SOURCE WATER ASSESSMENT

for the

Town of Oakland
Garrett County, Maryland

Prepared by
Maryland Department of the Environment
Water Management Administration
Water Supply Program
February 2004

TABLE OF CONTENTS

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 for evaluating the vulnerability to contamination of the source of a public drinking water supply. The assessment does not address the treatment processes, or the storage and distribution aspects 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 source water assessment 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 vulnerability 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.

Broadford Lake and Youghiogheny River are the sources of drinking water for the Town of Oakland's two water treatment plants. Broadford Lake was created in 1971 with a volume of approximately 630 million gallons and receives runoff from 6.8 square miles of mostly agricultural and forested land. The Youghiogheny River source watershed encompasses 93 square miles of mostly forested land in Maryland and West Virginia and provides water supply to the Town's approximately 1800 customers. Potential sources of contamination to the Town's surface water sources are agricultural land including crops and livestock, discharges from three wastewater treatment plants into the Youghiogheny watershed above the intake, spills and runoffs from roads and railroads run through the watersheds. Eutrophication of Broadford Lake from excessive nutrients (phosphorus) have resulted in low dissolved oxygen and algae blooms. This contributes to elevated organic carbon and the potential for higher levels of disinfection by products. Excessive algae can also result in objectionale tastes and odors in the treated water. A review of the water quality data available indicates that turbidity and contamination by pathogenic organisms are major concerns impacting the raw water quality of the Youghiogheny River.

The Town of Oakland's surface water sources are vulnerable to various activities occurring within the watershed. Continuous monitoring of contaminants is important to understand the changes in raw water quality to assure delivery of safe drinking water to the Town's customers. A monitoring program for Broadford Lake is recommended to track water quality changes over time and to provide the basis for evaluating the effectiveness of a long-term reservoir protection plan. Coordination with Garrett County Planning is recommended to help ensure that zoning in the reservoir watershed is protective of the source. The Town of Oakland, with the cooperation of county and State agencies and private landowners, is encouraged to protect their water supplies by reviewing, adopting and implementing specific management recommendations such as those listed in Section I of this report.

A. BACKGROUND

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 for evaluating the vulnerability to contamination of the *source* of a public drinking water supply. The assessment does not address the treatment processes, or the storage and distribution aspects 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 source water assessment 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 vulnerability 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 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.

B. DEVELOPMENT OF THE TOWN OF OAKLAND'S WATER SUPPLY

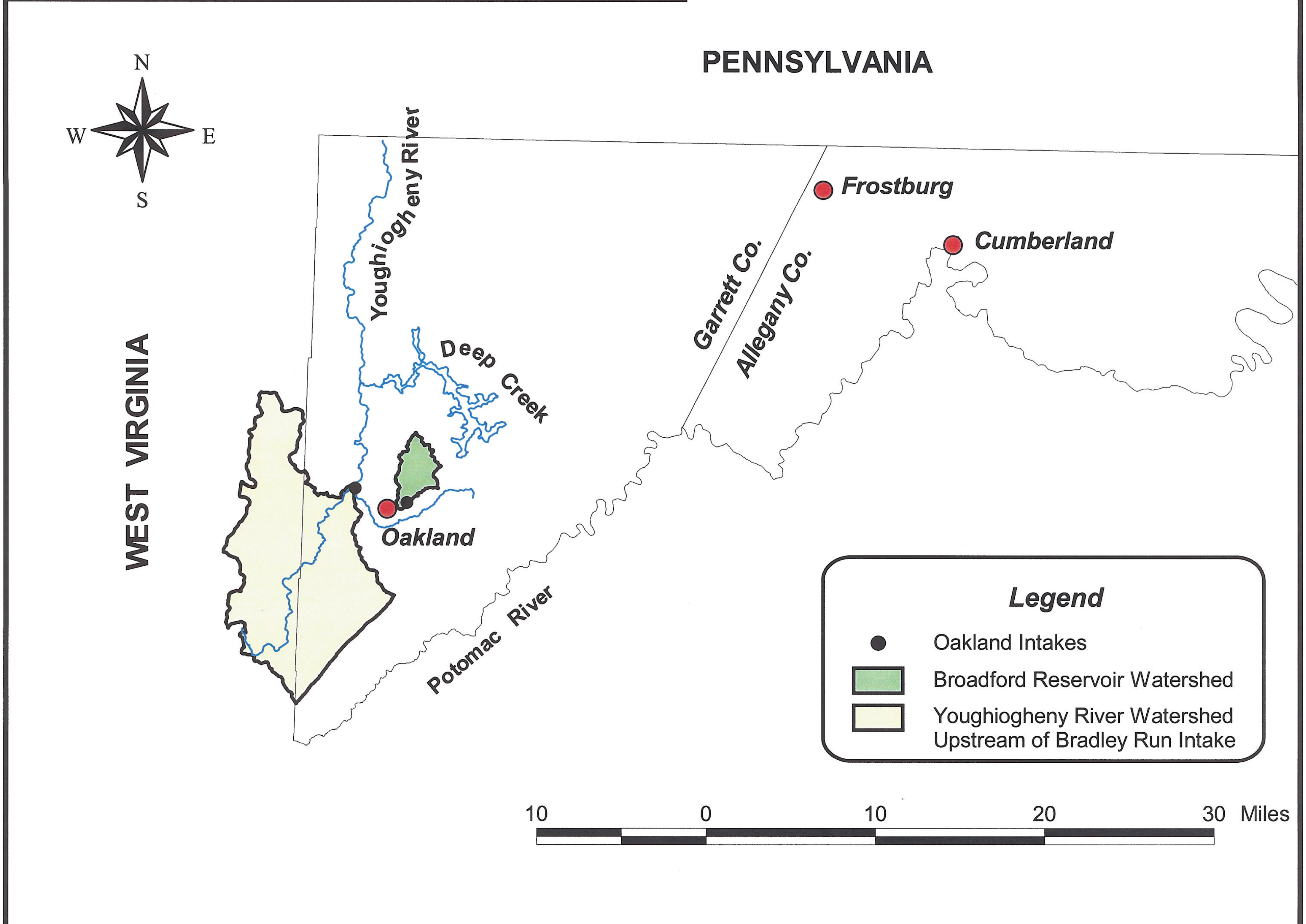
The Town of Oakland is located in southwestern Garrett County, Maryland. Oakland is the county seat and has a population of approximately 1800 people making it the largest municipality within Garrett County. The town lies in the Youghiogheny River watershed, which occupies the upper western corner of Maryland (see Figure 1). For many years the town relied on groundwater from wells for its public drinking supply, but there was not a sufficient amount of groundwater in the Oakland area to meet the communities future needs, so in 1961 the Bradley Run Water Treatment Plant was constructed. This plant is still in operation and draws water from the Youghiogheny River. An earthen dam was constructed on Broadford Run in 1971, creating Broadford Lake. This reservoir, which is located approximately 1.7 miles east of the town center, was created for the purpose of flood control, water supply, and recreational use. Oakland's Broadford Water Treatment Plant was constructed in 1971 adjacent to the lake and provides the town with its main source of drinking water.

The town owns and operates both water treatment plants which together service approximately 1800 residents in addition to commercial, and light industrial use. The service area around the town is approximately 3.4 square miles, and includes the old Bausch & Lomb facility, which was a major water user in the town, but it is now occupied by a glassblowing company with less demand. According to Town water officials, currently the Town's biggest water users are the hospital and two nursing homes.

The Broadford plant produces most of the town's water supply, almost 88% according to average flow values. The plant employs conventional water treatment processes; these include coagulation, flocculation, sedimentation, and filtration by three dual media (anthracite and sand) filters. Disinfection is accomplished through pre-chlorination of raw water entering the treatment plant. The plant has a design capacity of 0.8 million gallons a day (mgd), but averages 0.43 mgd. The plant operates approximately 16 hours per day.

The Bradley Run plant is operated for approximately 4 hours per day (six days per week) and averages a flow of 0.059 mgd. The design capacity of this plant is 0.5 mgd. The plant is located near the Town's golf course, adjacent to Bradley Run, approximately 1 mile from the pump station. The plant employs the same conventional treatment processes listed above.

Figure 1 - View of General Area



C. DESCRIPTION OF SURFACE SOURCES

Broadford Lake

The reservoir is the main source of drinking water for the Town of Oakland. Created in 1971 by an impoundment on Broadford Run, the reservoir has a volume of approximately 630 million gallons when full. It is rather long and narrow, 1.24 miles from headwaters to dam with a maximum width of 1200 feet; the reservoir is 1100 feet across at the intake location. The average depth in Broadford is 10.2 feet, with a maximum depth of 28.5 feet (MDE – Broadford Lake TMDL, 1999).

The Broadford dam is a rolled earth-filled structure. Cement grout was injected into a foundation of bedrock. Completed in December of 1970, the dam is 1,160 feet long, has a maximum height of 46 feet (from toe to crest), and a crest width of 16 feet. Normal pool elevation is 2,432 feet mean sea level (msl). The surface area of the lake is 138 acres during normal condition, but the maximum surface area attained if the water elevation was near crest is 326 acres (Army Corp of Engineers, 1979). Water is discharged from the reservoir by an overflow circular weir, which maintains the MDE required minimum discharge (outflow equal to inflow or if less, 67.3 gpm) from the lake.

Inflow into the lake is primarily from Broadford Run and one unnamed tributary entering on the northwest side of the reservoir. Discharge from the lake, which is estimated at 14.9 cubic feet per second (cfs), flows into Mountain Lake, which then discharges into the Little Youghiogheny River. Broadford Run travels approximately 3 miles from its headwaters, near Spring Glade Road, till discharging into the northeast end of the reservoir. There are several discernable small order tributaries that feed into Broadford Run (see Figure A-1 in Appendix A). The unnamed tributary has two discernable branches, and is buffered by forest for most of its course to the reservoir. However, it does drain a substantial amount of agricultural land.

The source water protection area (watershed) for Broadford Lake encompasses 6.8 square miles (4314 acres) of mixed land, a majority of which is used for agriculture (see Figure A-2 in Appendix A). The watershed is characterized by stream valleys and rolling uplands, and is located within the Allegany Plateau physiographic province. The Deep Creek Lake watershed is located adjacent to the Broadford Run watershed and lies to the east. The geologic stratum in the area includes shale, coal, and sandstone. Soils are formed in material weathered from a bedrock of shale, sandstone, and siltstone. Soils in the watershed are primarily Brinkerton and Andover silt loam, Elkins silt loams andand Cookport channery loams. The soils consist of either deep, moderately well drained to very poorly drained soils on floodplains (MDE – TMDL, 1999).

Broadford Lake's source water protection area is completely within Garrett County. There are no major municipalities located within the watershed except for a portion of Mountain Lake Park. The Town of Oakland municipal boundary is outside of the lake's watershed. Deer Park, a small community, lies just east of the watershed (see Figure A-1 in Appendix A).

Garrett County has a greater mean annual precipitation and a lower mean annual temperature than any other county in Maryland. The University of Maryland reports weather observations in Oakland (data from 1961-1990). Average annual temperature at Oakland is 47.7 ° F, with temperatures generally below freezing from December through February. Normal maximum temperatures in July is 79.8 ° F. The annual precipitation rate around Oakland is 46.77 inches, with the month of July the highest average, 5.12 inches. Average annual snowfall in this region is 83.9 inches.

Youghiogheny River

The Youghiogheny River has been used as a source of drinking water for the people of Oakland since 1962. The Youghiogheny is designated as a State Scenic River, and a portion of the river between Millers Run and Friendsville is designated as Maryland's only Wild River. This stretch of river, which is protected by land use regulations, is downstream of the city's intake location. The Youghiogheny River is west of the eastern continental divide, so the river eventually empties into the Gulf of Mexico through the Ohio and the Mississippi River systems.

The intake is located approximately 250 yards above the confluence of the Little Youghiogheny River, and a Baltimore & Ohio Railroad Bridge. The river is approximately 30 yards wide at the intake, which is located on the north bank, or the left side if looking downstream. There is a U.S. Geological Survey (USGS) stream gage located next to the Town's pumping station that has been recording water flow and stage height since 1941. The median annual flow at this gage is 165 cfs, and the highest recorded flow of 14,100 cfs occurred in January 1996. Flow data for this gage is available in real-time on the USGS website. Below is a monthly summary of median flows for the data record from 1941 – 1999:

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Median CFS	275	314	436.5	329	215.5	98	61	52	36	47	150.5	270	**165**

Cherry Creek is the main tributary in this portion of the Youghiogheny River basin that is entirely within Maryland. Major West Virginia tributaries include Snowy Creek, South Branch (Snowy Creek), Laurel Run, Rhine Creek, and Maple Run. Terra Alta Lake, Alpine Lake (also known as Hulls Lake), and Silver Lake are the major open water bodies in the source watershed.

The source water protection area (watershed) for the city's Youghiogheny River intake comprises 93 square miles (59,600 acres) of mostly forested land in West Virginia and Maryland. The watershed is almost equally divided between the two states, with 40.5 square miles within Maryland, and 52.5 square miles in West Virginia's Preston County. The entire basin is located in the Allegany Plateau physiographic province. The Cheat River watershed in West Virginia, and the North Branch of the Potomac in Maryland bound the intake's watershed. Backbone Mountain forms the southeast boundary of the watershed and the North Branch of the Potomac watershed. The highest point in Maryland, which lies along Backbone Mountain at an elevation of 3360 msl, is a part of the source water protection boundary.

Terra Alta, WVA, is the largest municipality in the watershed with a population of approximately 2000 people. Other smaller communities in the WVA portion of the watershed include Cornith, Hopemont, and Alpine Lake in the northern portion and Elgon, Aurora and Silver Lake in the southern portion of the watershed. The Town of Crellin is the largest community on the Maryland side of the watershed.

D. SOURCE WATER PROTECTION SITE VISIT

Personnel from the Maryland Department of the Environment's Water Supply Program visited the Town of Oakland's water systems on June 23, 1999 to discuss the assessments of Broadford Lake and the Youghiogheny River, and to describe the source water protection program. Main objectives of the site visit included: obtaining GPS locations of both water supply intakes, inspecting the integrity of the intakes, and documenting water operator's source water concerns. A windshield survey of the immediate watershed vicinity was also undertaken. Further watershed survey trips have been made.

Intake Integrity

The Broadford Lake intake is located approximately 10-ft. from shore on the eastern side of the reservoir. Two ten-inch screened intake pipes carry water to a 25-foot deep wet well at the pumping station. The pumping station, about 1000 yards from the plant, has three 500 gallon per minute (gpm) vertical turbine pumps, operated alternately or in combination, which send raw water up to the plant (MDE – CPE, 1999). The depth of the intake is not known, but it is on the bottom in presumably shallow water (<10ft deep). The town water superintendent did not express any concern with the intake. He doubted there were any structural problems that could effect water quality. MDE personnel did not observe any problems with the intake structure, or raw water line.

The Bradley Run Plant intake is located along the north bank of the Youghiogheny River and is composed of a concrete structure with a bar screen. A single three-inch intake pipe carries water to the raw water pump station that houses two 347-gpm vertical turbine pumps. The pumps are operated alternately and send water to the plant through a single 8-inch polyvinylchloride (PVC) pipe. PVC was used because it was most suited to handle the acidic conditions of raw water from the Youghiogheny River. (Bradley Run Plant - Open House Document, 1962). A water sample collected at the USGS stream gage in 1961 was measured at a pH of 4.3, which signified that the river was highly acidic at that time. The water superintendent did not express any structural concerns with this intake. MDE did observe old campfire rings and human debris in the vicinity of the intake, even on top of the concrete intake structure. The town tries to discourage people from recreating near the intake by letting the right-of-way grow in, but the superintendent believes people still come down to the river by way of the railroad tracks.

Concerns and Site Visit Observations

In addition to looking at the intake structures and land immediately around the river and lake, a drive through the Broadford Lake watershed was done, and a discussion with plant operators was undertaken to determine concerns and potential sources of contamination. Below are two lists of concerns that reflects operator concerns and MDE observations:

Broadford Reservoir

1. Oakland-Deer Park Rd. crosses the lake, potential for spills and road salt problems.
2. Algae growth in late summer becomes a problem.
3. Agriculture is prevalent up in the watershed
4. Small cattle farm in the watershed.
5. Onsite septic in residential area above lake.

6. Concern over the amount of ducks and geese using the lake.
7. Water plants backwash water drains down into the lake, in the vicinity of the intake.
8. Garrett County Sanitary District sewer line may pass through the lower watershed by the dam.

Youghiogheny River

1. Operator pointed out that Crellin WWTP is above intake, but believed it did not effect the plant.
2. Railroad tracks adjacent to the river for several miles above intake, with steep bank.
3. Baltimore & Ohio Railroad Bridge crosses downstream of intake, but operator expressed concern because it crosses the raw water line.
4. Water is hardest to treat after snowmelts.

E. WATERSHED CHARACTERIZATION

Source Water Assessment Area Delineation Method

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 – SWAP, 1999). Delineation of the source water area was performed by using ESRI's ArcView Geographic Information System (GIS) software, utilizing existing GIS data, and by collecting location data using a Global Positioning System (GPS). GPS point locations were taken at each water source intake during site visits and differentially corrected (for an accuracy of +/- 2 meters) at MDE. Once intake locations were established, watersheds were delineated based on existing MD Department of Natural Resources digital watershed data and MD State Highway Administration digital stream coverage. Digital USGS 7.5 topographical quad maps were also used to perform "heads up" digitizing, or editing, of watershed boundaries when needed.

Broadford Lake

General Characteristics

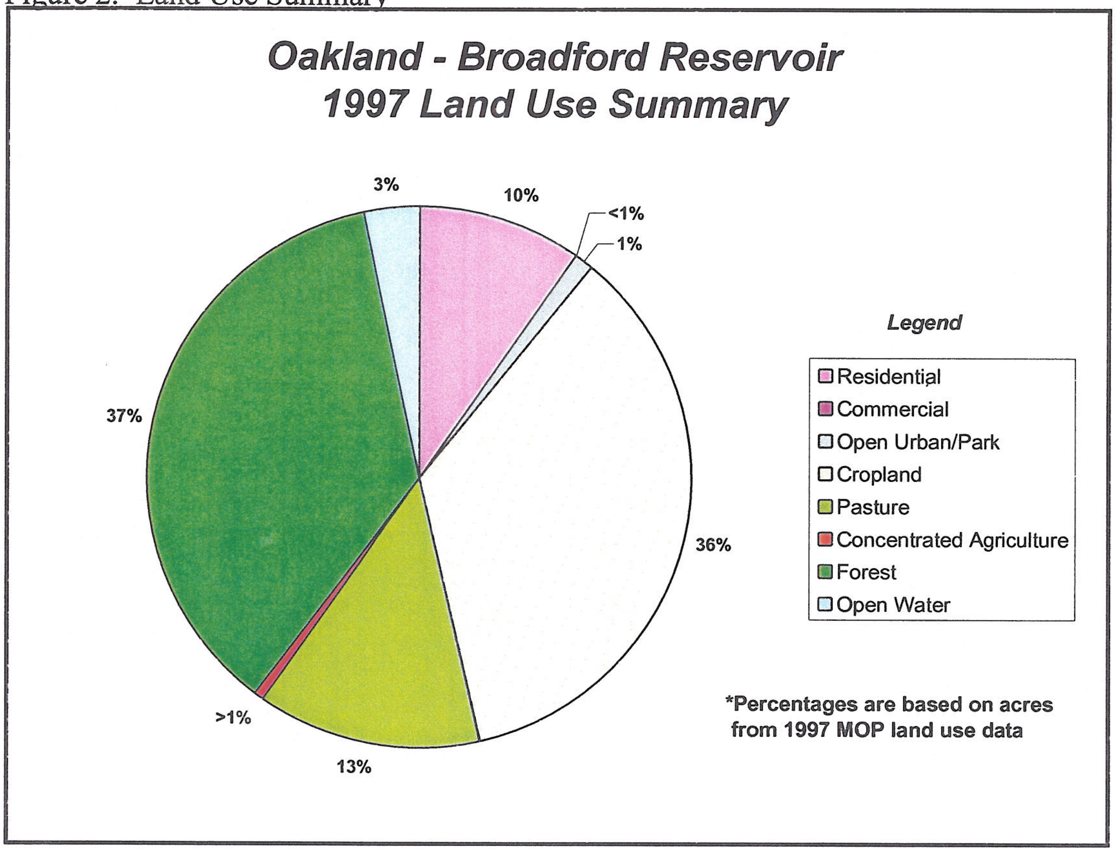
The watershed above Broadford Lake is 4.35 miles in length with a roughly north/south orientation. The entire watershed encompasses 6.8 square miles of mixed agricultural and forested land. Broadford Run is the main tributary to the lake draining approximately 5.65 square miles. The Broadford Run Valley has a maximum width of approximately 0.8 miles. The unnamed tributary is smaller, draining 1.1 square miles of predominantly agricultural land. The unnamed tributary empties into the lake on the north side of Deer Park Rd. into a wetland type setting.

The land categories within the entire Broadford Lake source water protection area (watershed) is listed in Table 1 and Figure 2. This information is based on the Maryland Department of Planning's 1997 land use data.

Table-1. Land Use Summary

Land Use	Total Area in Acres	Percent of Total Watershed
Residential	415.0	9.6
Commercial	9.4	0.2
Open Urban/Park	42.8	1.0
Cropland	1538.0	35.7
Pasture	570.1	13.2
Concentrated Agriculture	19.2	0.4
Forest	1579.2	36.6
Open Water	140.5	3.3

Figure 2. Land Use Summary



Based on Maryland Office of Planning's 1999 digital Property View for Garrett County, there are approximately 475 property parcels in the watershed. Of these, there are only ten parcels over 100 acres, which include the Town's property around the lake and a portion of the Mt. Nebo Wildlife Management Area. Property size averages approximately 9 acres per parcel. A property breakdown is summarized in Table 2.

Table-2. Property Summary

Property	Type	Total Area in Acres	Percent of Total Watershed
Broadford Lake	Town	440	10%
Recreation Area			
Mt. Nebo WMA	State	214	5%
Private	Private	3660	85%

Localized Characteristics

The Broadford Lake Recreational Area encompasses 300 acres surrounding the lake. The Town owns and operates the recreational area, which is composed of two swimming beaches and numerous picnic areas. Motorized boats are not allowed on the reservoir. The intake is located approximately 450 yards across the lake from the public beaches. The recreation area that is open to the public is concentrated on the western shore of the lake, on the opposite side of the intake and water plant. Most of the eastern border is forested (see Figure 1). The area around the lake considered "urban" in the 1997 MOP land use data is actually the park, but does include impervious surfaces such as parking lots.

The unnamed tributary empties into a wetland-like area on the north side of Deer Park Road. This county road crosses the reservoir for approximately 175 yards. Water flows through a culvert under the road. Forest and brush buffer the lower stretch (~770 yards) of Broadford Run before it empties into the reservoir. Between the mouth of the unnamed tributary and Broadford Run there is a large farm/pasture and an electrical substation. There are no residences immediately adjacent to the lake.

Youghiogheny River

General Characteristics

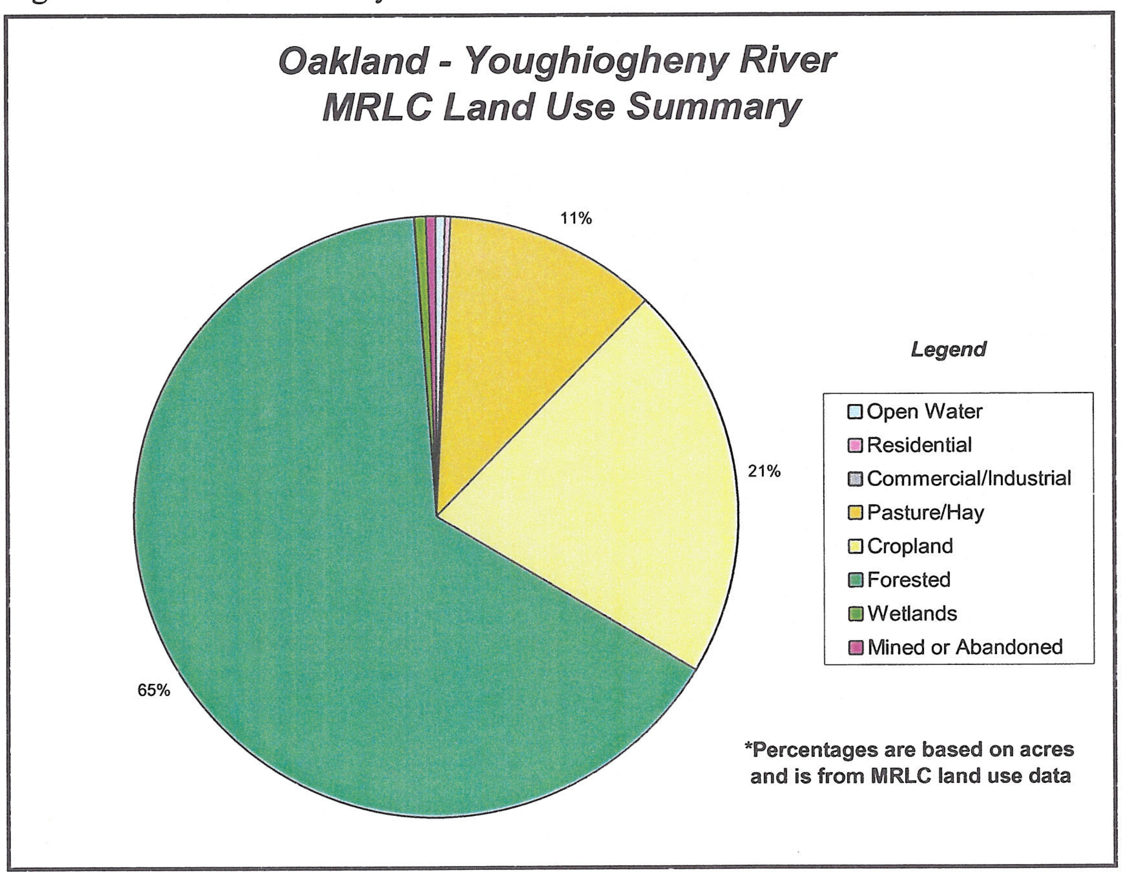
The Youghiogheny source watershed is a peculiar shaped basin encompassing 93 square miles of mostly forested land in Maryland and West Virginia. It gets its unique shape from the fact that tributaries to the river flow both north and south before combining near the Town of Crellin, Maryland and heading northeast. Snowy Creek is the large tributary that flows from the north; Laurel Run combines with Snowy Creek before it enters the Youghiogheny. The upper Youghiogheny River and Cherry Creek flow from the south (see Figure A-4 in Appendix A). The watershed is 18.25 miles long (north-south) and approximately 9.6 miles across at its widest point. The watershed is characterized by high, rounded mountains, but most higher order streams flow sluggishly through broad, low gradient valleys (WVa-DEP, 1998). A small amount of coal lies within the West Virginia portion of the watershed. Some of it has been mined, especially in the Laurel Run subwatershed. Most of the land is a patchwork of forests and agriculture, especially hay and buckwheat fields.

Table 3 presents a summary of land use in the entire Youghiogheny River basin upstream from the Town of Oakland's intake. This data is from the Multi-resolution Land Characterization Consortium (MRLC), a partnership of federal government agencies, including the EPA and USGS, that produce or use land use cover data. The data is based on 30-meter Landsat thematic mapper (satellite) data, and is commonly referred to as the National Land Cover Data set. The MRLC data was designed for use in models, and the "grid" total acres within the watershed will be slightly less than the actual land area due to the clipping of the data for analysis within the Youghiogheny watershed. The land use for Oakland's Youghiogheny source water protection area is outlined in Figure 3.

Table-3. Land Use Summary

Land Use	Total Area in Acres	Percent of Total Watershed
Open Water	319.4	0.5
Residential	231.0	0.4
Commercial/Industrial	10.9	<0.1
Pasture/Hay	6736.6	11.4
Cropland	12592.6	21.3
Forested	38410.9	65.1
Wetlands	369.9	0.6
Mined or Abandoned	329.0	0.6

Figure 3. Land Use Summary



Localized Characteristics

The source watershed above the intake is mostly forested all the way up to the Town of Crellin, approximately 4 river miles upstream. Chisholm Run is the first substantial tributary above the intake, 1.9 miles upstream, and drains several fields and a few small tracts of the Garrett State Forest. The Baltimore & Ohio Railroad tracks follow Chisholm Run down to the Youghiogheny River where the tracks continue and run adjacent to the river for approximately 2 miles passing above the intake. The tracks are within 100 yards of the river for a majority of this distance, at a higher elevation, and at the intake the distance shortens to only 50 yards. At the intake the river is approximately 30 yards wide.

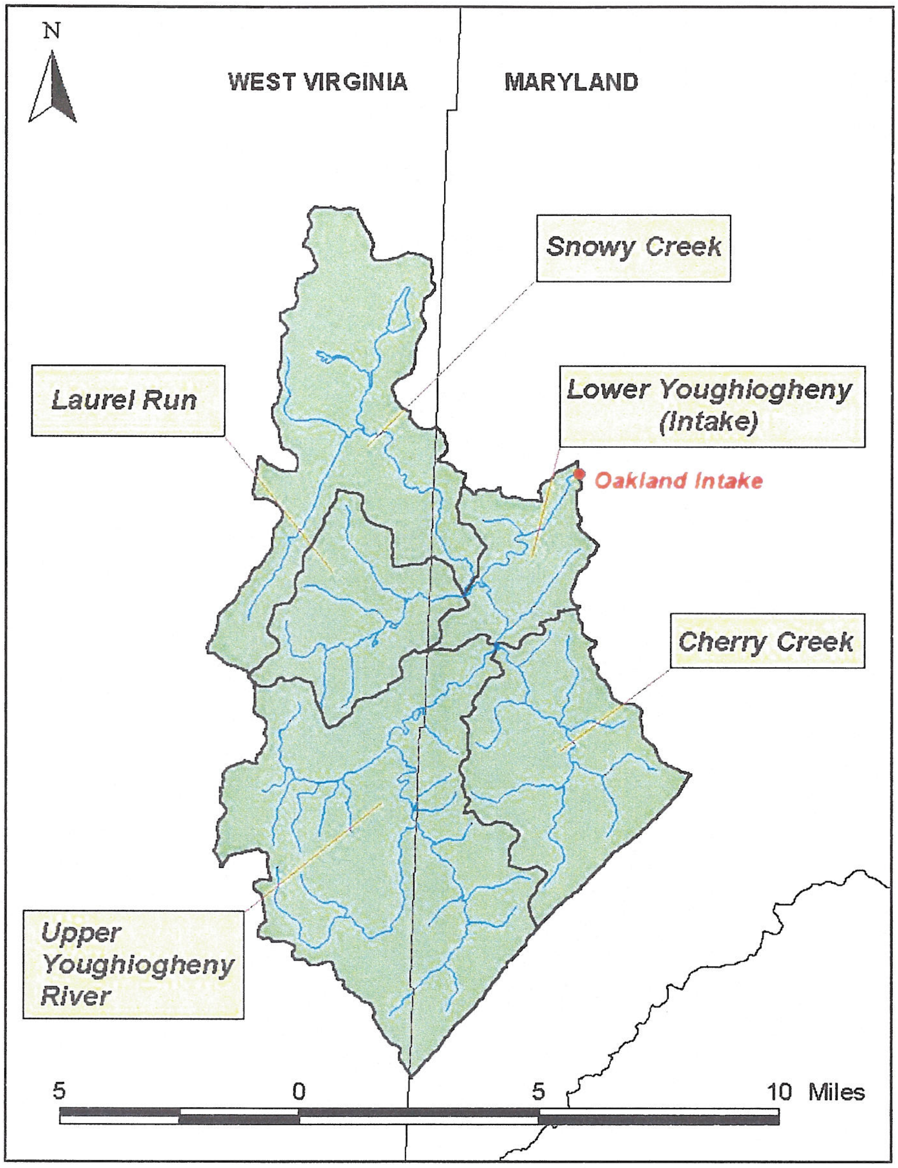
There are several reclaimed mine areas in the immediate upstream area of the intake. According to MD Bureau of Mines data in 1975 a surface mine permit was issued for the Youghiogheny Tree Farm property, but has since been reclaimed and released from bond. This mine was located almost directly across from the confluence of Chisholm Run and the river. The MD Bureau of Mines Abandoned Mine report referenced two old surface mines located approximately 0.7 and 1.3 miles above the intake on the north side of the river. According to the report the mine was sufficiently reclaimed, so that in 1977, the bond on the property was released. However, these reclaimed areas are readily apparent on MD DNR digital orthophoto quads (aerial photos) which were taken in 1995 (see Figure A-8 in Appendix A).

Subwatersheds

Maryland's Source Water Assessment Plan states that larger source water areas will be segmented into smaller subwatersheds to assist in the assessment and identify watersheds of concern. The Oakland Youghiogheny intake watershed was segmented into 5 subwatersheds for this assessment. These subwatersheds were delineated based on existing watershed boundaries provided by the West Virginia Department of Environmental Protection and Maryland Department of Natural Resources. Watershed boundaries were both created and modified (existing data) based on digital topographic maps for both West Virginia and Maryland. Each subwatershed is depicted and described in Appendix B.

Figure 4 is a map depicting the entire Youghiogheny River watershed (source area) with the five subwatersheds for the Town of Oakland's intake:

Figure 4. Subwatershed Map



F. POTENTIAL SOURCES OF CONTAMINATION

Broadford Reservoir

Non-Point Pollution Sources

With the absence of any substantial centers of urbanization, the Broadford Lake watershed is not threatened by urban non-point pollution runoff. Only 1% of the watershed is classified as "urban" by the 1997 Maryland Department of Planning land use data. This urban land is actually composed of parking areas and facilities associated with the recreation area; it also includes the dam structure. The one substantial commercial area depicted in the land use data is actually a school property, only half of which drains into the lake. There is also an auto body shop located near the confluence of Broadford and Perrys Glade Run, the only named tributary to Broadford Run. Analysis of aerial photography and land use data shows that a majority of the watershed's land is used for some type of agriculture. In addition, there is a small amount of residential land within the lake's watershed that may contribute to non-point pollution.

- *Residential Land*

Most residences in the watershed are not located within a sewer service area, and rely on septic systems. Septic systems, especially ones that fail, are potential sources of contamination by pathogenic protozoa, viruses, and bacteria. According to MOP 1997 land use data, almost 10% of the watershed is used for residences. Of this, only 17% of the residential land is within a sewer service area. Houses along Broadford Rd. and facilities in the recreation area are connected to Oakland's sewer system. Residences along this road are in the southeastern corner of the watershed near the lake. The other residential area on sewer is located farther up in the watershed near Deer Park, along Oakland - Deer Park Rd. and Oakland-Westernport Rd.

Most of the houses and farms in the upper watershed are on septic systems. Farms and residences are scattered throughout the watershed, but may not be depicted in the land use because of the 30-acre pixel limitation of the MOP data. However, there are several areas that have a more concentrated residential characteristic, and are reliant upon septic systems. The first, and farthest from the lake, is located in the headwaters region of Broadford Run. There are numerous residences located in this area between Keysers Ridge Rd. and Spring Glade Rd. Closer to the lake, there are some residential drives off of Oakland - Deer Park Rd. before it enters the village of Deer Park and leaves the watershed. These houses are located between Broadford Run and Perrys Glade Run. The third residential area is closest to the reservoir. Here a few houses lie on and just off of Deer Park Rd. before it merges with Old Oakland Rd. and passes over the lake.

It should be stated that while these residential areas are more concentrated with respect to housing in this watershed, they are not characteristic of high-density suburban development. These areas are not believed to be significant sources of pathogenic organisms, but are identified because of their unique location and/or density within the basin make them potential contamination sites.

- *Agriculture*

According to 1997 MOP land use data, almost half of the watershed is used for agricultural purposes (35.7% cropland, 13.2% pasture, 0.4% concentrated operations). Land used to grow crops can be a source of nutrients (from fertilizer), and synthetic organic compounds (pesticides). Agricultural land can also be a source of sediment runoff from erosion. Most cropland in Garrett County is used for oats or hay production (DOA Census of Agriculture, 1997). However, analysis of aerial photography shows that approximately half of the cropland in the watershed is used for row crops, such as corn. Pastures used to graze livestock can be sources of pathogenic protozoa, viruses, and bacteria from animal waste. Animal waste from pastures can also contribute to excessive nutrient (nitrogen and phosphorous) loading.

It would be difficult to discuss specific agricultural characteristics in the entire basin, since it is the most dominant land use. Refer to Figure A-2 in the Appendix A. Based on aerial photography, it appears that most, but not all of the row crop fields are in the unnamed tributary watershed. The concentrated agricultural area depicted in the land use data is located in the northwest portion of the watershed approximately 3-½ miles above the lake. There are several buildings, crop fields, and a pasture in this area, which is along Spring Glade Rd. Adjacent to the lake, near the electrical substation, is a cattle pasture. It is the closest pasture to the lake, however, there does appear to be a wooded buffer between the pasture and the reservoir.

Approximately 625 acres of farmland in the Broadford Lake watershed are included in the Maryland Land Agricultural Preservation Fund, a Department of Agriculture program which works with farmers to designate farmland in preservation districts, promotes easements, and sometimes excludes land from farming (MD DNR, MERLIN data). A good portion of the unnamed tributary's watershed is in a preservation district.

- *Mining and Forestry*

There are no active mines in the Broadford Lake watershed. According to MD Bureau of Mines data there was a surface mining permit granted in 1979 to the L.C. Coal Company for coal removal. The mine was located near the main stem of Broadford Run just above the confluence with an unnamed tributary (from the northeast) approximately 2 miles above the lake. The bond on the property was released, meaning that the operation was completed and the site was reclaimed adequately under Bureau regulations. Surface mines and abandoned mine land can contribute to sediment problems and lower the pH of receiving streams. Mining in the Upper Youghiogheny River basin has been minimal in the past, and only 6.9% of the state's coal reserves are located within this coal basin. Mining is a not believed to be a source of contamination in this watershed.

It is not known whether there has been any commercial logging within the Broadford Lake watershed, but it is doubtful. The only substantial tracts of forest are in the Broadford Lake Recreation Area and the Mt. Nebo Wildlife Management Area. The only known silviculture operation in the watershed is a tree farm located along Oakland - Deer Park Rd.

Point Discharge Pollution Concerns

There are no point sources of pollution within the Broadford Lake watershed.

Transportation Related Concerns

There are approximately 17.8 miles of improved roads that run in the Broadford Lake watershed. Major roads include Oakland – Deer Park Rd, which crosses the reservoir, Kings Run Rd., Spring Glade Rd., and Pysell Cross Cut Rd. Route 219 (Keysers Ridge Rd.), the largest highway, travels for approximately 1.1 miles in two segments through the watershed. Most of this stretch is within the Mt. Nebo Water Management Area. The water superintendent expressed concern over the potential for spills and road salt problems on Oakland – Deer Park Rd, where it passes through the lake on an man-made rock embankment. The regularity of hazardous material passing on this bridge is probably low, but the location of this bridge is of concern if a spill should occur.

Land Use Planning Concerns

A comparison between 1990 and 1997 MOP land use data shows the recent changes in watershed land development. Land use percentages are outlined in Table 4.

Table-4. 1990-1997 Land Use

Land Use	Percent of Watershed in 1990	Percent of Watershed in 1997
Residential	6.1	9.6
Commercial	0.1	0.2
Open Urban/Park	0.5	1.0
Cropland	36.9	35.7
Pasture	13.1	13.2
Concentrated Agriculture	0.2	0.4
Forest	39.1	36.6
Open Water	3.8	3.3

There are no zoning plans around the perimeter of the lake or the watershed, except the portion of land near the dam that is within the corporate limits of Mountain Lake Park. The Town of Oakland is in the process of designating an area west of the reservoir as a priority funding area to build a Route 219 bypass, however, this is outside of the watershed. According to the Garrett County Comprehensive Plan, the Broadford Lake watershed is listed as an agricultural resource area. Minimum residential lot sizes of 3 acres are required, and farmers within the watershed are encouraged to join the Maryland Agricultural Land Trust, which preserves agricultural land with the purchase of easements. As stated above, 625 acres of farmland in the watershed are included in the land trust, and an additional 200 acres of land adjacent to Broadford Run were recently added (personal communication., Garrett County Office of Planning).

Land use changes in the Broadford Lake watershed over the past several years have been minimal. Residential land increased slightly, while forested land decreased. Comparison of the land use maps shows that the new residential land in the 1997 data is located along Pysell Cross Cut Rd., on Broadford Road near the reservoir, and in the upper watershed between Keysers Ridge Rd. and Spring Glade Rd. Most of the forested land lost corresponds to residential land gained, except for the area with new residences along Pysell Cross Cut Rd., which was identified as cropland in the 1990 land use data. Nutrient runoff concentrations are lower from forested land when compared to agriculture and urban development, so a decrease in forested cover within the watershed would not be beneficial to the lake's water quality. However, the two largest continuous tracts of forest, Broadford Lake Recreation Area and the Mt. Nebo Water Management Area, account for approximately 32% of the forested land in the lake's watershed. This forested land should remain relatively protected from development in the near future.

According to the 1997 Census of Agriculture for Maryland, the amount of farmed acres in Garrett County has only slightly increased (<1000) from 1992-1997. There has been a decrease in the amount of farms raising livestock (beef and dairy cattle), but a slight increase (<1000) in the amount of animals raised over the same time period. Poultry and hog farms remained constant in the county. Garrett County is the largest producer of oats used for grain in the state, but the amount of acres and number of farms harvesting this crop have decreased since 1992. The current status of agricultural land in the watershed is not expected to change in the near future.

Youghiogheny River

Non-Point Pollution Sources

The non-point pollution situation on the Youghiogheny River intake is similar to the conditions at Broadford Lake. There are no substantial center of urbanization in the watershed, residential land use is minimal, and the majority of the watershed is a mix of forest and agriculture. However, unlike Broadford Lake, several small communities in the watershed have municipal wastewater treatment plants, and impacts from coal mining have been documented in the WVA portion of the watershed. Analysis of aerial photography and land use data shows that a majority of the watershed's land is forested. Forested land is less likely to contribute non-point sources of pollution than residential, agricultural, and urban land. However, there is a significant amount of agricultural land, especially in the Cherry Creek subwatershed, and several residential areas in both Maryland and West Virginia.

- *Residential Land*

The two major communities in the watershed, Terra Alta in West Virginia and Crellin in Maryland, both have sewer systems and do not rely on private septic systems. However, there are scattered residences and farms throughout the entire watershed that presumably rely on septic systems to treat household waste. Review of water quality data shows that coliform and fecal coliform bacteria levels in the Youghiogheny basin are high. Septic systems, especially ones that fail, are potential sources of pathogenic bacteria, protozoa, and viruses. The West Virginia Department of Environmental Protection (WV-DEP) noted in a 1998 report that residences in the village of Elgon and other residences adjacent to an unnamed tributary of Maple Run did not have appropriate sewage disposal systems. These residences along with several dairy farms apparently contributed to elevated concentrations of bacteria in Maple Run.

A 1983 sanitary survey indicated that over 80% of the Town of Crellin's dwellings discharged wastewater into the ground and into waterways in and around Crellin. A sewerage collection system and treatment plant was constructed in 1990. Beacuase of failing septic systems, the original sewer line was extended to include houses along MD Route 39 at the request of the local health department. Direct discharge of domestic waste and septic system failure were also noted in the unincorporated community of Hutton along MD Route 39. However, houses in this community are now tied into the Crellin wastewater system (Garrett County Water & Sewer Plan, 1997).

While only a small percentage (<1%) of the entire watershed is residential, small communities relying on old septic systems may contribute to the high levels of bacteria seen in the Youghiogheny River.

- *Agricultural Land*

Almost 33% of the Youghiogheny watershed upstream from Oakland's intake is used for agricultural purposes. Non-point problems associated with agricultural land are described above in the Broadford Lake section.

Of the 6700 acres of land classified as pasture/hay within the Youghiogheny basin, almost 80% is found in the Upper Youghiogheny and Cherry Creek subwatersheds. Elevated levels of bacteria have been found in Maple Run and Rhine Creek, both in the Upper Youghiogheny subwatershed. In both cases, dairy and cattle farms were noted as potential sources of the contamination. Pastures used to graze livestock can be sources of pathogenic bacteria, protozoa and viruses. High nutrient concentrations have been found in Cherry Creek, which may be from the application of fertilizer and animal waste associated with pastures. According to Maryland Office of Planning 1997 land use data, over half of Cherry Creek's watershed is used for agriculture (54% crops, 6% pasture). Approximately 850 acres of agricultural farmland in this subwatershed participates in the Maryland Agricultural Land Trust. Most of this land is located along small order streams (Fox Run, Frozen Camp Run, and Clark Run) on the southwest side of Cherry Creek.

The Snowy Creek subwatershed also contains a significant percentage (30%) of agriculture. Most of this land is located in the northwestern portion of the subwatershed; in the upper Snowy Creek valley that includes Terra Alta, and in the North Branch (Snowy Creek) valley above Terra Alta Lake. The South Branch has been identified as having high concentrations of fecal coliform, and livestock excrement was listed as the potential source (WV-DEP, 1998). Laurel Run and the Lower Youghiogheny subwatersheds have the least amount of agricultural land in the basin. Laurel Run has less than 10%, and no significant areas of concentrated farmland. The Lower Youghiogheny's agricultural land is mostly concentrated in the White Meadow Run valley, with some additional acreage adjacent to Chilsholm Run a few miles above the intake.

- *Mining*

The Youghiogheny River basin has a long history of coal mining. Analysis of land use maps and aerial photography depict regions of abandoned mine land in both Maryland and West Virginia. According to available records there are no currently active surface mines in the watershed (as of May 1, 2001). A query was executed on the WVA Department of Mines Internet site by searching USGS topographic quadrangles; no active mine permits or applications for permits were found. The MD Bureau of Mines also provided similar information, and there are no current mines in the Maryland portion of the watershed. The most common method used to extract coal in the Allegheny Plateau region is surface strip mining. Strip mining can have deleterious effects on water quality, such as reducing pH, increasing the concentrations of metals, and increasing surface runoff and erosion. However, abandoned mine land that is not reclaimed, or inadequately reclaimed, can cause similar and in some cases more significant water quality impairments than active mines.

The WV-DEP has documented that Laurel Run, which discharges into Snowy Creek above the Town of Crellin, has had water quality problems attributable to abandoned coal mines. This has lead to Laurel Runs placement onto West Virginia's 1998 303(d) list of impaired waters. According to the MRLC land use cover data set, a total of 328 acres, or almost 5%, of the watershed is classified as mined or abandoned mine land. Most of this area lies in an area known as Brushy Knobs and between Little Laurel Run and an unnamed tributary (see Figure 5). The last mining permit in the basin was issued in 1988 to the New Allegheny Corporation. There were three NPDES discharge permits associated with this 35-acre operation. The property was released from bond in 1993, and there have not been any active mines in the basin since. However, the cause of water quality problems in Laurel Run is from old abandoned mine land. According to the WV-DEP, and an analysis of aerial photos, there is a large, abandoned mining complex adjacent to Laurel Run approximately 1 mile west of the Maryland State line. It was reported in 1998 that this complex had a massive gob pile, which is a mound of refuse mine material (WV-DEP, 1998). Aerial photography also depicts several large surface mines (either abandoned or reclaimed) to both the east and west of the complex in both states.

Laurel Run is the only watershed that has been documented as having water quality impairments due to abandoned mine land, but there were two other permitted NPDES sites associated with mining in the Snowy Creek subwatershed. Both of these sites are located in West Virginia near the community of Corinth. The larger of these two sites was mined by the Buffalo Coal Company, which was issued a permit (WVA0051641) in 1988. The permit expired in 1993 and it appears that the site was reclaimed. The only other known mining related NPDES in the West Virginia portion of the watershed was a quarry located adjacent to Rhine Creek in the Upper Youghiogheny subwatershed. The quarry had three different discharge points; the permits were granted in 1995 and expired in 2000. According to the WVA-DEP Office of Mining and Reclamation's permit database this quarry is no longer in operation, or is not in need of permit because it no longer discharges into Rhine Creek.

There are also several old mine sites in the Lower Youghiogheny subwatershed within Maryland. Please refer to Localized Characteristics heading in this report for further information.

- *Forestry*

A timber harvest operation can disturb 8-10% of the total work area by road building and creating landing sites. These areas, if not maintained, can contribute to erosion and sedimentation in receiving waterways. Almost 65% of the watershed if forested, so forestry harvest operations are likely. Information on forestry harvests in West Virginia is limited, as well as in Maryland. However forestry harvest operations have been increasing in West Virginia, and most likely occur periodically in the Youghiogheny watershed in both states. Chisholm Run, the closest Youghiogheny tributary from the intake, drains several portions of the Garrett State Forest. Sale of timber on state land follows strict guidelines to ensure against environmental degradation, and all permitted harvests on private land in Maryland must comply with state regulations and inspections.

Point Discharge Pollution Concerns

There are three permitted point discharges in the Youghiogheny watershed upstream of the intake. All three point sources are effluent discharges from wastewater treatment plants. The Town of Terra Alta wastewater treatment plant (WWTP) and the Alpine Lake Public Utility WWTP are located in West Virginia, in the Snowy Creek subwatershed. Terra Alta WWTP services approximately 650 households and has a design capacity of treating 250,000 gallons a day. The effluent is discharged into the North Branch of Snowy Creek just below the town, and is approximately 1.65 miles above the confluence of the South Branch and Wardwell Run. The plant has had infiltration/inflow problems in the past; in 1998 the WV-DEP documented problems in the sewer collection system and occasional discharges of incompletely treated sewage into Snowy Creek. The town and WV-DEP were working on a solution to correct this problem. The Alpine Lake WWTP services the small community around the lake and a resort/conference center, it is designed to treat 60,000 gallons of sewage a day. The effluent is discharged into Wardwell Run, below the lake, and approximately 1.9 miles above the confluence of Wardwell run and the main branch of Snowy Creek. Infiltration/Inflow problems have also been documented at the Alpine Lake plant (WV-DEP, 1998). From the confluence of the main branch of Snowy Creek and Wardwell Run, the distance is approximately 10.8 river miles to the Town of Oakland intake.

The Garrett County Sanitary District operates the Town of Crellin's wastewater treatment plant on the Youghiogheny River. The plant discharges effluent directly into the Youghiogheny approximately 4 miles above the Town of Oakland intake. The plant is considered a minor municipal discharge and services approximately 125 households. The design capacity of the plant is 28,000 gallons per day, but the average flow is around 18,000 gallons a day. The plant employs a series of slow-rate sand filters and a UV light system. It was estimated that the plant releases 748 pounds of nitrogen and 124 pounds of phosphorous into the river each year (MDE GIS data).

According to MDE inspection personnel the plant usually operates within the limits of its permit, and there are no known problems with the collection system or treatment process (personal commnication, Western MD Field Office). A permit renewal was filed in February 2000. The permit engineer estimated that the dilution of the background flow to the permitted flow is very high (76%) during low flow conditions (7Q10), which results in a highly diluted effluent. Between January 1997 and October 1997 effluent from the plant had an average fecal bacteria concentration of 79MPN/100 mL, and a pH range of 6.5 to 7.3. Wastewater treatment plants in the watershed can be a source of pathogenic bacteria, protozoa, and viruses.

Transportation Related Concerns

According to MD State Highway Administration data, there are approximately 67.5 miles of improved roads in the Maryland portion of the Youghiogheny watershed. A majority of these road miles are small county routes where transportation (especially of hazardous materials) is probably limited. However, there are three main corridors of transportation through the Youghiogheny watershed. Route 219 (Elkins-Oakland Rd.) travels from Oakland's town center and heads southwest crossing through both the Cherry Creek and Upper Youghiogheny subwatersheds. The route crosses Cherry Creek and the Youghiogheny River once before exiting the basin. Route 50 (George Washington Highway) is an old east-west travel artery. The route enters the basin in the southeast corner of Cherry Creek, then continues west in the Upper Youghiogheny subwatershed, where it crosses and runs parallel to both Maple Run and Rhine Creek. The last noticeable route in the watershed is MD Route 39 (Hutton-Oakland Rd.), which turns into WVA Route 7 at the state border near the village of Hutton. Route 39/7 heads south from Oakland before turning northwest and towards Terra Alta. It runs through the Snowy Creek subwatershed, following the main stem of Snowy Creek, and has several stream crossings.

CSX Transportation maintains and operates three Baltimore & Ohio Railroad tracks in the Youghiogheny watershed. The track runs for approximately 12.4 miles through the Snowy Creek and Lower Youghiogheny subwatersheds. These tracks are heavily used and have the distinction of being the major rail route between Maryland and points west. From the west, the track passes by Terra Alta and runs adjacent to Snowy Creek. Near the Village of Hutton, over the state border, the rail line leaves Snowy Creek, and splits with an abandoned track that used to head south to Crellin. The main rail line travels down the Chisholm Run valley before running adjacent to the Youghiogheny River for approximately 2 miles. The tracks are within 100 yards of the river for a majority of this distance, at a higher elevation, and at the intake the distance shortens to only 50 yards. Below the intake there is a Baltimore & Ohio Railroad bridge that spans the river; the operator expressed concern with this bridge because it is directly above the raw water intake line for the Bradley Run plant.

Land Use Planning Concerns

A comparison between 1990 and 1997 MD Office of Planning land use data shows the recent changes in watershed land development. Land use percentages are presented Tables 5 and 6 for the Lower Youghiogheny and Cherry Creek subwatersheds, which both lie entirely within Maryland.

Table-5. ***Cherry Creek Subwatershed***

Land Use	Percent of Watershed in 1990	Percent of Watershed in 1997
Residential	0.5	1.6
Commercial	0.2	0.3
Surface Mine or Abandoned	0.1	0.2
Cropland	56.1	54.4
Pasture	5.3	5.5
Forest	37.9	38.1

Table-6. ***Lower Youghiogheny Subwatershed***

Land Use	Percent of Watershed in 1990	Percent of Watershed in 1997
Residential	5.2	10.1
Commercial	0.1	1.0
Surface Mine or Abandoned	1.6	0.6
Cropland	19.9	16.4
Pasture	1.2	1.4
Forest	71.9	70.6

There is a not a suitable land use data set to make a comparison of changes in the whole Youghiogheny watershed. The GIRAS land use data set, which was completed in the 1970s, would be difficult to compare to the MRLC because of differences in spatial scale, data collection, and land use classifications. The discussion in the next paragraph will focus on land use changes in the Maryland subwatersheds.

There are no zoning laws in Garrett County to prohibit development in the Youghiogheny watershed, however, land use changes in the Cherry Creek and Lower Youghiogheny subwatersheds over the past few years has been minimal. This would not be expected to change in the near future. Agricultural land and forest have remained nearly the same over the time period. The only noticeable difference in either subwatershed is a slight increase in residential land, especially in the Lower Youghiogheny. Residential land in the Lower Youghiogheny increased 5%; approximately 230 acres of new low-density residential land appeared in the 1997 data. This "new" residential land is located in several areas, but the most pronounced increase is in the Crellin area, where Snowy Creek empties into the Youghiogheny. Other areas include Dilly Rd./Old Crellin Rd., which is in the White Meadow Run Valley, Underwood Rd., and along Route 39 between Oakland and Crellin. While the densities of these residential areas are low, they rely on septic systems that can be a future source of pathogenic organisms, like bacteria, protozoa, and viruses. Also, this increase in residential land is located in the subwatershed closest to the Town of Oakland's intake. The growth in residential land is not considered serious enough to increase the susceptibility of the Oakland intake to contaminants, but future growth should be monitored, especially in proximity to the intake.

Land use changes in the Cherry Creek subwatershed have been minimal, with only a very slight increase in residential land. Agricultural land composed over 50% of the watershed in both 1990 and 1997. This would not be expected to change in the near future. The potential for contamination from this land use will hopefully decline once nutrient management plans are required for farms in Maryland starting in 2004.

The percent of mined or abandoned land in the Lower Youghiogheny watershed decreased by approximately 50 acres from 1990 to 1997, which may indicate that reclamation efforts are working and the land is reverting back to either forest and/or brush. It was noted in an old Bradley Run Plant brochure that PVC pipe was used in the raw water transmission line because of the acidic nature of the Youghiogheny River (Open House Brochure, 1962). A 1961 USGS water quality sample had a pH of 4.3. This condition was most likely attributable to active and abandoned mines in the watershed. A review of recent data, taken by the plant, show that pH levels in the river have improved. However, as late as 1998, acid mine drainage impacts have been noted in the Laurel Run subwatershed. WV-DEP stated, in a 1998 assessment, that future proposals for coal mining in the Laurel Run watershed should be scrutinized closely because of the high potential for acid mine drainage (WV-DEP, 1998). The last coal-mining permit in the watershed expired in 1993. Future mining in the watershed, especially near the intake should be discouraged because of past impairments to water quality. Both Maryland and West Virginia receive federal funds to reclaim abandoned mine lands. Reclamation projects in the Youghiogheny watershed, especially at the Turner-Douglas site, could improve water quality and mediate the effects of future acid mine drainage in the watershed.

G. REVIEW OF WATER QUALITY DATA

Several sources of water quality data were reviewed for both of Oakland's intakes. These include the MDE Water Supply Program's database for Safe Drinking Water Contaminants and monthly operating reports, MDE TMDL data, MDE bacteriological data, and West Virginia Department of Environmental Protection data.

Monthly Operation Reports

Existing Plant Data – Raw Water

The Town of Oakland is required to perform water quality tests on the drinking water it produces at both filtration plants. They are required to submit two monthly operating reports, one for each plant, to MDE's Water Supply Program. These reports include some water testing of the river and reservoir, or "raw water." Turbidity, alkalinity, and pH are the parameters tested daily when plants are operating. Review of the data indicates that the Youghiogheny River is subject to occasional periods of high turbidity, most likely caused by high intensity storms and/or snowmelt. For the October 1998 to September 1999 period of record, the average turbidity of raw water from the river was 9.0 NTU (Median value = 6.0 NTU), with the highest turbidity, 180 NTU, recorded in January 1999. Broadford Lake's average turbidity over the same time frame was 3.0 NTU (Median value = 3.0). However, the highest recorded turbidity during the year was only 7.1 NTU. Lower turbidities would be expected in the lake, the larger volume of water is able to mitigate storm water events that carry soil particles and in turn raise turbidity.

Alkalinity and pH measurements are also taken at both plants, however readings (including Turbidity) are not taken when the Bradley Run plant is not in operation. A review of this data over the same time frame (October 1998 to September 1999) shows that average pH and alkalinity at both plants are within acceptable drinking water ranges. The Bradley Run Plant, (Youghiogheny River) pH averaged 6.8, and average alkalinity was 18.2. Broadford Lake Plant averaged a pH of 7.1 and an alkalinity of 12.3.

Regulated Testing

The Town of Oakland is required to test for regulated contaminants in its finished water supply from both treatment plants. A large number of these samples are collected by MDE and analyzed by the Maryland Department of Health Laboratory. This data is then reported to the Maryland Department of the Environment's Water Supply Program. Tests for Synthetic Organic Compounds, Volatile Organic Compounds, and Inorganic Compounds are required on an annual basis. Below are tables of detected compounds. For the following sections of regulated monitoring detections, Plant ID = 1 – Broadford Plant, 2 – Bradley Run. Shaded samples also indicate data from Bradley Run Plant. All samples are of finished water, unless otherwise noted.

Inorganic Compounds

A summary of nitrate detections since 1993 is presented in Table 7.

Table-7. Nitrates

Contaminant	MCL (ppm)	Date	Result	Plant ID
NITRATE	10	02/22/93	1	1
NITRATE	10	04/28/93	0.39	1
NITRATE	10	11/17/93	0.4	1
NITRATE	10	03/14/94	0.54	1
NITRATE	10	05/08/95	0.003	1
NITRATE	10	08/05/96	0.4	1
NITRATE	10	08/27/96	0.26	1
NITRATE	10	03/31/97	0.65	1
NITRATE	10	06/09/97	0.5	1
NITRATE	10	05/05/98	0.6	1
NITRATE	10	01/18/00	0.5	1
NITRATE	10	02/16/00	0.7	1(raw)
NITRATE	10	02/22/00	1.1	1
NITRATE	10	12/06/00	1.44	1
NITRATE	10	06/01/00	0.4	1
NITRATE	10	02/22/93	0.9	2
NITRATE	10	05/14/93	0.36	2
NITRATE	10	08/24/93	0.2	2
NITRATE	10	12/23/93	1.3	2
NITRATE	10	11/30/94	0.55	2
NITRATE	10	05/08/95	0.011	2
NITRATE	10	08/05/96	0.6	2
NITRATE	10	08/27/96	0.38	2
NITRATE	10	03/31/97	0.6	2
NITRATE	10	06/09/97	0.6	2
NITRATE	10	05/05/98	0.6	2
NITRATE	10	12/16/99	1.4	2
NITRATE	10	02/16/00	1.5	2(raw)

The average detection of nitrates, since 1993, at the Broadford Plant is 0.7 mg/L, and 0.8 mg/L at Bradley Run.

Other inorganic compounds detected since 1993 are listed in Table 8.

Table-8. Other Inorganic Detects

Contaminant	MCL (ppm)	Date	Result	Plant ID
NITRITE	1	11/17/93	0.4	1
NITRITE	1	05/08/95	0.003	1
NITRITE	1	08/05/96	0.005	2
NITRITE	1	06/09/97	0.005	2
FLUORIDE	4	05/08/95	0.98	1

Table 8 (continued)

FLUORIDE	4	08/05/96	1.24	1
FLUORIDE	4	08/27/96	1.3	1
FLUORIDE	4	06/09/97	1.38	1
FLUORIDE	4	05/05/98	1.5	1
FLUORIDE	4	06/24/99	1.2	1
FLUORIDE	4	02/16/00	0.91	1(raw)
FLUORIDE	4	06/01/00	1.3	1
FLUORIDE	4	05/08/95	0.46	2
FLUORIDE	4	08/05/96	0.12	2
FLUORIDE	4	08/27/96	0.06	2
FLUORIDE	4	05/05/98	0.86	2
FLUORIDE	4	02/16/00	0.77	2(raw)
BARIUM	2	08/27/96	0.029	1
BARIUM	2	08/27/96	0.34	2
CHROMIUM	0.1	08/27/96	0.0007	1
NICKEL	0.1	08/27/96	0.0013	1

Volatile Organic Compounds (VOCs)

As Table 9 indicates, there have been only a few detections of VOCs at Oakland's water plants since testing began in 1990.

Table-9. Volatile Organic Compounds (VOCs)

Contaminant	MCL (ppm)	Date	Result	Plant ID
BENZENE	5	01/08/90	1	1
CARBON TETRACHLORIDE	5	07/18/90	1.1	1
CARBON TETRACHLORIDE	5	07/18/90	0.2	2
CARBON TETRACHLORIDE	5	10/26/90	0.9	2
CARBON TETRACHLORIDE	5	04/28/94	0.3	1
METHYLENE CHLORIDE	5	02/14/91	4	2
ETHYLBENZENE	700	04/28/94	0.9	2
XYLENES, TOTAL	10000	04/28/94	7.2	2

Compounds known as Trihalomethanes (THM) are the result of residual organic matter combining with chlorine during the disinfection process. Results from THM detects are summarized in Table 10. Data is separated by plant and specific compounds are totaled (by sample date) in the far right column.

Table-10. Trihalomethanes

Contaminant	Date	Result	Plant ID	Total THM
BROMODICHLOROMETHANE	07/18/90	3.6	1	
CHLOROFORM	07/18/90	78	1	
DIBROMOCHLOROMETHANE	07/18/90	0.2	1	**81.8**
BROMODICHLOROMETHANE	07/18/90	3.9	2	
CHLOROFORM	07/18/90	133.8	2	**137.7**
BROMODICHLOROMETHANE	02/14/91	3	1	
CHLOROFORM	02/14/91	22	1	**25**
BROMODICHLOROMETHANE	02/14/91	1	2	
CHLOROFORM	02/14/91	12	2	**13**
BROMODICHLOROMETHANE	03/16/92	2.8	1	
DIBROMOCHLOROMETHANE	03/16/92	0.3	1	
CHLOROFORM	03/16/92	18	1	**21.1**
BROMODICHLOROMETHANE	09/15/92	7.5	1	
CHLOROFORM	09/15/92	107	1	**114.5**
BROMODICHLOROMETHANE	12/21/92	3.8	1	
CHLOROFORM	12/21/92	27	1	
DIBROMOCHLOROMETHANE	12/21/92	0.4	1	**31.2**
BROMODICHLOROMETHANE	02/22/93	4.8	1	
CHLOROFORM	02/22/93	49	1	**53.8**
BROMODICHLOROMETHANE	03/22/93	1.5	2	
CHLOROFORM	03/22/93	24	2	**25.5**
BROMODICHLOROMETHANE	04/28/94	4.8	1	
CHLOROFORM	04/28/94	87	1	**91.8**
BROMODICHLOROMETHANE	04/28/94	2.1	2	
DIBROMOCHLOROMETHANE	04/28/94	0.2	2	
CHLOROFORM	04/28/94	28.4	2	**30.7**
DIBROMOCHLOROMETHANE	04/28/94	0.2	1	
BROMODICHLOROMETHANE	05/22/95	5.3	1	
CHLOROFORM	05/22/95	62	1	**67.5**
BROMODICHLOROMETHANE	01/25/96	2.7	2	
CHLOROFORM	01/25/96	70.3	2	**73**
BROMODICHLOROMETHANE	05/06/96	6	1	
CHLOROFORM	05/06/96	85	1	**91**
BROMODICHLOROMETHANE	05/06/96	6	2	
CHLOROFORM	05/06/96	71	2	**77**
CHLOROFORM	08/05/96	45.6	2	
BROMODICHLOROMETHANE	08/05/96	5.6	2	**51.2**
CHLOROFORM	12/17/96	22.6	1	
DIBROMOCHLOROMETHANE	12/17/96	1.1	1	
BROMODICHLOROMETHANE	12/17/96	5	1	**28.7**
CHLOROFORM	06/09/97	12	1	

Table 10 (continued)

DIBROMOCHLOROMETHANE	06/09/97	0.8	1	
BROMODICHLOROMETHANE	06/09/97	5	1	**17.8**
DIBROMOCHLOROMETHANE	06/09/97	7	2	
CHLOROFORM	06/09/97	36	2	
BROMODICHLOROMETHANE	06/09/97	3	2	**46**
BROMODICHLOROMETHANE	05/05/98	1.4	1	
CHLOROFORM	05/05/98	46.8	1	**48.2**
CHLOROFORM	05/05/98	45.9	2	
BROMODICHLOROMETHANE	05/05/98	1	2	**46.9**
CHLOROFORM	06/24/99	85.4	1	
BROMODICHLOROMETHANE	06/24/99	7.8	1	**93.2**
CHLOROFORM	12/16/99	27	2	
BROMODICHLOROMETHANE	12/16/99	2.1	2	**29.1**
CHLOROFORM	04/18/00	27	2	
BROMODICHLOROMETHANE	04/18/00	2.1	2	**29.1**
BROMODICHLOROMETHANE	06/01/00	6.4	1	
CHLOROFORM	06/01/00	94	1	**100.4**

Synthetic Organic Compounds
Table 11 lists a summary of SOC detects at both of Oakland's water treatment plants.

Table-11. Synthetic Organic Compouonds

Contaminant	**MCL (ppm)**	**Date**	**Result**	**Plant ID**
ATRAZINE	3	06/09/97	0.33	2
DI(2-ETHYLHEXYL) PHTHALATE*	6	05/08/95	2.05	1
DI(2-ETHYLHEXYL) PHTHALATE*	6	05/08/95	6.45	2
DI(2-ETHYLHEXYL) PHTHALATE*	6	06/09/97	0.89	2
DI(2-ETHYLHEXYL) PHTHALATE*	6	06/09/97	22.53	1
DI(2-ETHYLHEXYL) PHTHALATE*	6	06/24/99	0.7	1
DI(2-ETHYLHEXYL) PHTHALATE*	6	09/13/99	1.5	1
DI(2-ETHYLHEXYL) PHTHALATE*	6	04/18/00	0.9	2
DI(2-ETHYLHEXYL) PHTHALATE*	6	06/01/00	0.7	1
DI(2-ETHYLHEXYL) PHTHALATE*	6	06/01/00	1.3	1(raw)
HEXACHLOROBENZENE (HCB)	1	08/05/96	0.056	1
HEXACHLOROCYCLOPENTADIENE	50	08/05/96	0.056	2
DALAPON	200	06/01/00	0.42	1(raw)
DALAPON	200	09/13/99	0.99	1(raw)
DALAPON	200	09/13/99	0.99	1
DALAPON	200	06/24/99	1.52	1(raw)
DALAPON	200	06/01/00	2.29	1
DI(2-ETHYLHEXYL) ADIPATE*	400	06/09/97	1.48	1
DI(2-ETHYLHEXYL) ADIPATE*	400	06/01/00	0.6	1

* All Phthalate and Adipate samples had detections in Laboratory blanks.

MDE – Lake Broadford TMDL Data

All Maryland segments of the Youghiogheny River sub-basin have been identified as needing TMDLs (Total Maximum Daily Loads) for pollutants that may include one or more of the following: nutrients, suspended sediments, bacteria, and low pH (MD DNR-305(b) Report, 2000).

On the basis of water quality problems associated with nutrients, Broadford Lake was placed on the 1998 303(d) list, and a TMDL for nutrients was completed in 1999. Broadford Lake was monitored by MDE in August and September of 1993. Samples were taken from two different sites in the lake and at different depths. Table 12 and 13 provide a summary of the data collected for this project.

Table-12. MD TMDL Data

Station	Date	Depth	TOC	TKN	TP
		(m)	(mg/L)	(mg/L)	(mg/L)
BFR0007	08/03/1993	0.3	na	0.26	0.042
BFR0014	08/03/1993	0.3	na	0.49	0.062
BFR0007	09/08/1993	0.3	3.41	0.82	0.021
BFR0014	09/08/1993	0.3	4.2	0.23	0.017

TOC = Total Organic Compounds
TKN = Total Kedjhal Nitrogen
TP = Total Phosphorous

Table-13. Chlorophyll a Data

Station	Date	Depth	CHLA
		(m)	(mg/L)
BFR0007	08/03/1993	0	35
BFR0007	08/03/1993	0.3	6.6
BFR0014	08/03/1993	0	6.5
BFR0014	08/03/1993	0.3	9.3
BFR0007	09/08/1993	0	15.3
BFR0007	09/08/1993	0.3	12.6
BFR0014	09/08/1993	0	4.5
BFR0014	09/08/1993	0.3	4.2

MD DNR Core Sampling Data - Youghiogheny River

Data from state monitoring stations show elevated bacterial levels in the mainstem Youghiogheny River from MD Route 39 to the Youghiogheny River Lake, a distance of 26.6 miles. MD Route 39 crosses the river near the Town of Crellin, within the intake watershed. However, these stations (2) are located outside of the source water protection area (watershed). Data from station YOU1139, located approximately 800 yards downstream from Oakland's intake, will be included in this review. YOU1139 is a Department of Natural Resources CORE/Trend sampling site that is monitored monthly for several water quality parameters. Low pH levels have been documented at this site, as well as elevated bacteria concentrations (MD DNR 305b Report, 2000). It should be noted that this site also includes the drainage from the

Table 17 (continued)

11/16/2000	240	139.1
11/09/2000	1	12.2
11/02/2000	4	12.1
10/26/2000	50	29.2
10/19/2000	8000	2419.2
10/12/2000	50	47.4
10/05/2000	110	90.7
09/28/2000	800	1732.9
09/21/2000	30	71.7
09/14/2000	80	81.6
09/07/2000	1400	48.8

Note: Samples listed above as 1 MPN/100ml were reported from the laboratory as probable <2, and samples listed above as 0 MPN/100ml were reported as <1, they were changed for statistical purposes.

H. SUSCEPTIBILITY ANALYSIS

Each class of contaminants that were detected in the water quality data will be analyzed based on the potential they have of contaminating both Lake Broadford and the Youghiogheny River upstream of the intake. This analysis will identify suspected sources of contaminants, evaluate the natural conditions in each watershed that may decrease or increase the likelihood of a contaminant reaching the intake, and evaluate the impacts that future changes may have on the susceptibility of both intakes.

Microbial Contaminants

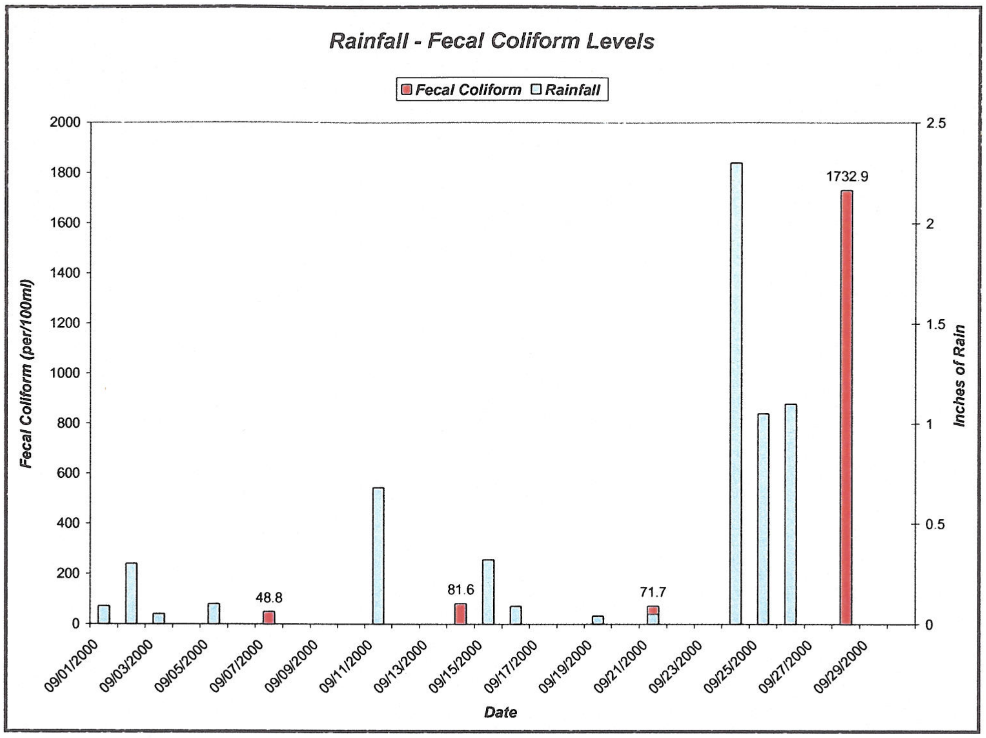
Under current regulations, the Town of Oakland is required to take 6 total coliform samples from finished drinking water at each plant per month. These bacteriological samples are collected at points in the distribution system. It would be difficult to use this data for the assessment because it does not adequately give an indication of contamination in both raw water supplies. Because of this lack of data, raw water bacteriological monitoring began in September 2000 at both plants. Table 18 displays a statistical summary of the bacteriological data presented previously in Tables 16 and 17.

Table-18. Summary of Bacteria Data

Source	*No. of Samples*	*Fecal Coliform*			*E. Coli*		
		Mean	**Median**	**Maximum**	**Mean**	**Median**	**Maximum**
Youghiogheny River	31	590	50	8000	382	49	2419
Lake Broadford	15	11	2	80	11	4	93

Mean concentrations most likely reflect random samples with high concentrations that are due to increased runoff during storms. See Figure 5 below.

Figure 5. Rainfall & Fecal Coliform Relationship



Streams which receive non-point source water runoff from pastures and concentrated livestock areas can have high concentrations of bacteria associated with eroding soil during periods of high flow. These bacteria can remain viable for long periods of time and attach to soil particles. During a storm, erosion of land surfaces may increase and previously eroded sediment in the streambed can be resuspended, leading to increased bacteria concentrations. Continuous point loading of bacteria from wastewater plant discharges can contribute to elevated concentrations at intake sites when combined with upstream sources during/after storms. Bacteria that are discharged in effluent and have settled can also become resuspended. Reservoirs, in general, can reduce the number of viable bacteria within a waterbody, but this is dependent on many environmental factors.

The only other bacteriological data that was available for this report were samples taken by the WV-DEP in 1996 as part of the Youghiogheny River watershed assessment. This data is listed in Table 15 in the WATER QUALITY REVIEW section of this report.. Counts ranged from 0 MPN/100ml in Laurel Run, to 5500 MPN/100ml in Rhine Creek. Unfortunately this study only sampled each site once, but it did give clues to the suspected sources of elevated bacteria levels, which are discussed below. This data shows that bacteria sources are fairly common throughout the entire watershed and not entirely particular to one stream or subwatershed.

In general, potential non-point sources of pathogenic protozoa, viruses, and bacteria in both of Oakland's source water areas include pasture (livestock), residential septic systems, and wildlife.

In the WV DEP assessment several sources of contamination were identified. In Rhine Creek two small communities and several cattle farms upstream of the sample site were identified as possible sources. Maple Run in the Upper Youghiogheny subwatershed also had elevated concentrations of fecal coliform; potential sources included dairy farms and residences without appropriately operating sewage disposal systems. It was also noted that cattle had direct access to the stream above the Maple Run sampling point. Concentrated livestock operations, especially farms/pastures adjacent to streams (some with unrestricted stream access) are likely sources of bacteria concentration in both the Youghiogheny River and Broadford Lake source watersheds. There are at least two known cattle/dairy farms in the Broadford Lake watershed, the approximate number in the Youghiogheny River watershed is not known, but based on the land use data they are probably common. According to the Youghiogheny River watershed assessment many valleys in West Virginia supported cattle farms (WV-DEP, 1998).

The three wastewater plants in the Youghiogheny River source watershed also contribute to bacteria loading. As discussed above, the two plants in West Virginia, Terra Alta and Alpine Lake, were both identified as having infiltration/inflow problems, and in the past Terra Alta has discharged incompletely treated sewage directly into Snowy Creek. The Town of Crellin's wastewater treatment plant does not have any documented problems with treatment or discharge, but it is a concern because of its location only four miles upstream of the Youghiogheny intake. This discharge presents additional loading of bacteria to the river.

The Town of Oakland has never tested for species of *Giardia* or *Cryptosporidium* in its water supplies. Both of these microscopic protozoa are believed to be fairly common in surface waters of the United States. High turbidity and elevated levels of fecal coliforms concentrations can be an indicator for the presence of these pathogens. Sources of contamination include human and animal waste, including birds. Water filtration does not always provide a 100% effective barrier; especially against the smaller *Cryptosporidium* oocysts. In addition, up to 35% of the raw water flow to the Broadford Plant is recycled backwash water, which could result in a large concentration of *Giardia* and *Cryptosporidium* within the treatment process (MDE – CPE, 1999). Some of this backwash water at the Broadford Plant is discharged into retention ponds, which eventually flows through groundwater back into the lake. However, the lake may decrease the liklehood (by die-off or natural attenuation) of Cryptosporidium and Giardia entering the Broadford Plant.

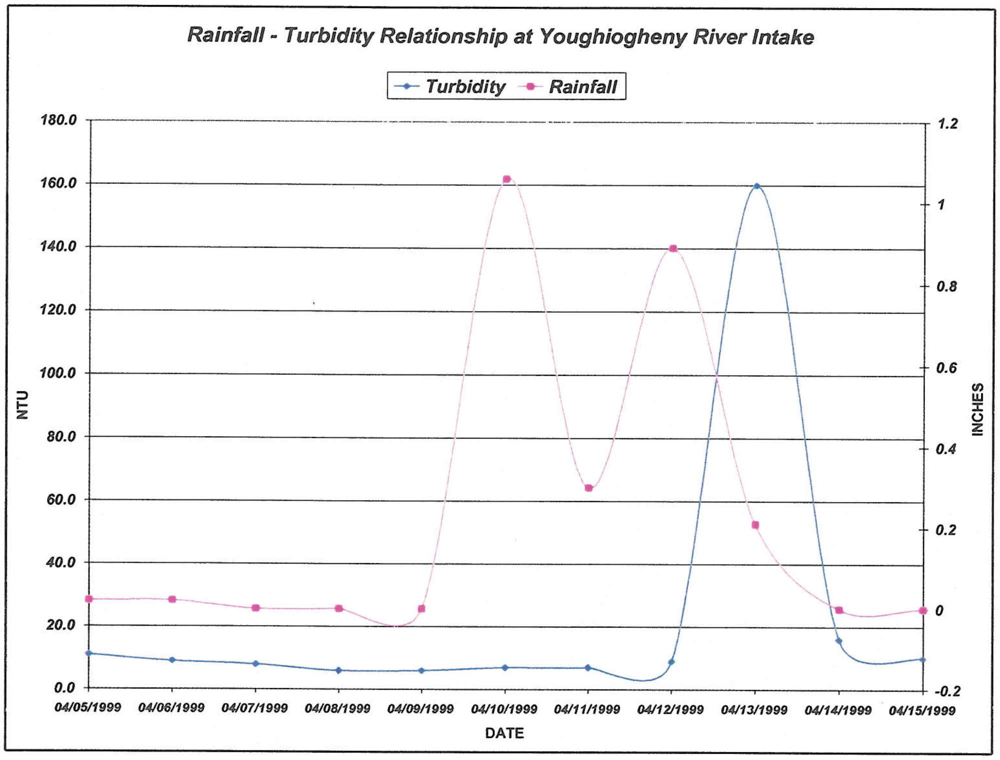
A review of current Garret County sewer maps depicts a sewer main that may lie within the lower portion of the watershed. However, data shows that bacteria contamination in the lake is not likely a problem under normal conditions at this time. Storm events may increase the concentrations of harmful bacteria in the reservoir, and future contamination is possible if conditions in the watershed change; i.e. septic system failure, increased development, and/or increased pasture land (livestock numbers). Broadford Lake is not susceptible to pathogenic microbial contamination at this time.

At this time the Youghiogheny River intake is susceptible to contamination by pathogenic bacteria, protozoa, and viruses. There are numerous sources of these contaminants within the watershed. Bacteriological concentrations are high enough to cause concern, and levels are most likely problematic during increased river flow due to storms/snowmelt.

Turbidity and Sediment

Excessively high turbidity can interfere with water treatment and can carry harmful microorganisms and compounds into drinking water supplies. 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, raising the turbidity. Figure 6 provides an example of the rainfall-turbidity relationship from April 1999 at the Youghiogheny River intake:

Figure 6. Rainfall & Turbidity Relationship



With 65% of the watershed forested, sediment loads to the river are expected to be moderate, but intense storms can generate much higher sediment loads, similar to the observed increase in turbidity seen above. Review of plant records and discussion with the water superintendent indicate that periodic increases of turbidity in the river have been and continue to be a common occurrence. The WVA-DEP noted that many sample sites in the Youghiogheny River watershed had moderate to high levels of in-stream sedimentation, which they attributed to a combination of low stream gradients (a natural phenomenon in this watershed) and soil erosion from farms and residential areas (WVA-DEP, 1998). Monthly total suspended solid (TSS) samples from the

DNR sample site below the intake averaged 11.5 mg/l. Table 19 is a comparison of suspended solids data from similar rivers in the same geographic region:

Table-19. Suspended Solids Data

Sample Site	**Average TSS**	**Maximum TSS**
	(mg/l)	(mg/l)
Savage River	6	22
Youghiogheny River (at Friendsville)	9.1	82
North Branch Potomac	17.2	158
Casselman River	6.77	46
Little Youghiogheny River	18.4	318
Youghiogheny River (near Intake)	**11.5**	**80**

- data from MD DNR CORE stations

Total suspended solids data near the river intake is comparable to other western Maryland river sample stations. Watershed contributions of sediment and other suspended particles which contribute to turbidity do not appear unique, or overly exaggerated, in the Youghiogheny River at the intake when compared to other similar hydrological and geographically located stations outside of and within the same major watershed.

The average turbidity in Broadford Lake from Oct. 1998 to Sept. 1999 was 3.0 NTU, with a maximum recorded value of just 7 NTU. Lakes and reservoirs provide longer water detention times, allowing for adequate settling of the larger turbidity particles and suspended solids. In addition, the location of the intake, approximately 1 mile from where Broadford Run enters the reservoir and ¾ miles away from the mouth of the unnamed tributary, offers protection from greater swings in turbidity during storms at the head of the lake. However, the lake is relatively shallow and wave action created by high winds does have the potential to stir up sediments from the bottom and re-suspend material, especially at the intake location, where the depth is approximately 10 feet. Sources of turbidity in the Broadford Lake watershed include natural erosion of streambanks, algae in the water column, and runoff from cropland, pastures, and residential land.

Future land use changes in both watersheds could increase the potential of turbidity contamination in the Youghiogheny River and Broadford Lake. Alteration to forested land could increase the amount of exposed surfaces that can lead to increased runoff and erosion. There has been some residential development in both source watersheds, though relatively small, and agricultural land use has remained fairly constant and would not be expected to change in the near future. Recovery of mineral and forest resources could potentially increase runoff and raise the potential for problematic turbidity events, especially in the larger and more likely Youghiogheny River watershed.

Inorganic Compounds

Nutrients

The Maryland water quality standards Surface Water Use Designation (COMAR 26.08.02.07) for Broadford Lake is Use I-P - *Water Contact Recreation, and Protection of Aquatic Life, and Public Water Supply.* In the 1998 Maryland Lake Water Assessment Report, the lake was identified as having dissolved oxygen problems and nuisance levels of algae. Broadford Lake was added to the state's 1998 303(d) list, which is a list of impaired waters. The water quality impairment at the lake consisted of a violation of the numeric water quality for dissolved oxygen, and the general narrative criteria for algal growth applicable to use I-P waters. The substance found to cause these water quality violations was phosphorous (MDE-TMDL Broadford Lake, 1999). Phosphorous is a nutrient that can cause excessive algal growth, and it is usually the limiting nutrient in freshwater lakes. Agricultural land is one of the major sources of phosphorous loading from runoff. Total phosphorous concentrations ranged from 0.017 mg/l to 0.062 mg/l, which exceeded the range of lakes that **do not** exhibit signs of nutrient over-enrichment (0.01 to 0.03 mg/l). Over-enrichment can lead to excessive algae growth. The death and decay of excessive algae by bacteria can cause violations in the dissolved oxygen water quality standard. This can disrupt the lake's ecosystem, result in taste and odor problems in drinking water, and free up potential contaminants from lake sediment.

Phosphorous is not a regulated drinking water contaminant, but high concentrations can lead to subsequent problems like those listed above. Nitrogen, in the form of nitrate and nitrite is a regulated contaminant. From 1993-2000 there have been 16 nitrate detections at the Broadford Lake Plant. Fifteen of these samples were from finished drinking water. The mean detection concentration for nitrates during this time period was 0.7 mg/l, well below the maximum contaminant level (MCL) of 10.0 mg/l. Potential anthropogenic sources of nutrients in the Broadford Lake watershed include fertilizer runoff (from the 1500 acres of cropland), livestock waste from pastures, and discharge from residential septic systems. The trend in nitrate detection concentrations have been relatively steady since 1993, so unless livestock numbers or agricultural land use drastically increases, it is unlikely that nitrate concentrations, or phosphorous, will increase in the future. The Broadford Plant's water supply is not susceptible to nitrate, however, at this time Broadford Lake is indirectly susceptible to phosphorus over-enrichment (contamination) related problems, such as algae blooms, taste and odor problems, and increased THM precursors. Maryland's Water Quality Improvement Act of 1998 (WQIA) requires that comprehensive and enforceable nutrient management plans be developed, approved, and implemented for all agricultural land throughout Maryland by 2004. In the future the implementation of these plans hopefully will reduce the amount of nutrients entering the lake, and reduce or reverse the effect of over-enrichment on lake water quality.

The Bradley Run Plant (Youghiogheny River) has had 13 nitrate detections from 1993-2000. These concentrations have ranged from 0.011 to 1.5 mg/l, and have a mean detection concentration of 0.7 mg/l. The highest observed value, 1.5 mg/l taken in February 2000, is the only "raw" water sample. These values are well below the MCL of 10.0 mg/l. Nutrient data from the MD DNR CORE station showed that concentrations of nitrate(+nitrite) were below the MCL, at an average concentration of 0.838 mg/l (data from 1991-1996). The maximum observed concentration was 2.0 mg/l. Total Nitrogen averaged 1.34 mg/l with a maximum concentration of 3.7 mg/l. Sources of nitrates in the Youghiogheny River watershed include the 19,300 acres of agricultural land (crops and pasture), residential septic systems, wastewater treatment discharge, atmospheric deposition, and wildlife. Cherry Creek, entirely within Maryland, is a likely a major source of nutrients to the Youghiogheny River. Over half of this sub-watershed's land is used for agriculture (5700 acres of cropland, 580 acres of pasture – MOP 1997 Land Use Data). The EPA took nitrate samples near the mouth of Cherry Creek in 1986 (see Figure 7). These concentrations ranged from 3.31 mg/l to 4.48 mg/l, the highest levels seen in the data reviewed by MDE (STORET DATA), but still less than half of the regulated MCL. With over 850 acres of land in the Maryland Agricultural Land Trust, coupled with little change in land use from 1990 to 1997, nutrient input from Cherry Creek will not likely increase in the future. As for the basin as a whole, increased residential development and wastewater discharges could increase the potential of nitrate contamination. Agricultural land would not be expected to change much in the near future. Garrett County's agricultural census showed little change in the number of farms and the amount of land farmed from the 1990 to 1997 census. At this time the Youghiogheny River intake is not susceptible to nitrate contamination.

The Town of Oakland received a waiver for nitrite testing after sampling results from 1993, 1995, 1996, and 1997 indicated that levels at both plants were below (at least half of) the MCL of 1.0 mg/l. See the WATER QUALITY REVIEW for the nitrite data. Nitrite and nitrate have the same potential sources of contamination. Nitrite is not a threat to contaminate the Youghiogheny River intake, and is not considered a threat to the water supply at the Broadford Plan, but may contribute to the over-enrichment of nutrients in lake and resulting eutrophic conditions.

Trace Metals

Regulated heavy metals are tested annually in the finished water produced at both of Okaland's water treatment plants, and since the early 1990's there have only been 4 detections. Barium, a relatively common heavy metal was detected twice, once at Broadford and once at the Bradley Run Plant. Both of these detections were significantly lower than the MCL and 50% trigger (refer to Table 8). Barium is most likely to be naturally occurring and does not pose a risk to either water source. Chromium and Nickel were both detected once, in a single 1996 sample, at the Broadford Lake Plant. The concentrations of these two samples were also significantly lower than the MCL and the 50% trigger. These two metals are most likely to be naturally occurring, and without any known significant sources in the watershed, do not pose a risk to the lake.

Laurel Run, which has been impacted by acid mine drainage, had elevated levels of aluminum, iron, and manganese in a 1996 sample included in the Youghiogheny River watershed assessment. The concentrations of iron (21 mg/l), manganese (1.5 mg/l), and aluminum (8.9 mg/l), were significantly higher than the national secondary drinking water regulations (non-enforceable guidelines that regulate contaminants that may cause cosmetic effects). Because of abandoned mine drainage found in Laurel Run, other trace metals may be present in the ambient water and/or sediment. If present in the upper watershed, heavy metals are not making it downstream to the intake in significant concentrations (according to Bradley Run annual data). Heavy metal contamination due to mining impacts in Laurel Run are not likely to threaten the

Youghiogheny River intake at this time, but more water quality testing and reclamation of abandoned mine land may still be needed.

Iron samples are taken a few times per month from the raw water at the Bradley Plant. Review of this data shows that concentrations of iron in the water commonly exceed the secondary drinking water standard of 0.3 mg/l. Iron is not tested in Broadford Lake, but levels may increase in the summer months when anoxic conditions in the bottom of the reservoir lead to conditions where elements are released from the bottom sediment. Iron is a common element in western Maryland waters, and high concentrations can be associated with aesthetic and nuisance effects such as taste and odor problems and fixture staining, but they are not necessarily public health concerns.

Radionuclides
Radionuclides have been detected once in the Broadford Lake supply, but the sample was well below 50% of the MCL. Gross Beta was 2 pC/l (MCL = 50 pC/l). Gross Alpha and Beta are tested once every four years at both water plants. No anthropogenic and/or significant natural sources are present in either of Oakland's source watersheds.

Other Inorganic Compounds
No sources of cyanide, asbestos, or fluoride were found within either source watershed. Fluoride samples from plant data are well below the primary drinking water standard of 2 mg/l. Fluoride found in the raw water supply is most likely from natural deposits. Both intakes are not susceptible to these contaminants.

Volatile Organic Compounds

The Town of Oakland is required to test finished drinking water from both plants annually for the presence of volatile organic compounds. Since 1990, 11 samples have been taken between both plants, and 5 samples have had detections, however there have been no detections since 1994. Carbon tetrachloride, the most common VOC detect, is a clear heavy organic liquid that evaporates from surface water but may leach into groundwater. All detections of carbon tetrachloride were below 50% of the MCL. The only compound detected within 50% of a MCL was Methylene Chloride, also know as Dichloromethane, which was detected at the Bradley Run Plant in February 1991. Methylene Chloride's greatest use is as a paint remover, but is also used as a chemical process solvent, grain fumigator, and as a laboratory solvent. There are several other uses, and it can also form as the result of chlorinating water, similar to a Trihalomethane. The chemical primarily degrades through evaporation, and when released into surface waters it is non-detectable 3-15 miles from its source. Also, the compound is completely biodegradable under most wastewater treatment conditions, and does not significantly bind to sediment. In light of these factors the source of this contaminant (for that one sample) was most likely the reaction of the raw water from the river with chlorine during the disinfection treatment process, or a laboratory error. With the lack of any detections since 1994 (for methylene chloride or any other regulated VOC) and with the absence of any significant potential sources, the Youghiogheny River and Broadford Lake intake are not susceptible to regular VOC contamination at this time. The only threat of potential VOC contamination would come from a spill. In Broadford Lake this is along Oakland- Deer Park Rd., which actually crosses the western finger (mouth of the unnamed tributary) of the reservoir on a man-made embankment. The regularity of hazardous material passing on this bridge is probably low, but the location of this bridge directly "on" the lake is a concern if a substantial spill should occur. At the Youghiogheny River intake, the old Baltimore & Ohio tracks, operated by CXS, pass extremely close to the intake. Regular transportation of hazardous material is likely, because these tracks are the main rail route between Maryland and points west. The tracks are adjacent to the Youghiogheny River for two miles above the intake and at a higher elevation. At the intake location, the tracks are clearly visible above an embankment. A hazardous spill along this stretch of the river could have a serious impact on the Town of Oakland's Youghiogheny River water supply.

Trihalomethanes (THMs) result from the reaction of naturally occurring organic matter with chlorine during the water treatment process. Currently, the EPA sets a MCL of 100µg/l (ppb) for Total THMs, but this level is scheduled to change in 2001 and 2003. The new MCL for systems serving 10,000 persons or less is 80µg/l (ppb) starting in 2003. This rule will apply to the Town of Oakland. Past THM samples were taken at the point of entry (water plant) to the water distribution system. The new MCL requires samples to be taken in the distribution system, so accurate comparisons of the old data and the new MCL cannot be made. In fact, concentrations may be higher in the distribution system because of longer contact time. The most common THMs detected at the Oakland water plants are chloroform and bromodichloromethane. Table 20 is a summary of THM detections at each Oakland plant:

Table-20. Total THM Summary

Plant	Contaminant	Years	Detections	Avg. Concentration (ppb)	Max. Concentration (ppb)
Broadford WTP	Total THMs	1990-2000	13	47.4	100.4
Bradley Run WTP	Total THMs	1990-2000	12	67.4	137.7

The average Total THM concentration at the Bradley Run plant is within 50% of the current MCL, and the average at the Broadford Plant is very close to MCL. Some major factors that may contribute to the formation of THMs at both of Oakland's water plants are discussed in the following paragraphs.

THM precursors, or disinfection byproduct precursors, tend to originate from terrestrial and aquatic vegetation (Cooke, 1989). The heavily forested watershed of the Youghiogheny River can contribute organic matter to the river and increase potential THM precursors. Also, agricultural land can be a major contributor to organic matter loading (Cooke, 1989). The amount of organic matter traveling downstream is probably high due to the nature of the watershed. Total Organic Carbon has averaged 2.86 mg/l for the period of 1991-1996, with a maximum concentration of 8.7 mg/l, from monthly samples at the MD DNR station just below the intake. Total suspended solids concentrations averaged 11.5 mg/L. When compared to data from similar streams in western Maryland, TOC (2.3-8.5 mg/l - range) and TSS (6.0-18.4 mg/l - range) averages are not significantly different. It appears the Youghiogheny River does not have a unique environmental situation that may be contributing to elevated levels of THMs in finished drinking water.

The watershed of Broadford Lake contributes organic matter directly into the reservoir, but in-lake processes also contribute to disinfection byproduct precursors in the lake. Algae, macrophytes (aquatic plants), animals, and sediments are all sources of dissolved and particulate organic matter and are therefore possible sources of THM precursors. Broadford Lake is classified as meso-eutrophic (MDE-303b List, 2000). Eutrophic, or biologically productive lakes, usually have greater quantities of precursor molecules in the water column (Clarke, 1989). The two highest detections of THMs at Broadford Lake occurred in the summer (June), when biological production in the lake is probably increased.

Also, the process of pre-chlorination at both the Broadford Plant and Bradley Run Plant may contribute to the formation of THMs. Conventional treatment may remove some of the organic material before chlorination, which is often the final step in conventional drinking water treatment. Bradley Run adds chlorine gas directly into the raw water pipe as it enters the plant, and at Broadford, sodium hypochlorite is added into the flash mixer. Post-chlorination is also performed at each plant.

Under the new THM regulations, Oakland will be required to monitor its distribution system for compliance with the Total THMs standard. Results of this testing will determine the need for further evaluation of the THM levels.

Synthetic Organic Compounds

Town of Oakland has had 19 SOC detections, in seven samples out of nineteen since 1994. Most of these detections have been at the Broadford Lake Plant, but concentrations, at either plant, were all significantly lower than the MCL regulation and 50% trigger. The most common compound found, Di(ethyhexyl)phthalate (DEHP) is a resin commonly found in plastics. Its prevalence in plastics makes it a hard substance to sample and test. Because this compound appeared in all laboratory blanks when detected, the reported quantities are not likely reflective of levels in the environment, but rather laboratory artifacts. Dalapon is a herbicide commonly used on right-of-ways and transportation corridors. Detects of dalapon, all four at Broadford, have been well below the MCL of 200ppb, and the 50% trigger. The only other compounds detected at either plant were hexochlorobenzene, hexachlorocyclopentadiene, and atrazine. Atrazine is a commonly used herbicide that is applied to corn and soybean fields. It is a fairly persistent compound and is often found in groundwater adjacent to row crop areas. Atrazine was the second most frequently detected pesticide in EPA's National Survey of Pesticides in Drinking Water Wells. Both hexochlorobenzene and hexachlorocyclopentadiene are rare compounds used in the production of other chemicals or are left over as byproducts of manufacturing processes. At this time the Town of Oakland's two intakes are not susceptible to SOC contamination. The only threat of SOC contamination at either intake would be from a spill. See above VOC section for spill contamination rationale.

Table 21. Susceptibility Analysis Summary - Youghiogheny River Intake

Contaminant	*Water Quality* (50% MCL Exceeded?)	*Potential Sources*	*Natural Attenuation in Watershed*	*Evaluation of Change to Natural Conditions*	*Intake Integrity*	*Currently Susceptible?*
Volatile Organic	Y	Spills	Y	P	N	N
Synthetic Organic	N	Agriculture	Y	P	N	N
Heavy Metals	N	Natural Deposits, Mining	Y	P	N	N
Nitrate/Nitrite	N	Agriculture/Septic/WWTP	Y	P	N	N
Fluoride	N	Natural Deposits	NA	P	N	N
Cyanide	N	None	Y	P	N	N
Asbestos	N	None	NA	P	N	N
Radionuclides	N	None	Y	P	N	N
Total/Fecal Coliform	Y	Land Use/Septics/WWTP	N	P	N	Y
Protozoa	I	Land Use/Septics/WWTP	N	P	N	Y
Viruses	I	Land Use/Septics/WWTP	N	P	N	Y
THMs	Y	Organic Material	N	P	N	N
Turbidity	Y	Erosion	N	P	N	Y

KEY:

Water Quality:
Y = Yes, data shows that a sample was greater than 50% of the MCL
N = No sample data was found above 50% of the MCL
I = Insufficient data

Potential Sources
(List of Sources, point and non-point)

Natural Attenuation in Watershed
Y = Highly probable that contaminant type is attenuated under natural conditions in the watershed
N = Contaminant is not attenuated naturally in the watershed
U = Unknown

Evaluation of Change to Natural Conditions
N = Future changes in the natural conditions of the watershed will likely increase the susceptibility of this intake to the contaminant type
P = Future changes in the natural conditions of the watershed are **not** likely to increase the susceptibility of this intake to the contaminant type

Intake Integrity
Y = Intake is vulnerable, or adds to the susceptibility of contaminant type
N = Intake does not contribute to vulnerability of contaminant type

Currently Susceptible
Y = Yes
N = No

Table 22. Susceptibility Analysis Summary - Broadford Lake

Contaminant	***Water Quality*** (50% MCL Exceeded?)	***Potential Sources***	***Natural Attenuation in Watershed***	***Evaluation of Change to Natural Conditions***	***Intake Integrity***	***Currently Susceptible?***
Volatile Organic	N	Spills	Y	P	N	N
Synthetic Organic	N	Agriculture	Y	P	N	N
Heavy Metals	N	Natural Deposits, Mining	Y	P	N	N
Nitrate/Nitrite	N	Agriculture, Septic	N	P	N	N
Fluoride	N	Natural Deposits	NA	P	N	N
Cyanide	N	None	Y	P	N	N
Asbestos	N	None	NA	P	N	N
Radionuclides	N	None	Y	P	N	N
Total/Fecal Coliform	Y	Land Use/Septics/Recreation	U	P	N	N
Protozoa	I	Land Use/Septics	U	P	N	N
Viruses	I	Land Use/Septics	U	P	N	N
THMs	Y	Organic Material	N	P	N	N
Turbidity	Y	Erosion	Y	P	N	N

KEY:

Water Quality:
Y = Yes, data shows that a sample was greater than 50% of the MCL
N = No sample data was found above 50% of the MCL
I = Insufficient data

Potential Sources
(List of Sources, point and non-point)

Natural Attenuation in Watershed
Y = Highly probable that contaminant type is attenuated under natural conditions in the watershed
N = Contaminant is not attenuated naturally in the watershed
U = Unknown

Evaluation of Change to Natural Conditions
N = Future changes in the natural conditions of the watershed will likely increase the susceptibility of this intake to the contaminant type
P = Future changes in the natural conditions of the watershed are **not** likely to increase the susceptibility of this intake to the contaminant type

Intake Integrity
Y = Intake is vulnerable, or adds to the susceptibility of contaminant type
N = Intake does not contribute to vulnerability of contaminant type

Currently Susceptible
Y = Yes
N = No

I. RECOMMENDATIONS FOR SOURCE WATER PROTECTION PLAN

With the information contained in this report, the Town of Oakland and other partners can take several steps to invest in efforts to protect their water supplies. A source water protection plan for Broadford Lake and the Youghiogheny River intake is the underlying goal of this assessment. Specific management recommendations for consideration are listed below:

Form a Local Watershed Planning Team

- In order to protect the interests of the Town's water supply, a watershed group should be formed. For Broadford Lake, the group could include town officials, citizens, Garrett County Planning officials, members from the Garrett County Sanitary District, the Garrett County Soil Conservation District office, and MDE. For the Youghiogheny Watershed this group would have to be expanded to include officials from Preston County, WVA, local WVA soil conservation district officers, the Town of Terra Alata, WVA, the Town of Crellin, MD, and appropriate personnel from the West Virginia Department of Environmental Protection.
- Goals of this group should include: increased citizen involvement in protecting the watersheds, a tool for keeping up to date on changes in the watershed, and to promote watershed protection and possibly recreational opportunities.

Public Awareness and Outreach

- Future Consumer Confidence Reports need to provide a summary of this report and indicate that the entire report is available to the general public through their library, contacting the town office, or by contacting the Water Supply Program at MDE.
- Road signs explaining to the public that they are entering a protected drinking watershed is an effective way of keeping the relationship of land use and water quality in the public eye, and help in the event of a spill notification and response.
- In order to facilitate the notification of potentially damaging spills, signs should be erected on major roads entering the Broadford Lake watershed, possibly erecting signs on Oakland-Deer Park Road and Spring Glade Road.
- Discuss with officials of CSX Transportation the occurrence, notification, and mitigation of potential spills near the intake along the Youghiogheny River.
- Include interested members of the public on the watershed planning team.

Monitoring

- Continue to monitor for fecal coliform and/or E. coli in the reservoir after the two-year MDE sponsored monitoring program is over.
- Continue to monitor for all Safe Drinking Water Act contaminants as required by MDE, including raw reservoir sampling when feasible.
- Create a baseline of water quality in Broadford Lake in order to track future changes and impacts. Regular monitoring of reservoir parameters such as dissolved oxygen, chlorophyll a, and secchi depth could provide information on changing conditions in the upper watershed.

- Discuss with MDE's TMDL Program future monitoring related to the TMDL and Maryland's Watershed Cycling Strategy.

Land Acquisition and Easements

- The availability of loans for purchase of land or easements for the purpose of protecting water supplies is available from MDE. Loans are offered at zero percent interest and zero points.
- Look into the availability of grants or loans and cooperation with conservation organizations to establish buffers along Broadford Lake streams or in sensitive areas such as the wetlands near the unnamed tributary.
- Ensure that easements between the Youghiogheny River and the railroad tracks remain forested.
- Work with the MD Department of Agriculture to promote agricultural preservation districts and easements through the Maryland Land Agricultural Preservation Fund in the Cherry Creek subwatershed (and other farmland within Maryland) with the local Soil Conservation Service and local farmers.

Contaminant Source Inventory Updates

- The Town of Oakland, and/or the new watershed group, should periodically conduct detailed field surveys of each watershed to ensure there are no new potential sources of contamination.
- Update MDE on potential land use changes that may increase the susceptibility of the reservoir to contaminants.
- Determine if Alpine Lake and Terra Alta (WWTPs) have or are planning to fix the infiltration/inflow problems at the sewage treatment plants in the Snowy Creek subwatershed.

Future Planning

- Meet with the Garrett County Office of Planning to discuss future land use changes and regulations within the Broadford Lake watershed.
- Ensure that the land around Broadford Lake, including the recreation area, remains Town property.
- Maryland's Unified Watershed Assessment, required under the EPA's Clean Water Action Plan of 1998, identified Broadford Lake as a Category I watershed. (All Category I watersheds corresponded to Maryland's 303(d) List). The State has given a high priority for funding assessment and restoration activities in this category of watersheds. The future Watershed Group should look into potential funding for these activities at Broadford Lake.

REFERENCES

Cooke, Dennis G. and Robert E. Carlson, 1989. Reservoir Management for Water Quality and THM Precursor Control. American Water Works Research Foundation, 387p.

MD Department of the Environment, 1999. Comprehensive Performance Evaluation of the Town of Oakland Water Treatment Plant, Oakland – Garrett County, Maryland. Water Supply Program, 33p.

MD Department of the Environment, 1999. Maryland's Source Water Assessment Plan. Water Supply Program, 36p.

MD Department of the Environment, 1999. Total Maximum Daily Loads of Phosphorous to Broadford Lake, Garrett County, MD. Technical and Regulatory Services Administration, 16p.

MD Department of Natural Resources, 2000. 2000 Maryland Section 305(b) Water Quality Report. Resource Assessment Service, 244p.

US Department of Agriculture, 1999. 1997 Census of Agriculture, Maryland State and County Data. National Agricultural Statistics Service, 367p.

West Virginia Department of Environmental Protection, 1998. An Ecological Assessment of the Youghiogheny River Watershed within West Virginia – 1996. Watershed Assessment Program, 55p.

Other Sources of Information

- MDE Water Supply Inspection Reports
- MDE Water Supply reader file for the Town of Oakland (PDWIS ID 0110008)
- MDE Water Supply Program Oracle Database (PDWIS)
- Town of Oakland Monthly Operating Reports (MORs) and Self-Monitoring Reports
- MD Department of Natural Resources Digital Orthophoto Quads for Garrett County
- Digital USGS Topographic 7.5 Minute Quadrangles, SureMaps Raster.
- Maryland Office of Planning 1997 and 1990 Garrett County Land Use data
- Maryland Office of Planning 1999 Property View Tax Map, Garrett County.
- Water Quality data from EPA's STORET database clearinghouse
- MD DNR Resource Assessment water quality data
- WVA spatial data from West Virginia Department of Environmental Protection
- EPA Chemical Fact Sheets, http://www.epa.gov/safewater/mcl.html
- MD Bureau of Mines, Abandoned Mine Land Report and associated data

APPENDIX A

Figure A-2. Broadford Lake Land Use Map

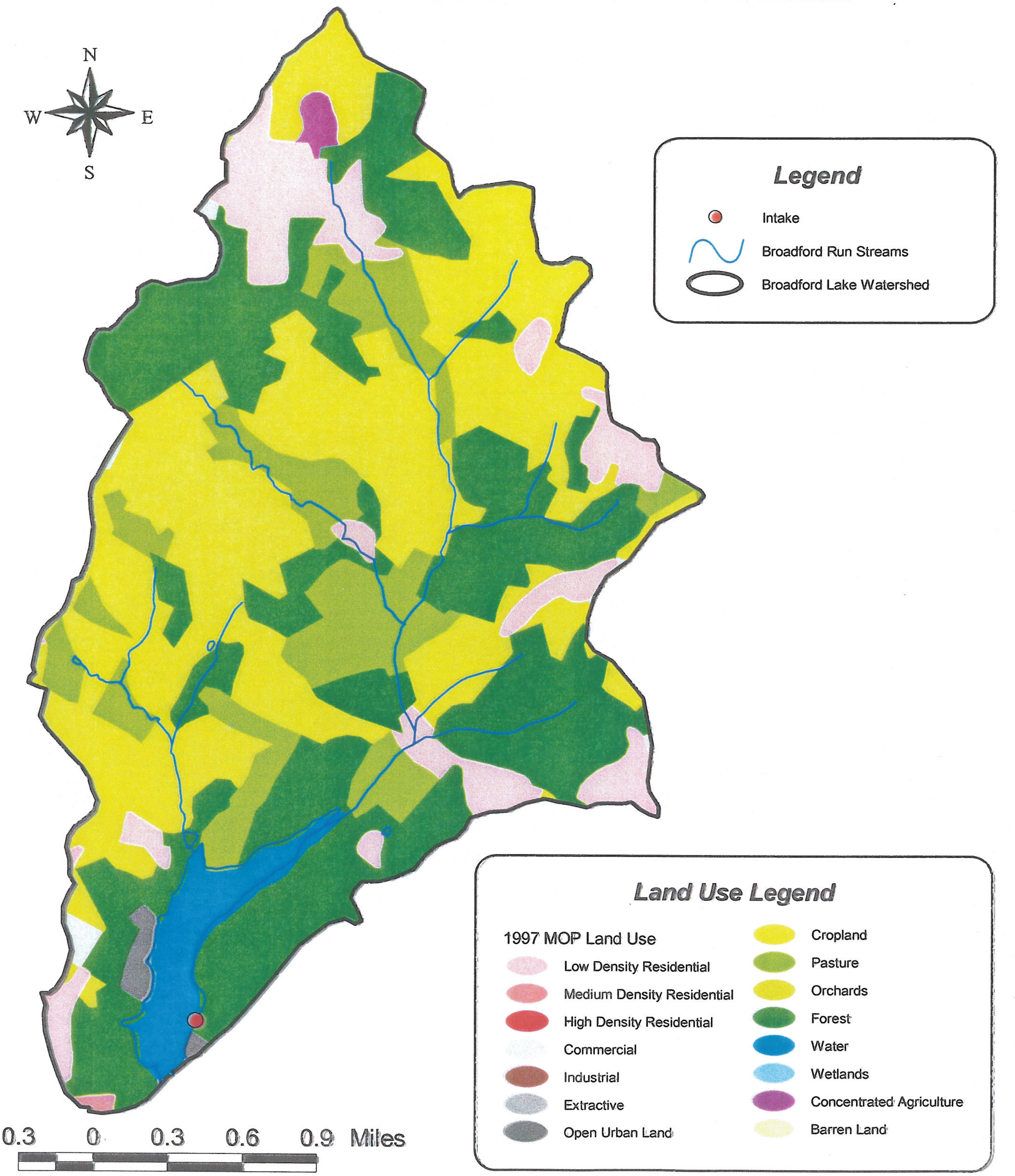


Figure A-3. Broadford Lake Topography and Major Roads

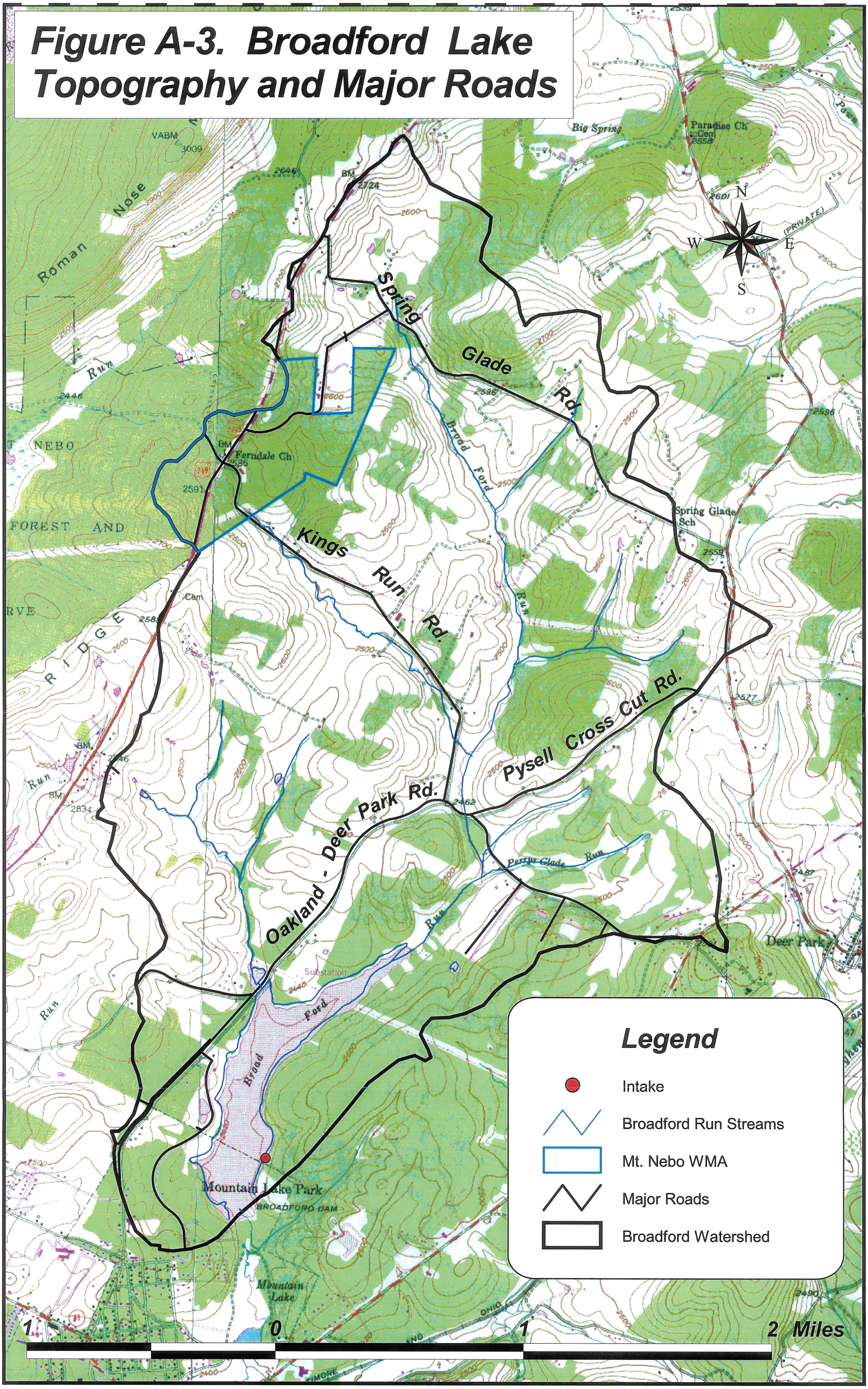


Figure A-4. Youghiogheny River Source Water Protection Area

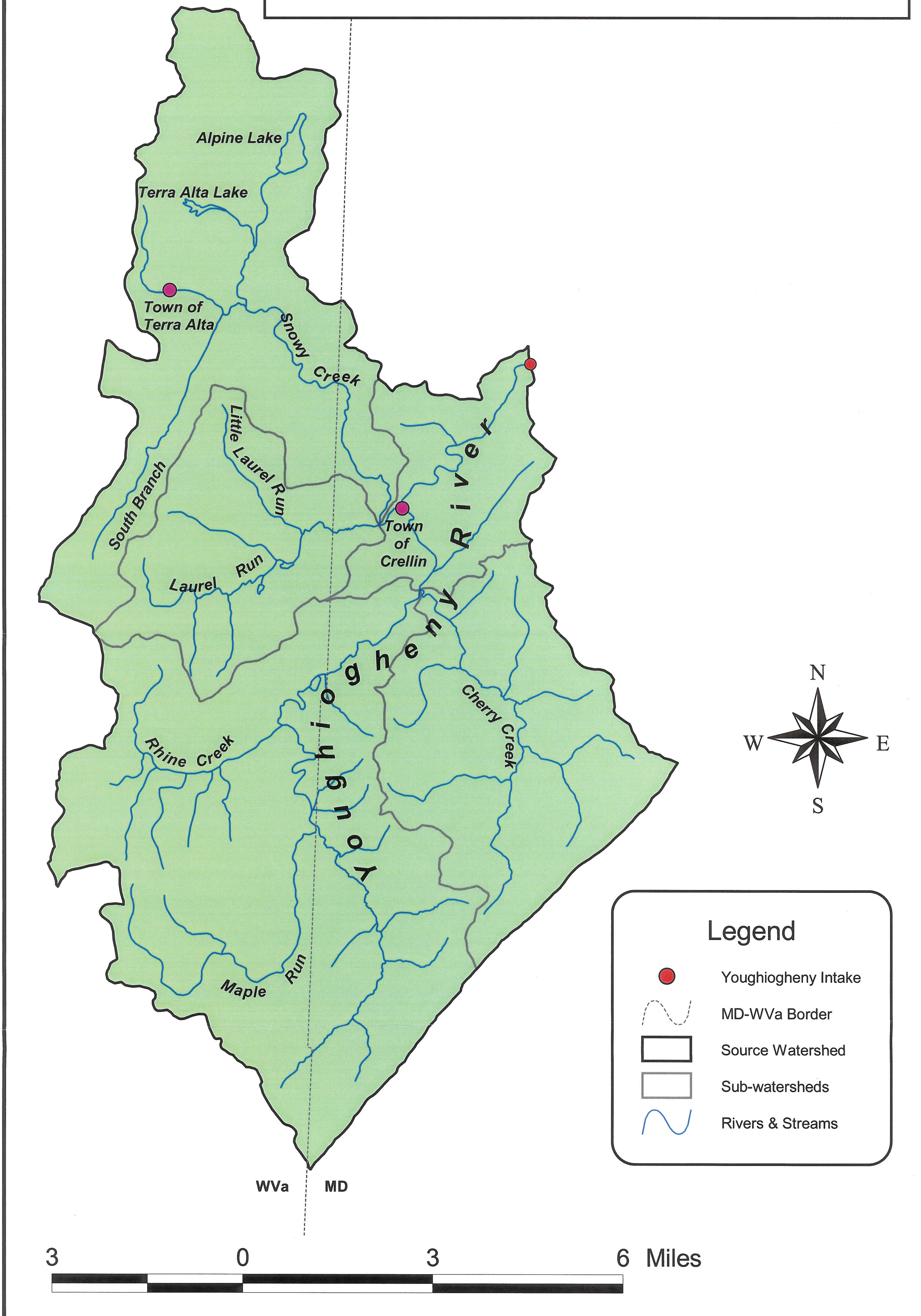


Figure A-5. Youghiogheny River Intake Land Use Map

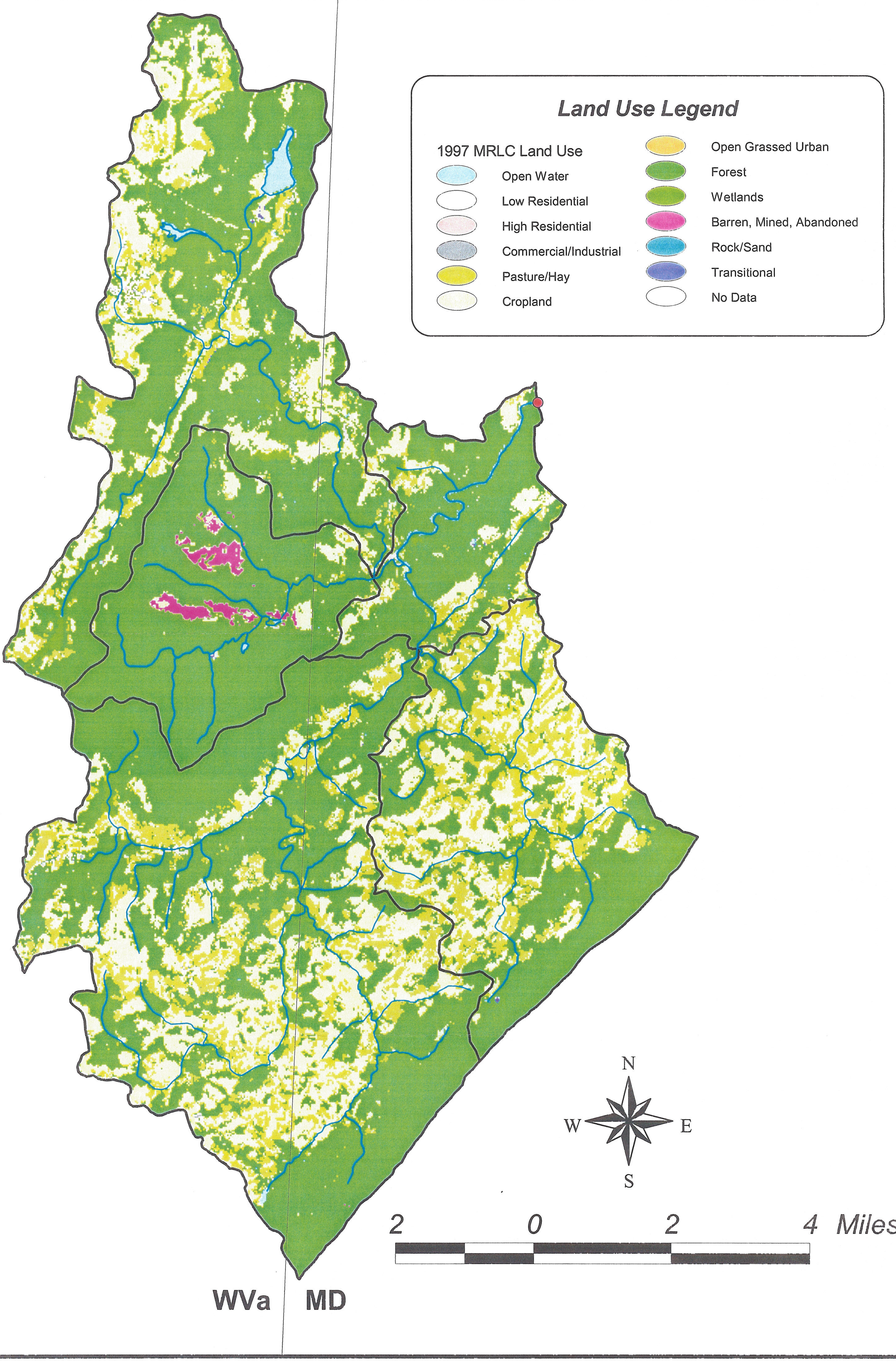
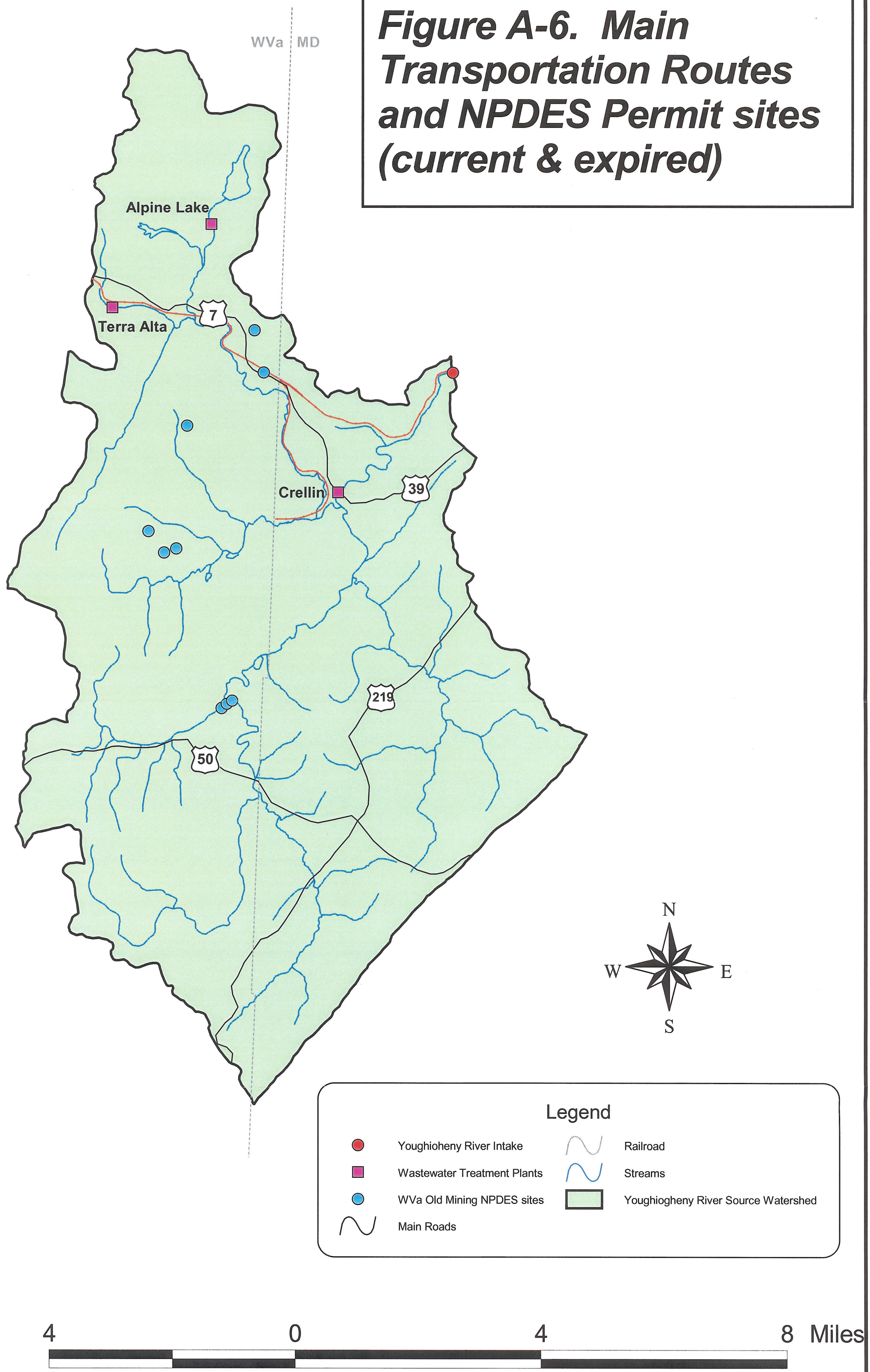


Figure A-6. Main Transportation Routes and NPDES Permit sites (current & expired)



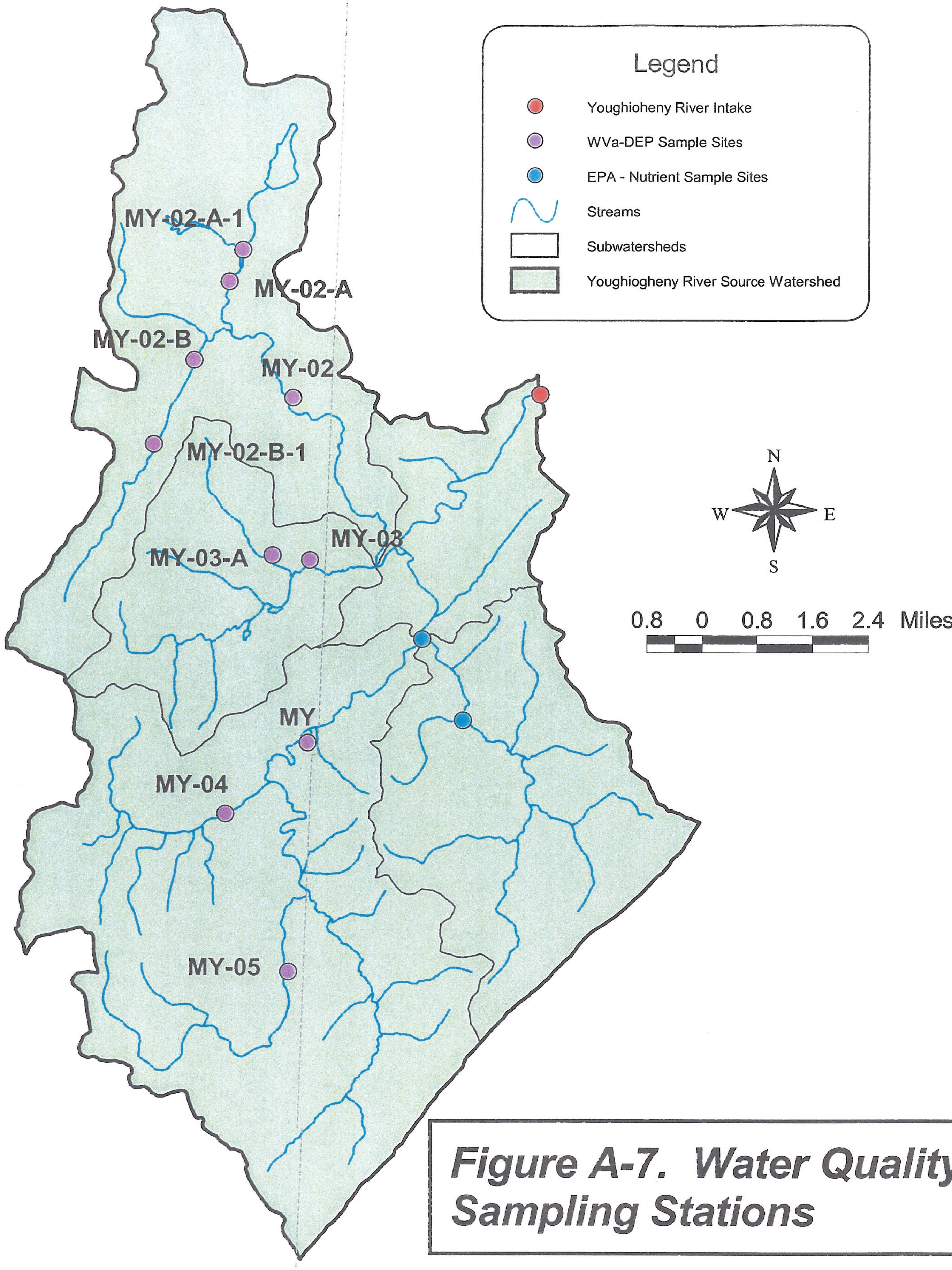
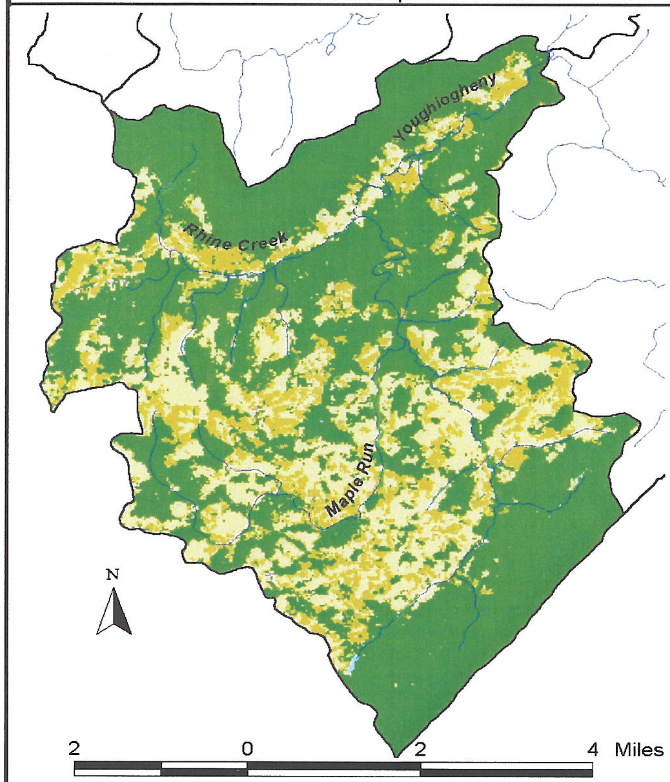


Figure A-7. Water Quality Sampling Stations

APPENDIX B

UPPER YOUGHIOGHENY RIVER

Total Area = **35.3** square miles



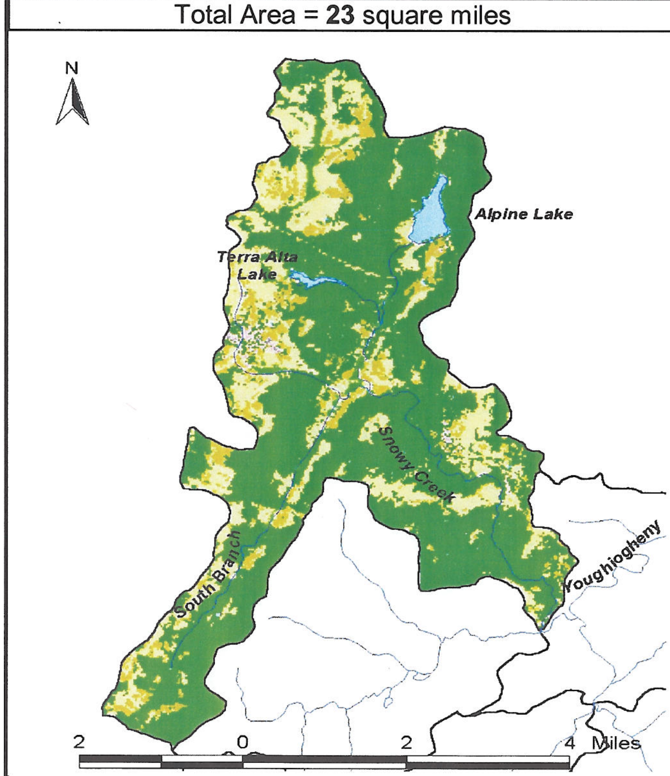
Land Use	Total Acres	% Watershed
Open Water	21.8	0.1
Residential	48.0	0.2
Commercial/Industrial	3.8	<0.1
Pasture/Hay	3002.2	13.4
Cropland	5349.8	23.9
Forested	13799.7	61.8
Wetlands	111.4	0.5
Mined or Abandoned	0.6	<0.1
Total	22337.3	100.0

This is the largest subwatershed in the source water protection area and has the second highest percentage of agricultural land in the basin. Most of this farmland is located in the Maple Run valley. Maple Run and Rhine Creek were tested for fecal coliform by the WVADEP, and exhibited the highest levels in the entire Youghiogheny basin (WVA portion). Sources may include two small communities and several cattle farms within the Rhine Creek Valley. In Maple Run valley, residences near the village of Elgon did not have appropriate sewage disposal systems according to a 1996 report*. Also, there were two dairy farms in the vicinity.

Rhine Creek water quality is generally considered good, and the WVDNR stocks the creek with brown trout. In the past, there was a quarry mine along Maple Run which was issued multiple NPDES permits, but these are no longer active. Also, there are three active natural gas wells near the village of Horshoe Run. Cathedral State Park, a 132 acre park of old growth forest, is located within this basin. Silver Lake, a small private reservoir, lends its name to a small community located near the head of the Youghiogheny River.

SNOWY CREEK

Total Area = **23** square miles



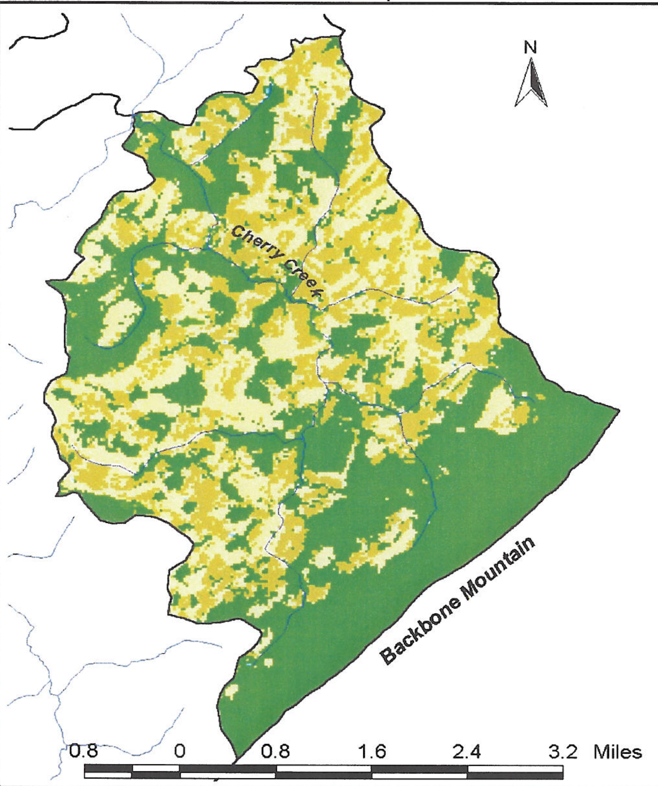
Land Use	Total Acres	% Watershed
Open Water	205.8	1.4
Residential	153.8	1.1
Commercial/Industrial	6.4	<0.1
Pasture/Hay	1057.9	7.3
Cropland	3224.7	22.2
Forested	9700.1	66.7
Wetlands	195.2	1.3
Mined or Abandoned	0.3	<0.1
Total	14544.2	100.0

Snowy Creek is the second largest subwatershed in the basin. The South Branch and North Branch-Wardell Run combine to form Snowy Creek, which empties into the Youghiogheny River below Laurel Run. For the purpose of this SWAP and the land use above, Snowy Creek is analyzed above its confluence with Laurel Run. The subwatershed is mostly forested (67%), but does have substantial agricultural land (30%). Terra Alta, population 2000, is the largest town in the WVA portion of the intake's basin*. It is located southwest of Terra Alta Lake. This lake, and Alpine Lake are both privately owned recreational lakes. The communities of Terra Alta and Alpine Lake both have wastewater treatment facilities which discharge into this subwatershed. The South Branch has had relatively high levels of fecal coliform in the past, most likely due to livestock excrement*. Two coal mines operated in this subwatershed, but the permits expired in 1993 & 1997. The Baltimore & Ohio railroad tracks (3) pass through Snowy Creek.

CHERRY CREEK

Total Area = **16.5** square miles

Land Use	Total Acres	% Watershed
Open Water	9.0	0.1
Residential	7.0	0.1
Pasture/Hay	2379.5	22.7
Cropland	2960.6	28.3
Forested	5070.7	48.5
Wetlands	37.1	0.4
Total	10464.0	100.0

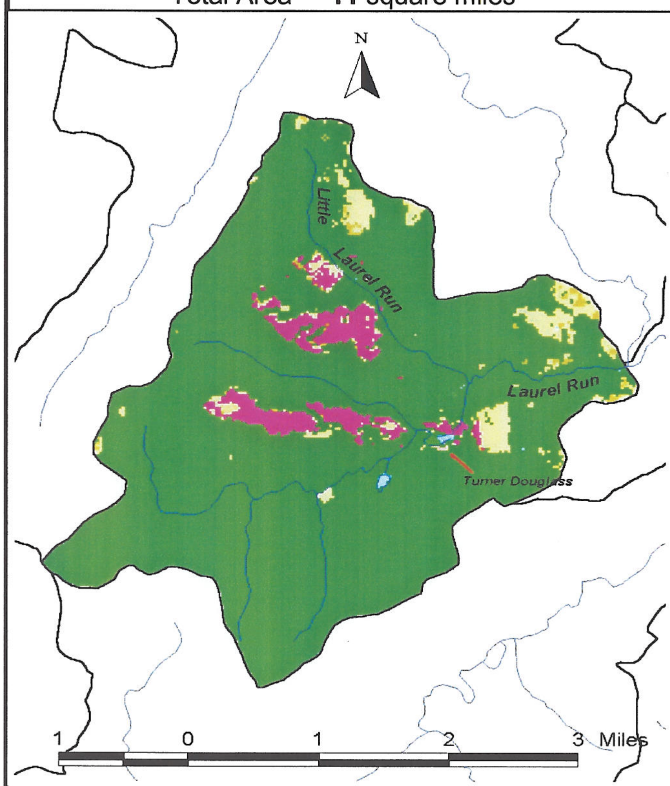


The Cherry Creek subwatershed is located entirely within Maryland. The third largest subwatershed, Cherry Creek has the highest comparable percentage of agricultural land use in the basin (51%). According to 1997 Maryland Office of Planning land use data, this percentage is even higher (56%). Most of the cropland is located in an area known as Pleasant Valley. The EPA took several water samples from Cherry Creek in 1986 and found elevated levels of nitrates (ranging from 3.31 - 4.48 mg/L)**. According to MD Department of Natural Resources data, approximately 850 acres of land in this basin is included in the Maryland Agricultural Land Trust.
Most of the forested land in the subwatershed is concentrated along the northwest slope of Backbone Mountain. An area known as Allegany Heights (elevation - 3200 ft msl) makes up the southeastern corner of this basin. MD Route 219, from Oakland, is the main transportation route through this subwatershed.

LAUREL RUN

Total Area = **11** square miles

Land Use	Total Acres	% Watershed
Open Water	10.9	0.2
Residential	5.1	0.1
Commercial/Industrial	0.6	<0.1
Pasture/Hay	41.6	0.6
Cropland	307.8	4.4
Forested	6240.0	89.9
Wetlands	5.8	0.1
Mined or Abandoned	327.7	4.7
Total	6939.5	100.0

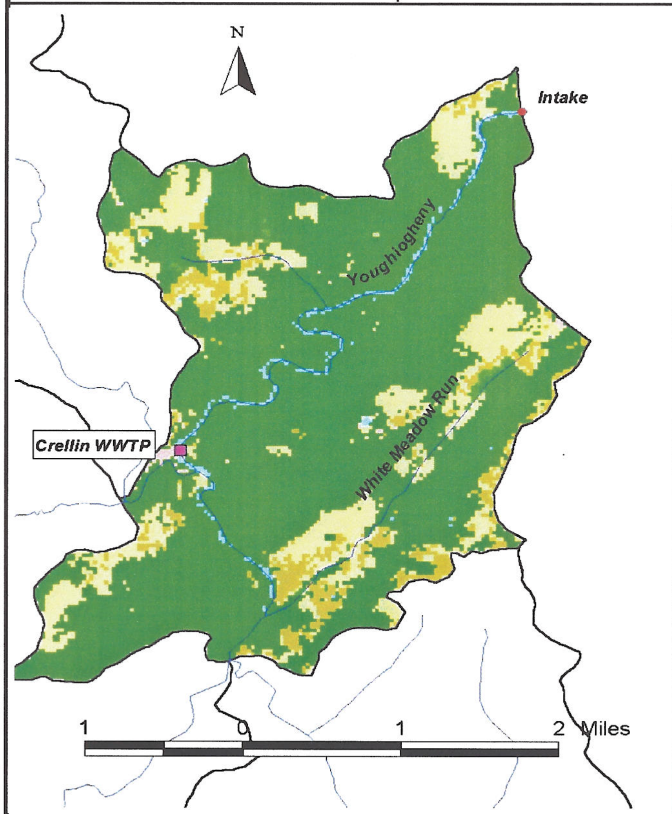


Ninety-two percent of the Laurel Run subwatershed is located within West Virginia. Laurel Run combines with Snowy Creek approximately 0.6 miles above the Youghiogheny River. The subwatershed is heavily forested (90%) and has the least amount of land used in agriculture in the whole basin. However, Laurel Run is the only subwatershed that has any substantial mining impacts. WVDEP reported in 1996 the presence of a massive gob pile (mine refuse) at an old mine complex, referred to as Turner Douglas on topographic maps, approximately 1 mile upstream from the MD State line. There have been several surface coal mines in this basin. These coal seams and associated overburden material have been known to cause acid mine drainage*. WVDEP tested Laurel Run in 1996 and concentrations of aluminum, iron, and manganese were above WVA water quality criteria. The pH of the stream was 3.47, well below the recommended limit of 6.0. Also, no benthic organisms were collected at this site during sampling by the WVDEP. A 1998 study confirmed that Little Laurel Run has also been impacted by acid mine drainage.

LOWER YOUGHIOGHENY (NEAR INTAKE)

Total Acres = **7.4** square miles

Land Use	Total Acres	% Watershed
Open Water	73.0	1.6
Residential	16.6	0.4
Pasture/Hay	258.6	5.5
Cropland	727.7	15.5
Forested	3600.0	76.6
Wetlands	21.1	0.4
	4697.0	100.0



The Lower Youghiogheny subwatershed includes a small portion of Snowy Creek, below Laurel Run, White Meadow Run, and the last few miles of the Youghiogheny above the Oakland intake. Like Cherry Creek this subwatershed is entirely within Maryland.

It is mostly forested (77%), but does have some agricultural land use (986 acres), located mostly in the White Meadow Run valley.

Maryland Office of Planning 1997 land use data is comparable to the MRLC data in this basin, but differences include residential land use (10%) and one surface mine area. Analysis of aerial photographs show that this area is most likely a reclaimed surface mine at the present time. The Town of Crellin, population approximately 300), is the only substantial municipality in the subwatershed. The Town has a municipal NPDES permit and discharges sewage effluent from its WWTP directly into the Youghiogheny River, approximately 4 miles upstream of the intake.

Three Baltimore & Ohio railroad tracks pass through the subwatershed. These tracks are adjacent to the main stem Youghiogheny for several miles above the Oakland intake.

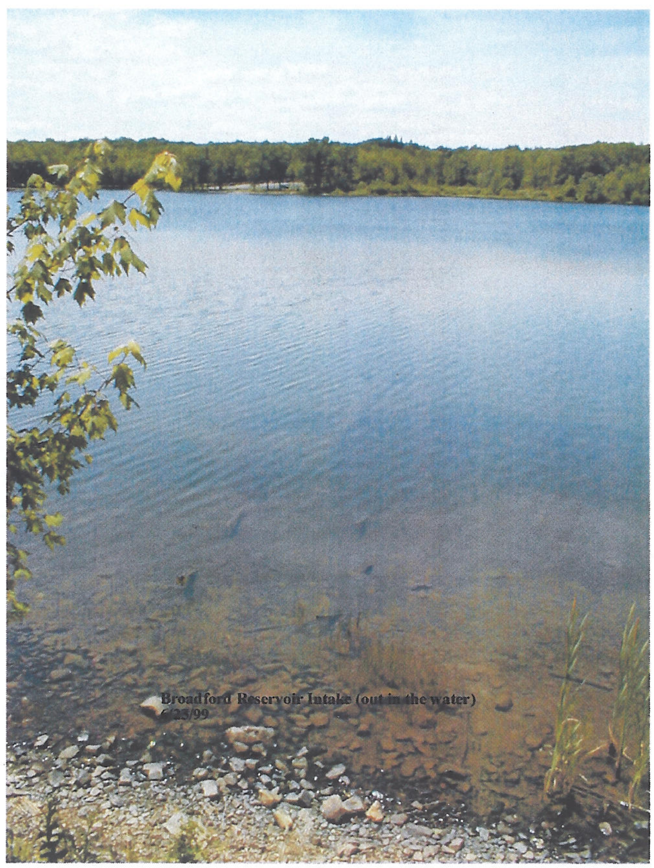
* Taken from: An Ecological Assessment of the Youghiogheny River Watershed within West Virginia - 1996

** STORET Data, EPA 1986.

APPENDIX C

Appendix – Photos.

Broadford Reservoir (from Dam)
6/23/99



Broadford Reservoir Intake (out in the water)
6/23/99

View of Broadford Lake
In the general direction of Intake