" concrete pipe and the existing sluice gate under the railroad to the 4 million gallon raw water reservoir located on the plant site. The raw water reservoir dredging and other improvements to the raw water facilities completed in 1999.

The Leslie Water Treatment Plant began operation in 1992. It is a direct-filtration type plant with a nominal capacity of 450,000 gallons per day. The filters are "Dynasand" filters as manufactured by Parkson Corporation. The Dynasand filter is a continuous backwash, deep bed filter in which the influent is introduced at the top and distributed evenly into the sand bed. Raw water from Northeast Creek is directed to the intake structure which is the wet well of the raw water pumping station. Water is pumped from this point to a 1.0 million gallon raw water reservoir located at higher elevation at the vicinity of Leslie WTP. Raw water flows through an 8-inch line by gravity from the raw water reservoir to the plant.

The Town is currently in the process of designing upgrades to the Rolling Mill Water Treatment Plant (WTP) to accommodate growth over the next 20 years within the Town and service area. Proposed improvements to the Rolling Mill WTP which are being discussed with MDE include the addition of two 2.0 million gallons per day maximum daily flow modules (1 redundant) with room for a third. In order to meet the maximum flow-by requirements in the Northeast Creek, the Town will withdraw raw water from the tidal portion of the Northeast Creek and pump to the raw water reservoir located at the Rolling Mill WTP.

Upgrades to the Leslie WTP include the installation of flocculators and settlers ahead of the existing filters, which will increase the plant maximum daily capacity to 830,000 gallons per day. Construction of these improvements is underway and is scheduled to be completed by September 2004. During the period of low-flow, the Leslie WTP will not operate. Improvements to the Rolling Mill WTP will allow transfer of water to the higher pressure zones served by the Leslie WTP during periods the Leslie plant is temporarily shut down.

The Town is planning to erect two elevated storage tanks, one to replace the aging and undersized Mauldin Avenue tank, and one to serve Zone 2 NE, which is currently served through a pressure reducing valve.

3.0 RESULTS OF SITE VISIT(S)

Water Supply Program personnel conducted a site survey of the Town of North East and other raw water facilities in order to accomplish the following tasks:

- To collect information regarding the locations of raw water sources and intakes by using Global Positioning System (GPS) equipment.
- To determine the general condition and structural integrity of intakes and other raw water facilities.
- To discuss source water issues and concerns with the Town's water system operators.

- To conduct a windshield survey of the watershed and to document potential problem areas. Additional tours of the watersheds were taken on follow-up visits.

Concerns and Site Observations

- Railroad track adjacent to Rolling Mill raw water reservoir presents a potential for hazardous material spills.
- A quarry upstream of Rolling Mill intake.
- A superfund site exists in the watershed above the plants. MDE conducted water quality monitoring for surface water and ground water. Samples from the surface water showed no significant impact. The superfund impacted the ground water in the area.
- Application of deicing agents (salt) on I-95 during the winter months is a major concern of Town's operators.

4.0 WATERSHED CHARACTERIZATION

4.1 Source Water Assessment Area Delineation Method (Surface Water)

An important aspect of the source water assessment process is to delineate the watershed area that contributes to the source of drinking water. A source water protection area is defined as the whole watershed area upstream from a water plant's intake (MDE, 1999). Delineation of the source water area was performed by using ESRI's Arc View Geographic Information Software (GIS), utilizing existing GIS data, and by collecting location data using a Global Positioning System (GPS). GPS point locations were taken at the water source intake and differentially corrected (for an accuracy of +/-2 meters) at MDE. Once the intake location was established, the contributing area was delineated based on existing Maryland Department of Natural Resources digital watershed data and Maryland State Highway Administration digital stream coverage. Digital USGS 7.5 topographical maps were also used to perform "heads up" digitizing, or editing, or watershed boundaries.

4.2 General Characteristics

The drainage area above the Town of North East's new proposed intake located in the tidal portion of North East Creek encompasses approximately 46 square miles (29,805 acres) of mixed land use. The watershed is mostly (about 80%) in Cecil County, Maryland and approximately 20% of the watershed is extended into Pennsylvania. Table 4.1 shows the land use distribution in the Northeast Creek Watershed. Figure 4.1 shows the land use within the watershed above the Town's intakes.

Table 4.1. Maryland and Pennsylvania Land Use Distribution in the Northeast Creek Watershed.

Land Use	Total Acres	% of Watershed
Cropland	10,493.29	35.21%
Forest	9,402.49	31.55%
Industrial	211.57	0.71%
Low-density residential	867.16	2.91%
Pasture	7,841.77	26.31%
Water	153.68	0.52%
Wetlands	555.88	1.87%
High-density residential	31.37	0.11%
Extractive	247.16	0.83%
Grand Total	**29,804.38**	**100.00%**

Source: Maryland Department of Planning's 1997 land use data.

4.3 Localized Characteristics

Residential and commercial development density are the highest around the Town's intakes compared to the rest of areas in the Northeast Creek Watershed. The Town of North East does not own and maintain land in the watershed except a small portion of land around the Town's water treatment plants and intake structures. Interstate Highway 95, U.S. Route 40, and State Highways 7, 272 and 273 are the major roads in the watershed. The rail lines are in close proximity to the intakes and raw water reservoir at Rolling Mill plant.

5.0 POTENTIAL SOURCES OF CONTAMINATION

Watershed sources of contaminants in the Northeast Creek can be categorized as either point or non point sources and include agricultural activities, residential runoff, wastewater treatment plants, septic systems and erosion and disturbance of vegetation along streams in the watershed. Figure 5.1 depicts the potential point contaminant sources are made in the Northeast Creek source water assessment area.

5.1 Non Point Sources

According to Pennsylvania and the Department of Planning's 1997 land use data, 18,035 acres in the watershed are used for agricultural purposes (cropland and pasture). Land used to grow crops can be a source of nutrients (from fertilizers), synthetic organic compounds (herbicides) and sediment load. Pastures for grazing livestock and concentrated animal feed lots can be sources of nutrients and pathogenic protozoa, viruses and bacteria from animal waste.

Developed lands account for approximately 4.0% of the watershed, with a high concentration located just above the Town's intake. Lawn and pavement in the residential area result in increased storm water velocities and can cause streambed and stream bank erosion and transport of sediment to the intakes. Commercial and industrial land uses present the greatest challenge for managing storm water due to the high percentage of impervious surfaces on these properties. Water quality impacts from new low density residential development are generally not as significant as impacts from previously developed areas, due to controls in place through State and county stormwater regulations. Conversion of forested lands, however, to developed land, even if low density residential development can result in increased stream erosion due to the significant change in the quantity of runoff from developed land.

In 1997 forested lands accounted for about 31.5% of the total watershed. The highest concentration of forested land is located in the stream Valley and the lower quarter of the watershed. Forested lands are the most desired land use for water supply purposes.

5.2 Point Sources

Point sources are regulated to minimize water quality impacts through the National Pollutant Discharge Elimination System (NPDES). Two NPDES permits have been issued for the discharge from two sewage treatment plants within the Pennsylvania portion of the watershed. One is publicly owned municipal (PA0057096 Oxford Area Sewer Authority) and one is for a non-publicly owned (Dawn Holding Co. PA0053970). According to the Pennsylvania Department of Environmental Protection records, the facilities are active and performing in compliance with their NPDES permits requirements. Given the quantity and current quality of the discharges from these sewage treatment plants, they are not believed to significantly impact the quality of water at the North East intakes.

There are no surface discharges from sewage treatment plants in the Maryland portion of the watershed. Two NPDES permits in Maryland are (1) NPDES MD0000167 for a granite mining and crushing facility (quarry) and (2) NDPDES MD0067661 for a groundwater

remediation system for Mechanics Valley Trade Center (Ordinance Products, Inc.). The quarry mines granite (gneiss). Large pieces of granite are blasted in the mining pit and hauled by trucks to the top. The large pieces of rock are then loaded into conveyors which lead to crushers that produce smaller rocks of various sizes. The different grades of rocks are then stockpiled until shipment. The wastewater from this facility consists of stormwater runoff and groundwater which is withdrawn to keep the pit dewatered. The NPDES permit for the quarry controls pH and total suspended solids. The Ordance Products, Inc. (OPI) site occupies 94.6 acres in Cecil County, approximately 3 miles north of the Town of North East. The OPI site was operated as an ordinance components manufacturing plant from 1957 to 1979. The operation moved out of state and the OPI site was abandoned. The property remained vacant until 1986, when the property was sold to Mechanics Valley Trade Center, Inc. (MVTC). In January 1990, MVTC was sold, under full environmental disclosure. MDE and EPA conducted several environmental investigations and remedial investigations since 1987. The current status of the site as reported by MDE's Waste Management is that five nearby residential wells are impacted by site-related contaminants, four of which are above regulatory levels. EPA is maintaining filtration systems on all five of these wells. MDE submitted written comments to EPA on an environmental consultant's draft Remedial Investigation (RI) report on April 2003. As of December 2004, EPA's contractor was conducting additional fieldwork to finalize the Remedial Investigation report (MDE, Division of Federal Superfund Division).

Cecil County landfill (Hog Hill) is located at 758 East Philadelphia Road (Route 7), which is in that part of the basin upstream of the proposed tidal intake. The 200 acre landfill is an active municipal landfill located on 415 acres of property in Cecil County. This property includes the Cecil County road maintenance building, landfill maintenance building, scale house and salt storage barn. MDE's Waste Management Administration, Solid Waste Program currently regulates the Hog Hill landfill. New landfill cells are lined prior to depositing refuse at the landfill. The landfill groundwater-monitoring network is monitored twice a year and has not detected contamination of the groundwater. This site is on the State Master List and identified by the EPA Comprehensive Environmental Response, Compensation and Liability Information System and is assigned "No Further Remedial Planned" status.

A sewage pump station is located upstream of the proposed intake as shown in Figure 5.1. A sewage spill occurred from a failure of a pump at this pump station along Northeast Creek in 2002.

5.3 Land Use Planning Concerns

A comparison between 1994 and 2002 Maryland Department of Planning land use data shows changes in watershed land development. Land use percentages are shown in Table 5.

Table 5 – Change in Maryland Land Use between 1994 and 2002

Land Use	1994	2002	% Change
Residential	7.9%	12.4%	+4.5%
Commercial/Industrial	1.3%	2.8%	+0.9%
Cropland/Pasture	55.3%	51.8%	-3.5%
Exractive	0.8%	0.9%	+0.1%
Forest	31.5%	29.9%	-1.6%
Open urban land	0.7%	0.7%	0.0%
Orchards/vineyards/horticulture	0.1%	0.0%	0.1%

The most significant changes are the increase in residential land use and decrease of agricultural (cropland and pasture) land use over the past eight years in the Northeast Creek Watershed. There was also a decrease in forested land of about 500 acres during this period. The successful completion of the upgrades to the Town's water plants will ultimately lead to more development, some of which is in the drinking water watershed. The rate of growth is likely to be much greater than previously experienced (Transviron, 2001) and substantially decrease the forested land cover in the lower portion of the watershed.

5.4 Transportation Related Concerns

Another potential source of contamination in the Northeast Creek Watershed is transportation, including highways, roads, railroads, and petroleum and gas pipelines. Interstate highway I-95 is a major highway that crosses the watershed above the Northeast intake and is a concern for spills in the watershed. Routes 40, 7, 272, 273 and 274 are used heavily for commercial traffic and cross portions of Northeast Creek Watershed. Two major railroads cross the watershed near the Rolling Mill and Leslie water treatment intakes and may pose a great risk to the Town's sources of drinking water. In 1997, an idle Amtrak air compressor was pushed off the tracks and into the Rolling Mill raw water reservoir. In 2004, a 72-car freight train partially derailed, causing a large spill of granular phosphate salts along the bank of the creek upstream of the Rolling Mill intake. These events illustrate the potential for a truly hazardous situation to occur given the wide range and volume of materials that passes by each day along these major transportation arteries upstream and adjacent to the Town's water intakes.

Colonial Pipeline, an interstate carrier of petroleum products, crosses the Northeast Creek's entire width of the watershed above the intakes. Pipeline accidents and leaking of petroleum products can cause contamination of raw water with volatile organic compounds.

6.0 REVIEW OF WATER QUALITY DATA

6.1 Rolling Mill and Leslie Water Treatment Plants' Data

Several sources of water quality data were reviewed for the Town of North East's Source Water Assessment. These include MDE Water Supply Program's database for safe drinking water contaminants and monthly operating reports from the town's water treatment plant. Data from the United States Geological Survey.

Water quality data for the Town of North East water sources will be compared with Maximum Contaminant Levels (MCLs) set by the U.S. Environmental Protection Agency to ensure safe drinking water. If the monitoring data is greater than 50% of MCL for at least 10% of the time, a detail susceptibility analysis will be performed for that contaminant and its potential sources.

Inorganic Compounds (IOCs)

The Town of North East's water treatment plants (Rolling Mill and Leslie) regularly test for the presence of nitrate and other inorganic compounds. Table 6.1 and 6.2 are summaries of testing results for IOCs detected in finished water from 1993 through 2004 in each water treatment plant. No inorganic compounds exceeded MDE's criteria (>50% of the MCL for at least 10%of the samples) for a detailed susceptibility analysis.

Table 6.1. Inorganic Compounds (IOCs) Detected at the Rolling Mill Water Treatment Plant

Contaminant	Date	Result	Units	MCL
BARIUM	10/25/94	0.024	mg/L	2
BARIUM	06/18/96	0.032	mg/L	2
BARIUM	04/24/00	0.023	mg/L	2
BARIUM	05/02/01	0.025	mg/L	2
BARIUM	05/03/02	0.025	mg/L	2
BARIUM	05/09/03	0.028	mg/L	2
BARIUM	04/19/04	0.029	mg/L	2
FLUORIDE	05/03/02	0.783	mg/L	4
LEAD	06/18/96	0.001	mg/L	0.015
NITRATE	03/31/93	3.7	mg/L	10
NITRATE	06/18/93	1.3	mg/L	10
NITRATE	09/30/93	0.6	mg/L	10
NITRATE	12/21/93	1.9	mg/L	10
NITRATE	07/18/94	0.92	mg/L	10
NITRATE	06/11/96	1.8	mg/L	10
NITRATE	06/18/96	2.6	mg/L	10
NITRATE	10/29/96	2.6	mg/L	10
NITRATE	03/26/97	1.88	mg/L	10
NITRATE	06/11/97	2.1	mg/L	10
NITRATE	06/16/97	1.65	mg/L	10
NITRATE	05/04/98	1.91	mg/L	10

Table 6.1. Inorganic Compounds (IOCs) Detected at the Rolling Mill Water Treatment Plant continued

Contaminant	Date	Result	Units	MCL
NITRATE	06/30/98	1.7	mg/L	10
NITRATE	09/17/98	1	mg/L	10
NITRATE	04/06/99	2.6	mg/L	10
NITRATE	05/04/99	3.2	mg/L	10
NITRATE	04/24/00	1.41	mg/L	10
NITRATE	04/10/01	1.9	mg/L	10
NITRATE	04/16/01	1.9	mg/L	10
NITRATE	05/02/01	1.87	mg/L	10
NITRATE	04/08/02	3.1	mg/L	10
NITRATE	05/03/02	1.14	mg/L	10
NITRATE	04/01/03	1.7	mg/L	10
NITRATE	04/19/04	1.41	mg/L	10
NITRITE	06/11/96	0.002	mg/L	1
NITRITE	10/29/96	0.004	mg/L	1
SELENIUM	10/25/94	0.002	mg/L	0.05
SODIUM	06/11/97	29.4	mg/L	
SODIUM	06/30/98	9.7	mg/L	
SODIUM	09/17/98	22.2	mg/L	
SODIUM	04/06/99	21.28	mg/L	
SODIUM	04/24/00	21.8	mg/L	
SODIUM	04/10/01	27.5	mg/L	
SODIUM	04/16/01	22	mg/L	
SODIUM	05/02/01	22.3	mg/L	
SODIUM	04/08/02	22.3	mg/L	
SODIUM	05/03/02	20.6	mg/L	
SODIUM	04/01/03	30	mg/L	
SODIUM	05/09/03	25.6	mg/L	
SODIUM	04/19/04	26.7	mg/L	
SULFATE	10/25/94	26	mg/L	
SULFATE	06/11/96	38.8	mg/L	
SULFATE	10/29/96	35.5	mg/L	
SULFATE	06/11/97	37.9	mg/L	
SULFATE	06/30/98	31.9	mg/L	
SULFATE	09/17/98	43	mg/L	
SULFATE	04/06/99	30.3	mg/L	
SULFATE	04/10/01	42.3	mg/L	
SULFATE	04/08/02	39	mg/L	
ANTIMONY	04/24/00	0.003	mg/L	0.006
ANTIMONY	05/02/01	0.002	mg/L	0.006

Table 6.2. Inorganic Contaminants (IOCs) Detected at the Leslie Water Treatment Plant

Contaminant	Date	Result	Units	MCL
BARIUM	06/18/96	0.032	mg/L	2
BARIUM	04/24/00	0.024	mg/L	2
BARIUM	05/02/01	0.024	mg/L	2
BARIUM	04/11/03	0.036	mg/L	2
BARIUM	04/19/04	0.026	mg/L	2
FLUORIDE	05/03/02	0.724	mg/L	4
LEAD	06/18/96	0.001	mg/L	0.015
NITRATE	03/31/93	1.8	mg/L	10
NITRATE	06/18/93	2.6	mg/L	10
NITRATE	09/30/93	1.7	mg/L	10
NITRATE	12/21/93	2.4	mg/L	10
NITRATE	07/18/94	1.3	mg/L	10
NITRATE	11/30/95	2	mg/L	10
NITRATE	06/18/96	1.9	mg/L	10
NITRATE	07/02/96	2.1	mg/L	10
NITRATE	06/11/97	2.7	mg/L	10
NITRATE	06/16/97	2.67	mg/L	10
NITRATE	06/30/98	1.9	mg/L	10
NITRATE	09/17/98	1.3	mg/L	10
NITRATE	12/01/98	0.84	mg/L	10
NITRATE	04/06/99	2.5	mg/L	10
NITRATE	06/04/99	3.2	mg/L	10
NITRATE	04/24/00	2.07	mg/L	10
NITRATE	04/13/01	3.1	mg/L	10
NITRATE	04/16/01	2.5	mg/L	10
NITRATE	05/02/01	2.85	mg/L	10
NITRATE	04/08/02	2.6	mg/L	10
NITRATE	05/03/02	1.44	mg/L	10
NITRATE	10/15/02	1.43	mg/L	10
NITRATE	04/01/03	2.3	mg/L	10
NITRATE	10/06/03	2.55	mg/L	10
NITRATE	10/22/04	2.34	mg/L	10
NITRITE	07/02/96	0.003	mg/L	1
SODIUM	07/02/96	22	mg/L	
SODIUM	06/11/97	25.4	mg/L	
SODIUM	06/30/98	11.4	mg/L	
SODIUM	09/17/98	19.3	mg/L	
SODIUM	04/06/99	20.2	mg/L	
SODIUM	04/24/00	9.79	mg/L	
SODIUM	04/13/01	14.1	mg/L	
SODIUM	04/16/01	17	mg/L	
SODIUM	05/02/01	16.2	mg/L	
SODIUM	04/08/02	22.3	mg/L	

Table 6.2. Inorganic Contaminants (IOCs) Detected at the Leslie Water Treatment Plant continued

Contaminant	Date	Result	Units	MCL
SODIUM	04/01/03	22.2	mg/L	
SODIUM	04/11/03	18.5	mg/L	
SODIUM	04/19/04	15.6	mg/L	
SULFATE	11/30/95	59.4	mg/L	
SULFATE	07/02/96	31.3	mg/L	
SULFATE	06/11/97	30.6	mg/L	
SULFATE	06/30/98	31.5	mg/L	
SULFATE	09/17/98	31.2	mg/L	
SULFATE	04/06/99	29.1	mg/L	
SULFATE	04/13/01	15.1	mg/L	
SULFATE	04/08/02	16.5	mg/L	

Synthetic Organic Compounds (SOCs)

Of all the synthetic organic compounds analyzed at these plants, only atrazine and di(2-ethylhexyl)phthalate were detected at greater than 50% of the maximum contaminant level (MCL) values. Concurrent with the samples, the laboratory analyzes organic free water for quality control purposes. The results from the quality control samples all show detectable levels of di(2-ethylhexyl)phthalate. Therefore, di(2-ethylhexyl)phthalate detections in the tables below are not believed to represent the actual water quality at the plants. Samples are collected by both MDE and the water treatment plant operations personnel. Tables 6.3 and 6.4 are lists of each SOC detected for the years 1995-2003, from the Rolling Mill and Leslie WTPs.

Table 6.3. Synthetic Organic Compounds (SOCs) Detected at the Rolling Mill Plant

Contaminant	Date	Result	Units	MCL
BHC-GAMMA(LINDANE)	06/11/96	0.009	ug/L	0.2
DALAPON	07/31/95	0.204	ug/L	200
DALAPON	06/11/97	0.59	ug/L	200
DALAPON	09/17/98	0.28	ug/L	200
DALAPON	04/06/99	1.75	ug/L	200
DALAPON	08/24/99	1.59	ug/L	200
DALAPON	04/19/00	1.69	ug/L	200
DALAPON	04/06/04	0.67	ug/L	200
DI(2-ETHYLHEXYL) ADIPATE	03/26/97	24	ug/L	400
DI(2-ETHYLHEXYL) ADIPATE	04/10/01	0.8	ug/L	400
SIMAZINE	06/11/96	0.677	ug/L	4
SIMAZINE	06/11/97	0.52	ug/L	4
DI(2-ETHYLHEXYL) PHTHALATE	07/31/95	3.18	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	09/17/98	0.5	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	04/19/00	0.9	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	04/19/00	0.6	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	04/07/02	2.7	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	04/01/03	0.8	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	05/09/03	12	ug/L	6

Table 6.3 Synthetic Organic Compounds (SOCs) Detected at the Rolling Mill Plant continued

Contaminant	Date	Result	Units	MCL
HEXACHLOROCYCLOPENTADIENE	06/11/96	).08	ıg/L	50
HEXACHLOROCYCLOPENTADIENE	06/11/97	0.05	ug/L	50
METOLACHLOR	06/11/96	1.58	ug/L	
METOLACHLOR	06/18/96	2.3	ug/L	
ATRAZINE	06/11/96	2.68	ug/L	3
ATRAZINE	06/18/96	2.8	ug/L	3
ATRAZINE	06/11/97	0.66	ug/L	3
ATRAZINE	06/16/97	0.7	ug/L	3
ATRAZINE	08/01/00	0.5	ug/L	3
2,4-D	06/11/96	0.3	ug/L	70
2,4-D	04/19/00	0.47	ug/L	70
2,4,5-T	04/07/02	0.16	ug/L	
ETHYLENE DIBROMIDE (EDB)	09/17/98	0.012	ug/L	0.05

Table 6.4. Synthetic Organic Compounds (SOCs) Detected at the Leslie Water Treatment Plant

Contaminant	Date	Result	Units	MCL
DALAPON	07/31/95	0.786	ug/L	200
DALAPON	09/17/98	0.48	ug/L	200
DALAPON	04/06/99	1.75	ug/L	200
DI(2-ETHYLHEXYL) ADIPATE	07/31/95	0.51	ug/L	400
SIMAZINE	07/02/96	0.46	ug/L	4
SIMAZINE	06/11/97	0.83	ug/L	4
SIMAZINE	06/16/97	0.4	ug/L	4
DI(2-ETHYLHEXYL) PHTHALATE	07/31/95	0.54	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	07/02/96	2.89	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	09/17/98	1.6	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	04/19/00	1.1	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	04/19/00	0.6	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	04/10/01	2.6	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	04/07/02	1.9	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	04/01/03	0.5	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	04/06/04	1.1	ug/L	6
HEXACHLOROCYCLOPENTADIENE	06/11/97	0.07	ug/L	50
METOLACHLOR	06/18/96	1	ug/L	
ATRAZINE	07/02/96	1.22	ug/L	3
ATRAZINE	06/11/97	0.88	ug/L	3
ATRAZINE	06/16/97	0.5	ug/L	3
PENTACHLOROPHENOL	04/19/00	0.02	ug/L	1
DICAMBA	09/17/98	0.06	ug/L	
DICAMBA	04/06/04	0.07	ug/L	
ETHYLENE DIBROMIDE (EDB)	09/17/98	0.024	ug/L	0.05

Volatile Organic Compounds (VOCs)

No volatile organic compounds other than disinfection by-products (DBP) were detected in the water leaving the Town of North East's water treatment plants. Compliance with the disinfection by-products rule is determined by level in the distribution system. Samples for DBP collected in 2002-2004 are shown in Table 6.5. These data indicate that changes will be needed at the North East plants for the facilities to consistently meet the current standards of 80.0 0 micrograms per liter (µg/l) for total THM and 60.0 0 µg/l for total THM and 60.0 µg/l for HAA at all locations.

Table 6.5. North East Disinfection Byproducts by Year (µg/l)

	THM				HAA			
Year	Average	Max	Min	Count	Average	Max	Min	Count
2002	113.04	359.80	30.26	8	59.48	79.61	46.64	8
2003	70.59	124.51	25.32	8	55.00	95.50	33.10	8
2004	76.20	148.31	14.31	7	30.91	49.34	4.88	7
Total	86.61	359.80	14.31	23	48.84	95.50	4.88	23

Table 6.6. North East Disinfection Byproducts by Quarter (2002 through Jan 2005) (µg/l)

	THM				HAA			
Quarter	Average	Max	Min	Count	Average	Max	Min	Count
1	37.07	63.20	14.31	9	45.60	75.46	14.24	9
2	72.05	89.40	53.16	5	60.42	79.61	40.30	5
3	109.75	149.72	77.06	5	51.41	95.50	4.88	5
4	138.54	359.80	69.54	6	41.91	49.15	33.10	6
Total	82.96	359.80	14.31	25	48.84	95.50	4.88	25

Table 6.7. Disinfection Byproducts by Sample Location (µg/l)

	THM			HAA		
Sample Location	Average	StdDev	Count	Average	StdDev	Count
Irishtown Pumpingstation	99.48	96.39	11	43.84	14.60	11
Razorstrap Pumpingstation	68.48	31.97	13	51.61	22.30	13

Microbiological Contaminants

MDE, with the cooperation of the Town of North East water treatment operators, began a raw water bacteriological monitoring program in September 2000. The raw water was collected weekly and tested for fecal and E. coli. Figure 6.1 and 6.2 show the results in Most Probably Number/100 ml from September 2000 through October 2002. The table below summarizes the data with respect to the previous and current state water quality standards for fecal coliform and E.coli. These samples were collected from the point at which the water leaves the presedimentation reservoir at each facility. Some removal of coliform organisms may occur during the settling process which would suggest higher levels in the creek. Conversely, since the reservoirs are open, it is also possible that birds waste could elevate some samples. For these reasons, it is difficult to correlate the fecal coliform and E.coli levels to specific conditions in the creeks or watershed. Sampling results from streams whose watersheds have similar land use characteristics generally show that higher concentrations of microorganisms are present following storm events.

Table 6.8–Fecal Coliform and E. Coli Results Greater Than Water Quality Standard

Plant	No. of samples		No. of E.coli results >126 MPN/100 ML	No. of fecal coliform >200 MPN/100ML
	E. Coli	Fecal		
Rolling Mills	90	88	11	10
Leslie	90	89	16	12

Turbidity

Turbidity is described as a measure of cloudiness of water. It is used to indicate water quality and treatment effectiveness. Higher turbidity level are often associated with higher levels of disease causing microorganisms such as viruses, parasites and bacteria.

Turbidity is measured in the water leaving the presedimentation facilities at the North East Water Treatment Plants on a continuous basis. The monthly summary statistics for each month during the period 2002-2004 is presented in Table 6.9. For this period, the average daily measured was 8.6 nephelometric turbidity units (NTU) for Rolling Mill plant and 8.2 nephelometric turbidity units (NTU) for Leslie plant; minimum turbidity measured was 1.69 NTU at Leslie, during month of May and the maximum turbidity measured was 181.6 NTU at Rolling Mill. The average turbidity of the water leaving the presedimentation facilities exceeds the current MCL; therefore, turbidity is a contaminant of concern. The daily logs indicate that excessive turbidity are generally reduced by the third day following storm events.

Table 6.9. Turbidity by Month Based on Data for 2002 through 2004

Month	Rolling Mill			Leslie		
	Average	Max	Min	Average	Max	Min
Jan	6.17	17.50	2.72	8.84	30.01	2.83
Feb	6.01	26.30	2.09	9.02	51.54	2.93
Mar	9.82	84.30	2.61	10.32	30.91	3.08
Apr	7.54	54.50	2.04	6.67	44.75	2.55
May	8.08	138.00	3.18	7.52	64.50	1.09
Jun	12.40	181.00	2.09	10.11	60.83	1.37
Jul	7.77	135.00	1.48	6.83	45.70	1.48
Aug	5.01	33.00	1.41	6.12	28.00	2.15
Sep	7.51	49.90	1.74	5.43	33.97	1.53
Oct	10.87	159.00	3.01	6.22	24.93	2.46
Nov	10.00	55.20	2.27	10.74	51.01	3.74
Dec	12.18	42.00	3.34	11.94	34.24	3.66
All	8.61	181.00	1.41	8.24	64.50	1.09

6.2 New Tidal Intake Water Quality Data

MDE requested the Town to conduct water quality testing of the proposed tidal intake location to determine water quality concerns and the treatability of the raw water at this new

location. The water quality parameters recommended by MDE were for: temperature, pH, salinity, chloride, nitrates, TOC, turbidity, conductance, fecal coliform, and total coliform. MDE's letter of September 17, 2001 and Transviron, Inc.'s letter of April 12, 2002 with the attachments describing the results of the tests for the above water quality parameters. Copies of the letters are included in Appendix A. Additional studies conducted by MDE's Water Supply Program and Technical and Regulatory Service's Compliance Monitoring Program to further assess the water quality of the new water intake. The results of these studies are summarized in a report titled "Source Water Quality Assessment of Proposed Drinking Water Intake Site for Town of North East, Maryland" and MDE letter of February 13, 2003. A copy of each document is included in Appendix B. Of particular note, testing data showed fairly high sodium and chloride values during drought conditions, bromide as high as 2 mg/L (which contribute to excessive DBPs) and iron and manganese over secondary standards.

Figure 6.1 – Raw Water Fecal Coliform for Northeast

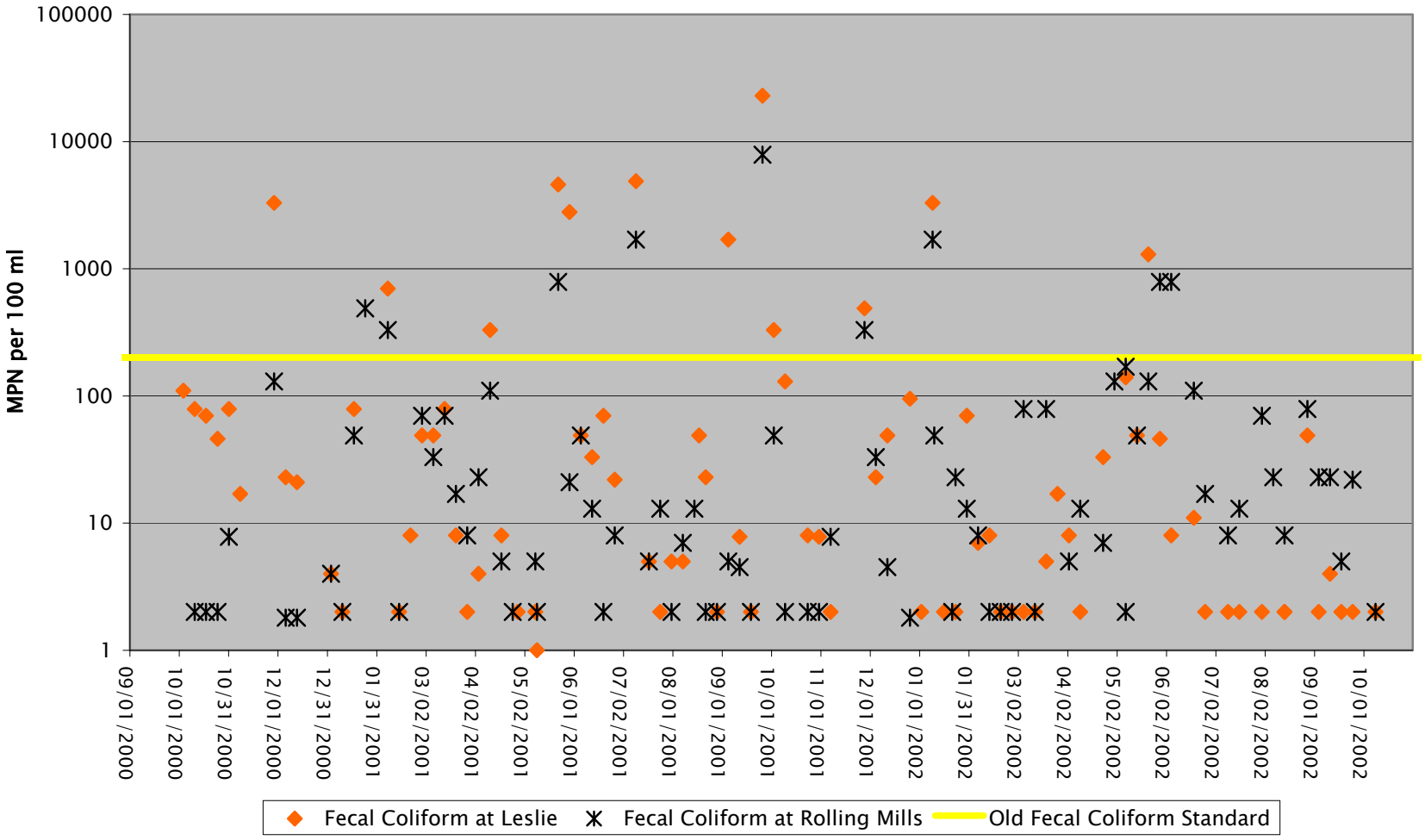
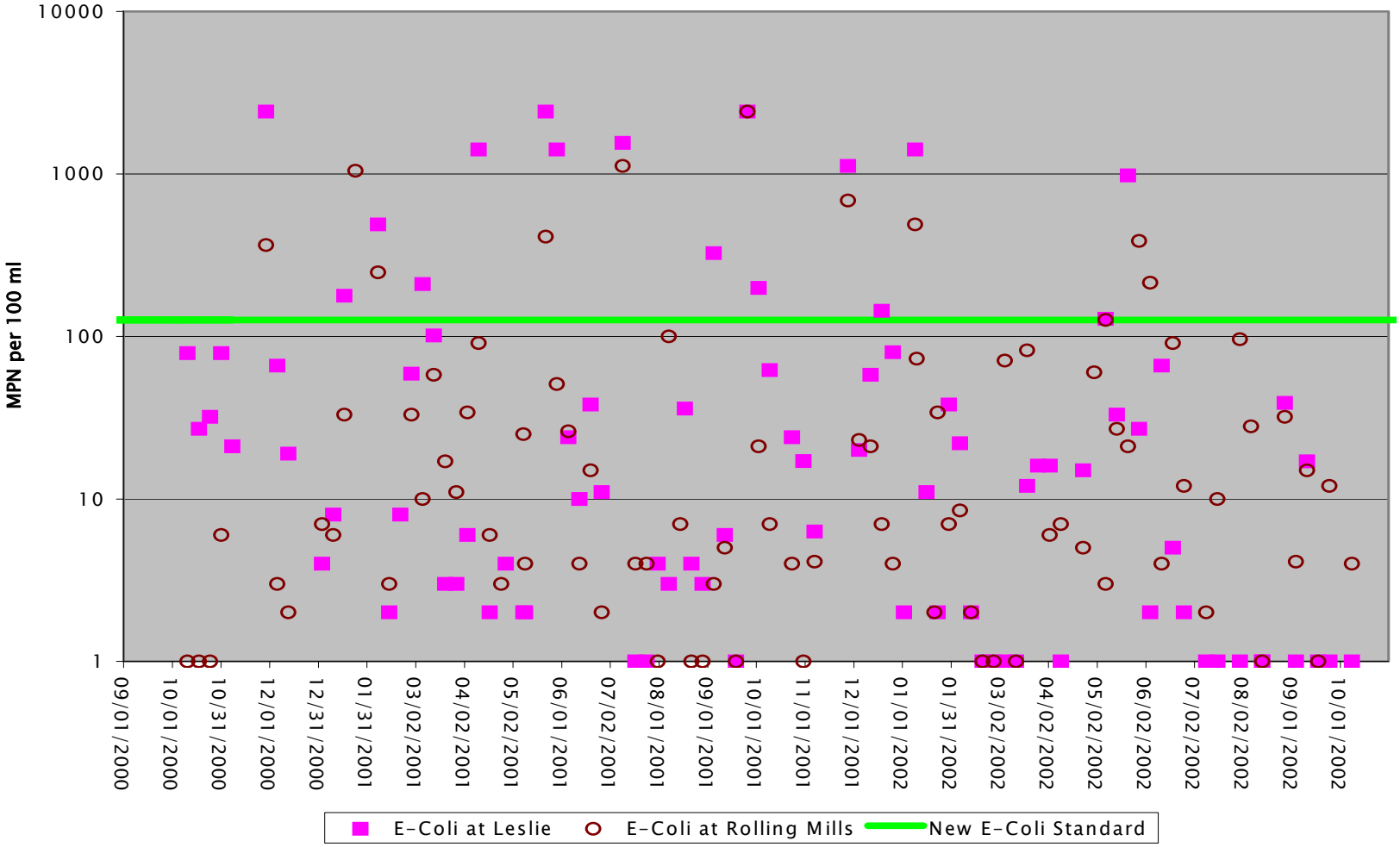


Figure 6.2 – E-Coli Assays for Northeast



7.0 SUSCEPTIBILITY ANALYSIS

Each class of contaminants that were detected in the water quality data have been analyzed to determine the potential they have to contaminate the Town of North East's raw water sources. The analysis has identified suspected sources of contaminants, evaluated the natural condition of the watershed, increase or decrease the likelihood of contaminants entering the raw water, and the impact that future changes may have on the susceptibility of the Town of North East's water supply source (Northeast Creek).

7.1 Leslie and Rolling Mill Water Treatment Intakes

Inorganic Compounds (IOCs)

Several inorganic compounds (IOCs) have been detected below the maximum contaminant level in finished water from the Leslie and Rolling Mill Plants. Nitrate was the most common IOC detected with no result exceeding 50% of MCL. Based on the available data, the Leslie and Rolling Mill Plants' intakes are not susceptible to inorganic compounds regulated under the Safe Drinking Water Act.

Synthetic Organic Compounds (SOCs)

There are several SOC detects at the Leslie and Rolling Mill Plants, but all results are less than 50% of MCL, with the exception of two results of atrazine at the concentrations of 2.68 and 2.8 ug/L from Rolling Mill Plant. Di(2-ethylhexyl)phthalate was the most common SOC detected but as explained in Section 6.1, the results are not believed to represent actual concentrations in the water supply.

Atrazine can enter the Northeast Creek following springtime herbicide application. A review of triannual pesticide usage surveys compiled by the Maryland Department of Agriculture shows that the usage of atrazine has declined in Cecil County in the past ten years. Given the fact that the most recent samples have no detections of atrazine, the reduced usage rate and the continued conversion of cropland to residential land, it is unlikely that atrazine concentration will increase in the future. Given the trend of reduced atrazine levels, the water system is not considered susceptible to regular contamination of synthetic organic compounds. Given the significant amount of human activity in the watershed, it is quite conceivable that spills or intentioned discharge of organic contaminants may occur in the watershed and affect the water supply.

Disinfection Byproducts (DBPs)

Trihalomethanes (THMs) and Haloacetic acids (HAAs) both exceeded 50% of MCL from water treated at the Town of North East's water treatment plants. In some samples, concentrations were well in excess of maximum contaminant levels. The Disinfection Byproducts Rule (DBPR) establishes MCLs based on average concentrations for the most common and well-studied halogenated DBPs: total trihalomethane (TTHMs) and five of the nine haloacetic acids (HAAs) as well as bromate and chlorite. TTHM is defined as the sum of chloroform, bromoform, bromodichloromethane, and dibromochloromethane; HAA is defined as the sum of mono-, di-, and trichloroaceticaeids, and mono- and dibromacetic acids. The MCLs for the disinfection byproducts are shown below:

Table 7.1. Disinfection Byproducts MCLs.

Total Trihalomethanes (TTHMs)	0.080 µg/l
Haloacetic Acids (HAAs)	0.060 µg/
Bromate	0.060 µg/
Chlorite	1.0 µg/

In addition to MCLs, the DBPR requires the use of treatment techniques to reduce DBP precursors and to minimize the formation of unknown DBPs. It requires that a specific percentage of influent total organic carbon (TOC) be removed during treatment. The treatment technique uses TOC as a surrogate for natural organic natter (NOM), the precursor material for DBPs. A TOC concentration of greater than 2.0 mg/l in a system's raw water is the trigger for implementation of the treatment technique. Required removal of TOC by enhanced coagulation for plants using conventional treatment is shown in the table below:

Table 7.2. Required Removal of TOC by Enchanced Coagulation for Plants Using Conventional Treatment.

rce Water TOC (mg/l)	**Source Water Alkalinity (mg/l as CaCo3)**		
	0-60	>60 to 120	>120
>2.0 – 4.0	35%	25%	15%
>4.0 – 8.0	45%	35%	25%
>8.0	50%	40%	30%

We evaluated sample results from the North East Rolling Mill Water Treatment Plant for a seventeen-month period (January 2004 through May, 2005). As the average source water alkalinity was between 0-60 mg/L, the plant removed the required percentage of TOC during that period. North East should continue monitoring for TOC in the raw and finished water to optimize its operations for compliance with the DBP Rule. The tidal intake presents unique concerns due to the potential of increased DBPs under the presence of bromides. A special treatment process is needed to deal with this issue.

Microbiological Contaminants

The consistent presence of fecal coliform bacteria in the Northeast Creek indicates susceptibility to pathogenic microorganisms. A sampling program being carried out by the Town of North East for fecal bacteria shows that the values for the Northeast Creek periodically exceeded the level of 200 MPN/100 ml, the previous State water quality standard for the Northeast Creek. The new standard for the Northeast Creek and other state-designated recreational trout and water supply sources is currently set for E.coli at 126 MPN/100 ml. As substantial concentrations of E. coli were found under various flow conditions, this probably reflects the difficulty in interpreting the data due to the sample location. Non point sources such as agriculture and urban land uses have been shown to be the most significant concern in watersheds with similar characteristics.

Giardia and *cryptosporidium* are fairly common in surface water and associated with human and animal waste, including cattle (particularly high numbers from infected young calfs),

sheep, horses, birds, pets and various wildlife species such as deer, raccoons, opossums, rabbits, rats and squirrels. Like most all surface water supplies, the water intakes are susceptible to contamination by *giardia, cryptosporidium* and other pathogens.

Turbidity and Sediment

Highly turbid water can cause additional demands on water treatment plants and sediment can carry harmful microorganisms and compounds into drinking water suppliers. Turbidity is used as a surrogate indicator for the presence of *Cryptosporidium* and *Giardia*, and increased water turbidity is indicative of elevated bacteria concentrations. Turbidity is caused by erosion of materials from the contributing watershed. Turbidity may be from a wide variety of materials, including soil particles and organic matter created by the decay of vegetation. During storm events and/or snowmelts, surface runoff increases. Runoff during a storm event occurs when the rate of precipitation exceeds the rate of infiltration. As runoff increases during a storm and/or snowmelt, the increased flow of water can cause soil and other material to erode, increasing suspended solids and raising the turbidity.

There are several factors in the watershed that can contribute to increased turbidity/sediment. Runoff from paved surfaces (residential and commercial developments) increases the amount of flow in tributaries quickly and leads to bank erosion. Allowing cattle and other livestock unfettered access to streams destroys protective vegetation along riparian areas where soils can runoff directly into a waterway. Also, row cropping on steep slopes and forestry operations throughout the watershed may contribute to increased sediment and turbidity.

The average raw water monthly turbidity at the Elkton water treatment plant during 2002 and 2003 was 11.8 NTU; the highest average turbidity of 21.4 NTU was recorded during the month of June. The average turbidity of raw water exceeds the current MCL; therefore, turbidity is a contaminant of concern.

Consistency with Clean Water Act Findings

The findings of this source water assessment are in general agreement with the impairments designated in the state's findings under the Clean Water Act. The Northeast River has been designated as impaired for excessive nutrients (nitrogen and phosphorus). MDE completed Total Maximum Daily Loads (TMDLs) for Northeast River in January 2004. Excessive phosphorus in fresh waters contributes to increased algal growth, which leads to higher concentrations of total organic carbon and potential for higher levels of disinfection byproducts.

8.0 RECOMMENDATIONS FOR SOURCE WATER PROTECTION PLAN

This report is compiled based on the existing and available data from several sources. It provides general information as a first step towards establishing and implementing source water protection plan for the Town of North East's surface water source. Additional data may be needed to further understand the areas of concern or establishing specific source protection goals. The following list of recommendations are offered to begin a focused source water protection effort for the Northeast Creek Watershed.

- The Town of North East should take a lead role in forming a local watershed planning team to develop and implement strategies to protect Northeast Creek as a drinking water source.
- A formal or informal agreement should be developed to engage officials from jurisdictions in MD and PA on a continuing basis.
- Encourage broad stakeholder participation, including soil conservation districts, County Planning and Zoning, transportation officials, community association leaders, farmers and existing environmental groups.
- Establish clear and achievable goals, objectives and milestones to ensure the highest quality raw water.
- A well thought out plan for being notified of hazardous material spills, and strategy for responding is critical to ensuring safe water for the Town of North East.
- Erect road signs in strategic locations to alert the public that they are entering a drinking water watershed.
- Continue monitoring for fecal coliform and *E. coli* in the raw water.
- To better understand the causes of the repeated high disinfection by product levels algae monitoring and/or indicators of algae bloom in Northeast Creek would be helpful The Department of Natural Resources may be of assistance in this effort.
- The watershed group should periodically conduct its own detailed field survey of the watershed to ensure there are no new sources of contaminants.
- The Cecil County Soil Conservation District and Pennsylvania Districts should continue to develop projects to reduce pathogens and nutrients from animal waste from entering upstream tributaries. Stream fencing and establishing forested riparian buffers are particularly helpful.
- The soil and erosion control and stormwater management regulations and practices in the Pennsylvania Townships within the watershed should be reviewed and compared with Maryland's standards.
- The Town should work closely with the County's Technical Advisory Group to encourage the application of progressive stormwater management practices to reduce future impacts (erosion and sediment transport, temperature impacts and oils, other contaminants, salts from road runoff) from the new development.

REFERENCES

Cecil County Water and Sewerage Plan, 2001.

Maryland Department of the Environment (MDE), *Maryland's Source Water Assessment Plan*, Water Supply Program, February 1999.

Maryland Department of the Environment (MDE), *Northeast River in Cecil County, Maryland*, January 2004.

Maryland Department of the Environment (MDE) *Source Water Quality Assessment of Proposed Drinking Water Intake Site for the Town of North East, Maryland*, March 2003.

Report on Water Supply Study North East Water Service Area, Transviron, Inc. Consulting Engineers, Lutherville, MD, March 2003.

Town of North East Water System Facilities Study, Rummel, Kepper & Kahl, February 1996.

U.S. Department of Agriculture, Soil Conservation Service, December 1973.

OTHER SOURCES OF INFORMATION AND DATA

EPA's *Guidance Manual for Source Water Assessments*
MDE and Pennsylvania NPDES Permits
MDE Waste Management Sites Database
MDE Water Appropriation and Use Permits
MDE Water Supply Inspection Reports
MDE Water Supply Program Oracle Database
Town of North East Water Treatment Plant Monthly Operating Reports (MORs) and Self Monitoring Reports