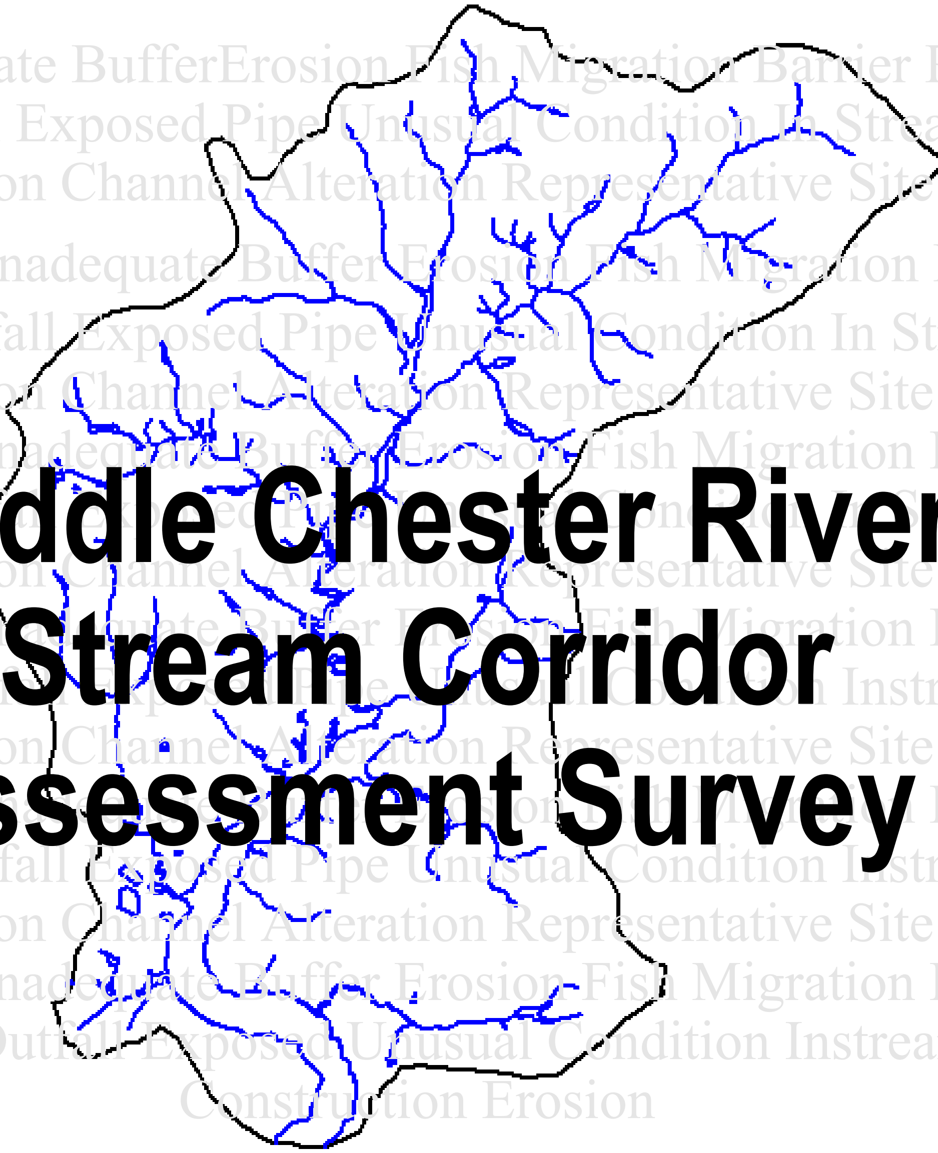
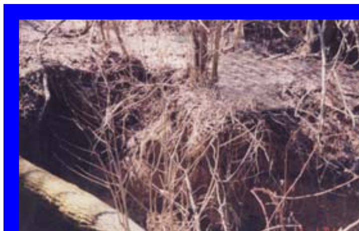
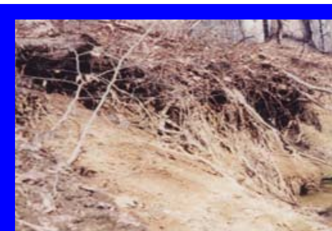


Middle Chester River Stream Corridor Assessment Survey

Watershed Restoration Division
Chesapeake & Coastal Watershed Services
Maryland Department of Natural Resources
April 2002



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MIDDLE CHESTER STREAM CORRIDOR ASSESSMENT SURVEY

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PREPARED BY

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CHESAPEAKE AND COASTAL WATERSHED SERVICES
MARYLAND DEPARTMENT OF NATURAL RESOURCES
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SUMMARY

The Middle Chester River watershed encompasses over 37,000 acres and includes land in both Kent and Queen Anne's Counties. In 1998, the Maryland Clean Water Action Plan identified the Middle Chester River as one of the State's water bodies that did not meet water quality requirements. In response to this finding, the Maryland Department of Natural Resources and the Kent County formed a partnership to do a Stream Corridor Assessment (SCA) survey of the Kent County portion of the Middle Chester River Watershed. The Kent County portion of the watershed covers 29,000 acres and lies within the Coastal Plain of Maryland.

In 2001 a Stream Corridor Assessment of the Middle Chester stream network was performed. This survey is not intended to be a detailed scientific evaluation of the watershed. Instead, the Middle Chester SCA survey was designed to provide a rapid overview of the entire stream network to determine where potential environmental problems are located and to collect some basic information about the stream. Results for this survey will be combined with other information on the Middle Chester Watershed to develop a Watershed Restoration Action Strategy.

Over 60 miles of stream in the Middle Chester Watershed were surveyed. There were 42 potential environmental problems were identified. The most common environmental concern seen during the SCA survey was fish migration blockages, which were reported at 24 sites. Other potential environmental problems recorded during the survey include: 6 bank erosion sites, 5 sites with inadequately vegetated stream buffers, 3 unusual condition sites, 3 pipe outfalls sites, and one trash dumping site.

At each site, data was collected about each problem, its location noted, and photographs taken to document existing conditions. To aid in prioritizing future restoration work, field crews rated all problem sites on a scale of 1 to 5 in three categories. They were: 1) the severity of the problem; 2) how correctable the specific problem was; and 3) how accessible the site was. In addition, field teams also collected information on both in and near stream habitat condition at 15 representative sites that were spaced at approximately ½ to 1 mile intervals along the stream.

This SCA survey has been developed by the Maryland Department of Natural Resources (DNR) Watershed Restoration Division as a watershed management tool. One of the main goals of the SCA survey is to compile a list of observable environmental problems so that future restoration efforts can be better targeted. It is important to note that all the problems identified can be addressed through existing State or Local government programs. The value of the present survey is that it can help to place the problems in a watershed context, and can be used by a variety of resource managers to plan future restoration work. Results from the present survey are being combined with other information about the area to develop a Watershed Restoration Action Strategy (WRAS) for the Kent County portion of the Middle Chester River Watershed.

ACKNOWLEDGEMENTS

Without the hard work and dedication of the Elk Neck Crew of the Maryland Conservation Corps, this survey would not have been possible. The crew chief during the survey was Margit Pruett. The crewmembers were Justin Wilson and Damion Krylow.

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INTRODUCTION

In 1998, Maryland's Clean Water Action Plan identified bodies of water that failed to meet water quality related requirements. One of the water bodies identified in the report was the Middle Chester River. The Middle Chester River Watershed is the center section of the Chester River, which is a tributary to the Chesapeake Bay. A map showing the location of the Middle Chester River Watershed is presented in Figure 1. The watershed encompasses over 37,000 acres and includes land in Kent County (29,000 acres) and in Queen Anne's County (7,800 acres). In response to the findings of the Maryland Clean Water Action Plan, the Maryland Department of Natural Resources has formed a partnership with Kent County to work together to assess and improve environmental conditions in the Middle Chester Watershed. The main goals of this partnership are to develop and implement a Watershed Restoration Action Strategy (WRAS) for the Kent County portion of the Middle Chester Watershed. The Kent County portion of the watershed encompasses 78% of the total watershed area.

The first step in developing a Restoration Action Strategy for the Middle Chester Watershed is to do an overall assessment of the condition of the watershed and the streams within it. This initial step is being accomplished using two approaches. First, a watershed characterization is being done that compiles and analyzes existing water quality, land use, and living resources data about the Middle Chester Watershed (Shanks, 2001). While the watershed characterization provides good overall information on environmental conditions within the Middle Chester Watershed, for the most part, information on the location of specific environmental problems is limited. To provide specific information on the location of environmental problems and restoration opportunities, a Stream Corridor Assessment (SCA) survey of the Kent County portion of the Middle Chester River Watershed was also done.

The Stream Corridor Assessment survey is a new survey that has been developed by DNR's Watershed Restoration Division as a watershed management tool to identify environmental problems and helps prioritize restoration opportunities on a watershed basis. As part of the survey, specially trained personnel walk the watershed's entire stream network and record information on a variety of environmental problems that can be easily observed within the stream corridor**.** Initial field surveys were done from January 2001 through July 2001. Because of problems accessing some areas do to very marshy ground within the stream corridor, an aerial survey was also done for the area was done in August, 2001. Sites found during the flight are given a plane symbol in Figure 4.

The Kent County portion of the Middle Chester River Watershed encompasses approximately 29,000 acres (45 square miles) and lies entirely within Maryland's Coastal Plain. There are over 60 miles of stream within the watershed. The Chester River Watershed is among some of the most productive agricultural land in Maryland and approximately 76% of the land in the watershed is in agricultural use. Forest and wetlands are present on approximately 15 % of the land. These areas tend to be present predominantly along the stream corridors. Chestertown is also present in the Middle Chester River Watershed and urban land is estimated make up 8% of the land use. A digital orthophoto map of the Middle Chester River Watershed is shown in

Figure 2. Figure 3 shows the same watershed boundaries superimposed on a seven and ½ minute USGS topographic quadrangle map.

As mentioned earlier the Maryland Department of Natural Resources is working with Kent County to develop a Watershed Restoration Action Strategy (WRAS) of the Middle Chester River Watershed. As part of this process, data collected during the SCA survey will be used to help define present environmental conditions, as well as possible restoration opportunities in the watershed. This information combined with the watershed characterization and other local knowledge of the watershed, will be used to develop and Action Strategy for the Kent County portion of the Middle Chester River Watershed. The Watershed Restoration Action Strategy in turn, will help guide future restoration efforts with the ultimate goals of restoring the areas natural resources and meeting State water quality standards.

Middle Chester Watershed
Kent and Queen Anne County, Maryland

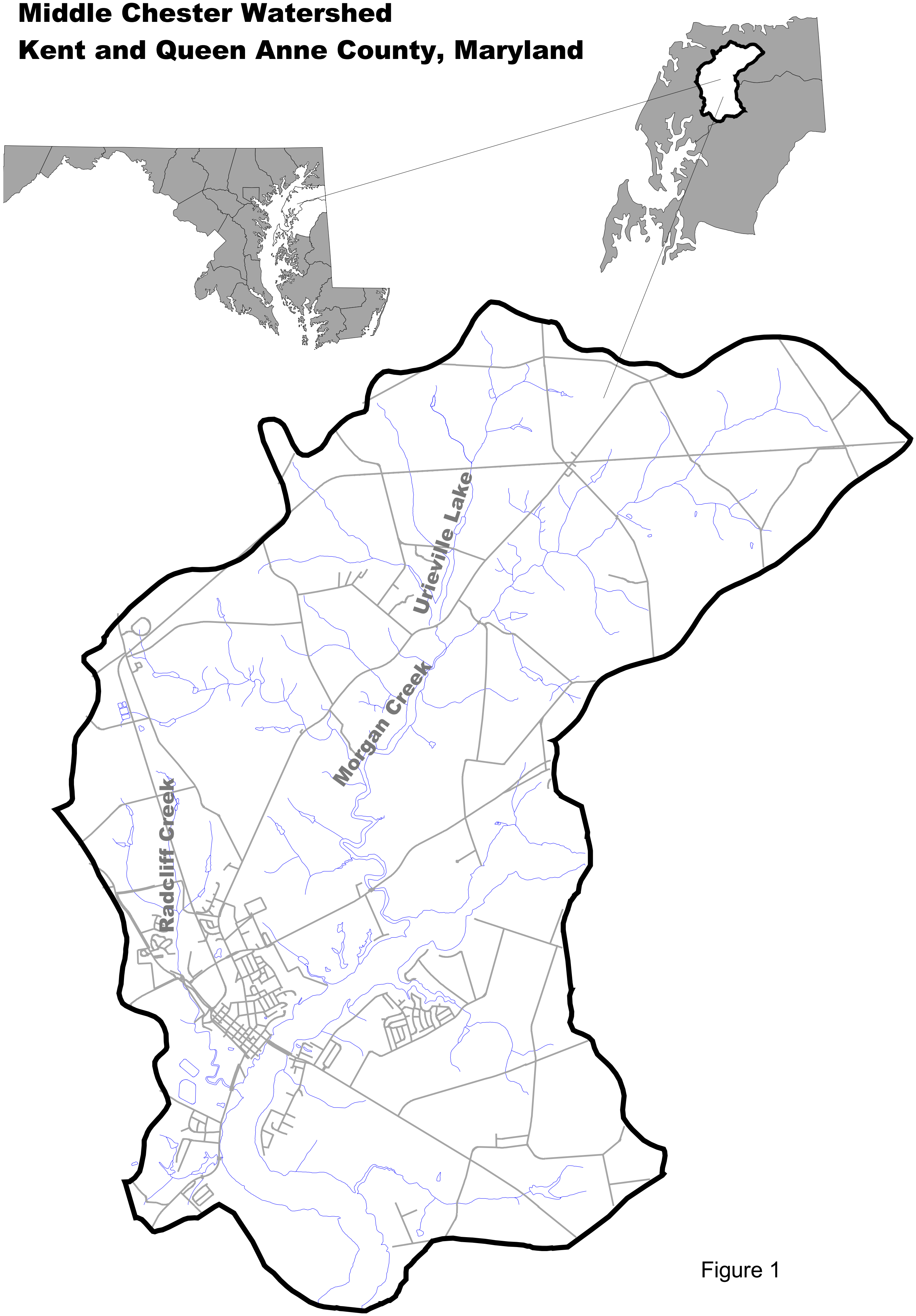

Figure 1

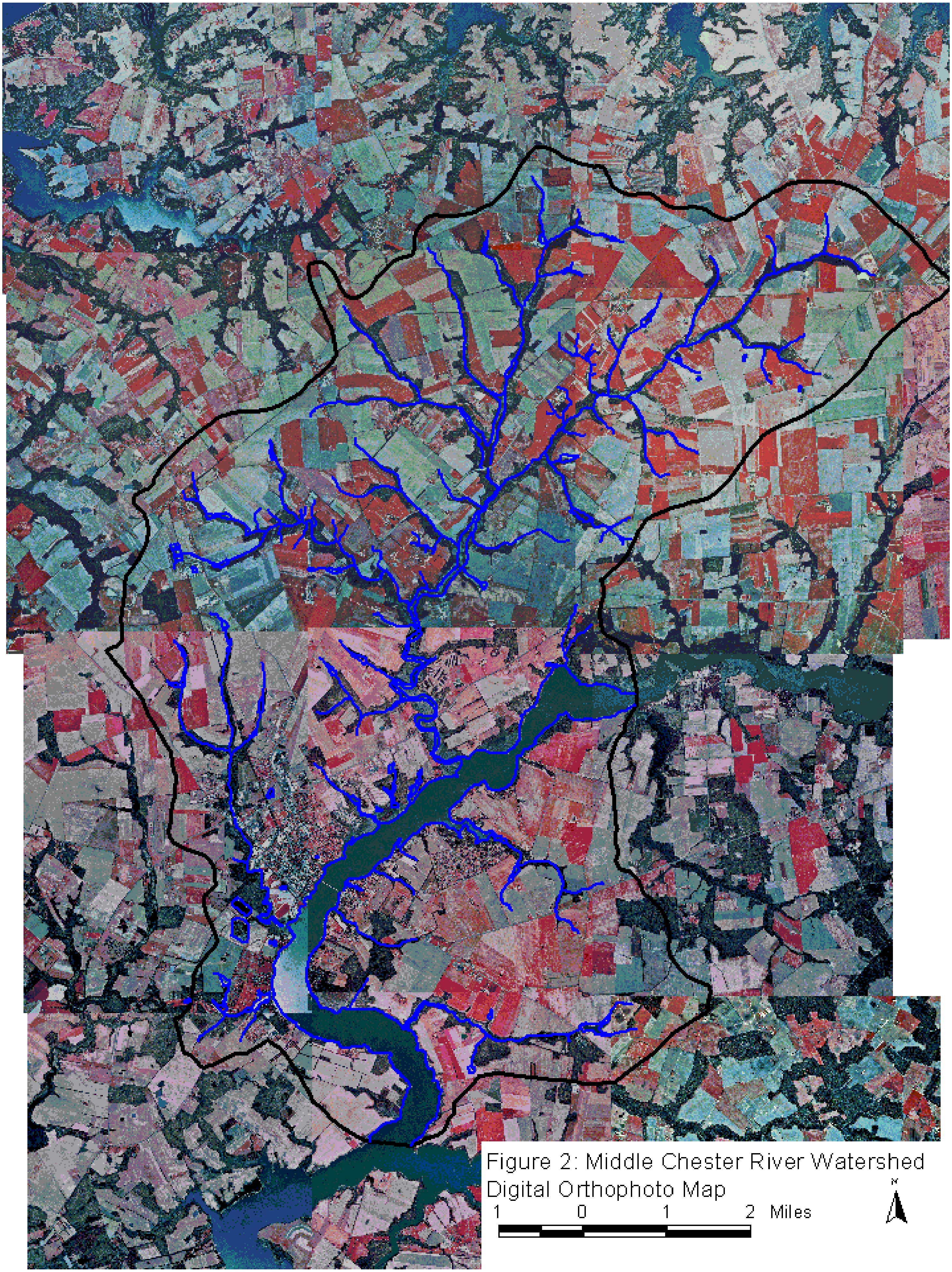

Figure 2: Middle Chester River Watershed
Digital Orthophoto Map

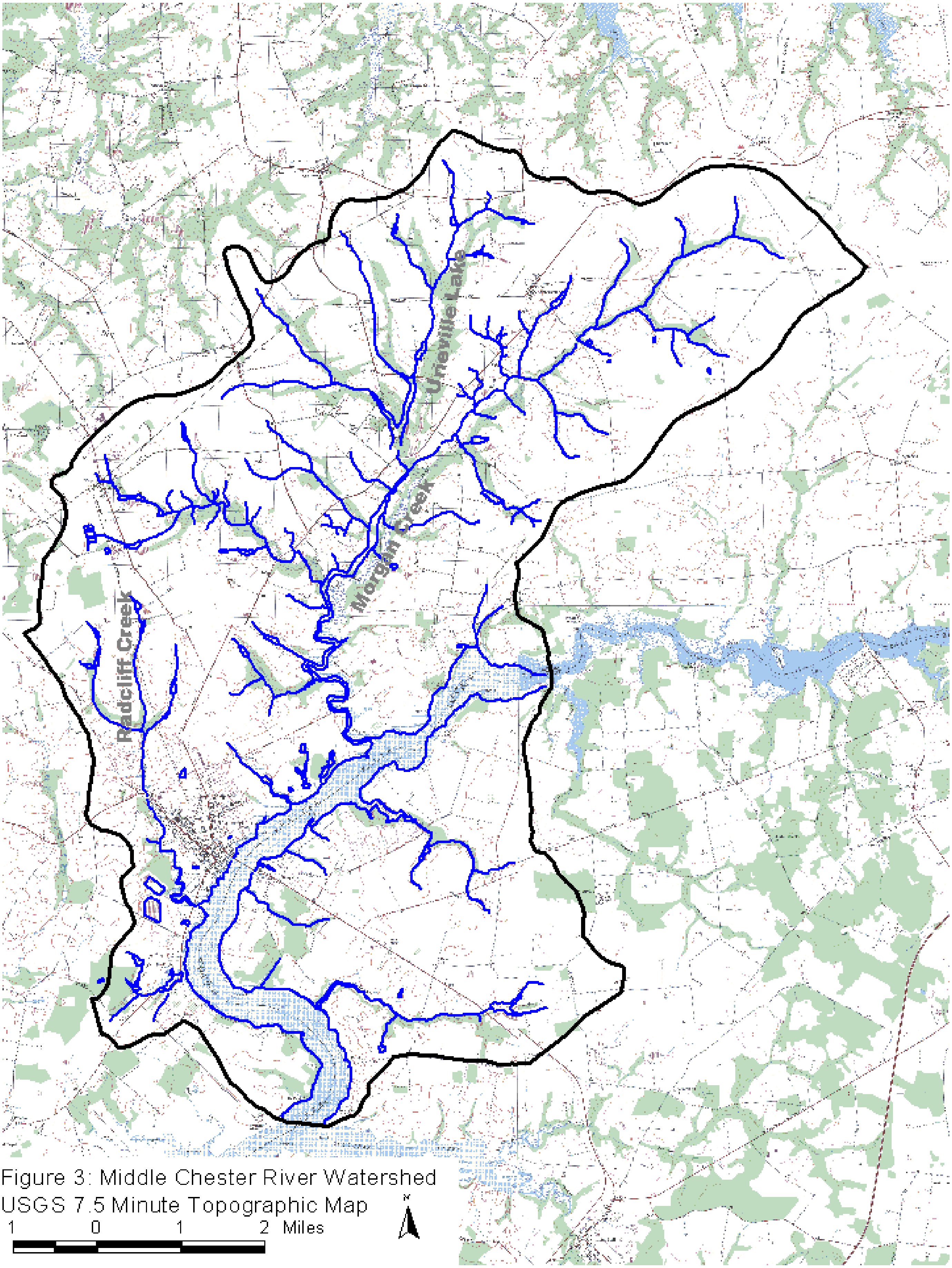

Figure 3: Middle Chester River Watershed
USGS 7.5 Minute Topographic Map

Middle Chester

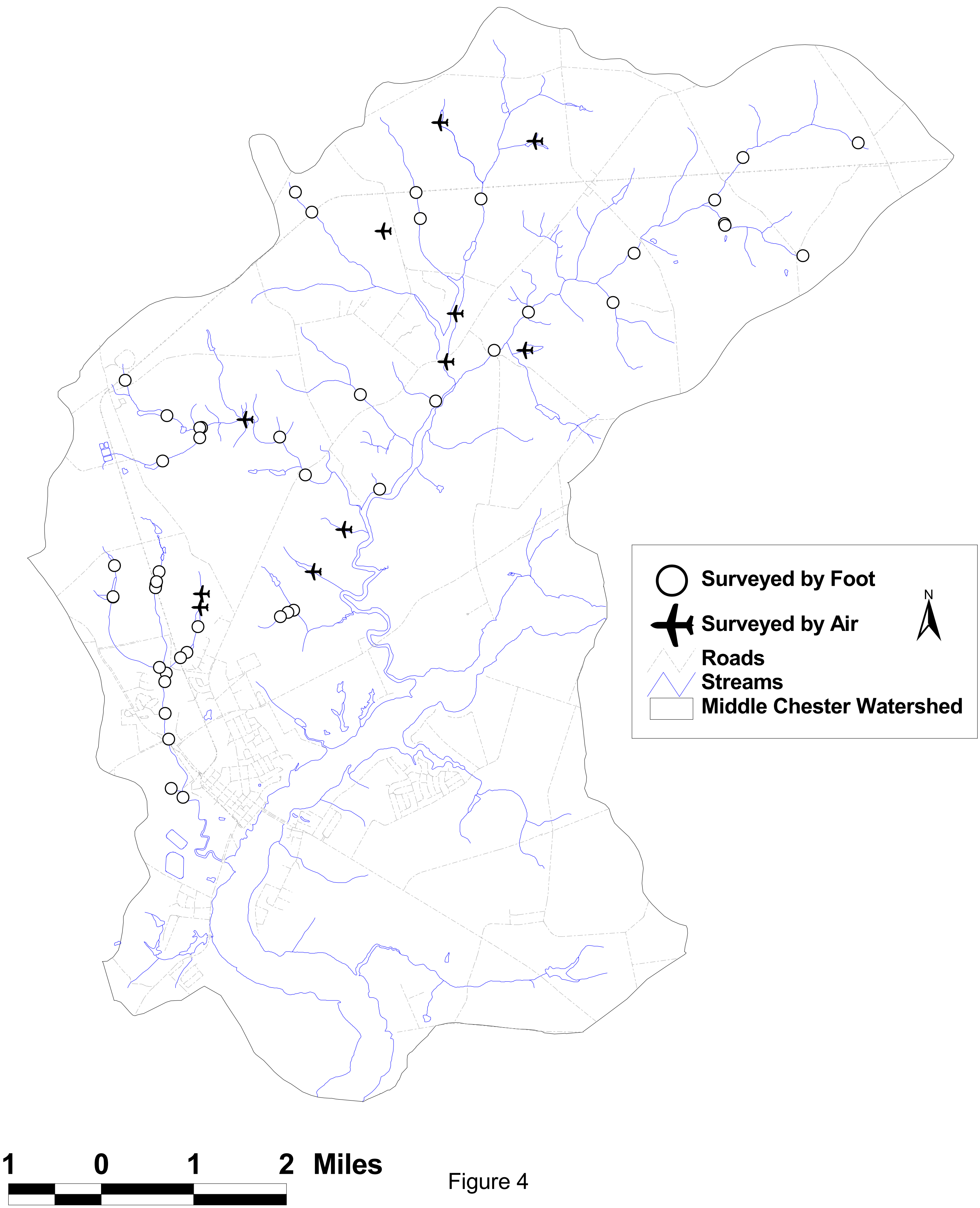

Figure 4

METHODS

To help identify some of the common problems that affect streams in a rapid and cost effective manner, the Watershed Restoration Division of the Maryland Department of Natural Resource has been working for the last several years to develop the Stream Corridor Assessment (SCA) survey. The four main objectives of the survey are:

1. To provide a list of observable environmental problems present within a stream system and along its riparian corridor.

2. To provide sufficient information on each problem so that a preliminary determination of both the severity and correctability of a problem can be made.

3. To provide sufficient information so that restoration efforts can be prioritized.

4. To provide a quick assessment of both in- and near-stream habitat conditions so that comparative assessments can be made of the condition of different stream segments.

It is important to note that the SCA survey is not intended to be a detailed scientific survey, nor will it replace the more traditional chemical and biological surveys. Instead, the SCA survey provides a rapid method of examining an entire drainage network so that future monitoring, management and/or conservation efforts can be better targeted. One advantage of the SCA survey over chemical and biological surveys is that the SCA survey can be done on a watershed basis both quickly and at relatively low cost.

Maryland's SCA survey is really not a new concept but a refinement of an old approach, which in its simplest form is often referred to as a stream walk survey. Many of the common environmental problems affecting streams, such as excessive stream bank erosion or blockages to fish migration, are fairly easy to identify by an individual walking along a stream. Furthermore, an advanced degree in forestry is not needed to identify a stream segment that doesn't have any trees along its banks, nor does one need a degree in sanitary engineering to see that a sewage pipeline has been exposed by stream bank erosion and is leaking sewage into the stream. With a limited amount of training, most people can correctly identify these common environmental problems.

As mentioned earlier, a walking survey of stream systems is not a new concept and there have been several attempts to standardize this approach over the years. Many earlier approaches such as EPA's, "Streamwalk Manual" (EPA, 1992), Maryland Save our Stream's "Conducting a Stream Survey," (SOS, 1970) and Maryland Public Interest Research Foundation "Streamwalk Manual" (Hosmer, 1988) were designed to be done by citizen volunteers with little or no training. While these surveys can be a good guide for citizens that are interested in looking at their community streams, the data collected during these surveys can vary significantly based on the background of the surveyor. In the Maryland Save our Stream "Stream Survey," for example, citizen groups are given some guidance on how to organize a survey and are provided a slide show explaining how to do the survey. After approximately one hour of training, citizen volunteers are then sent out in groups to walk designated stream segments. During the survey, volunteers usually walk their assigned stream segment in a couple of hours and return their data sheets to the survey organizers to be analyzed. While these surveys can help make communities more aware of the problems present in their local stream, citizen groups normally do not have the expertise or resources to properly analyze or fully interpret the information collected. In addition, the data collected is usually only enough to indicate that a potential environmental problem exists at a specific location but does not provide sufficient information to judge the severity of the problem.

Other visual stream surveys, such as the National Resources Conservation Service's "Stream Visual Assessment Protocols" (NRCS, 1998), are designed to be done by trained professionals looking at a very specific stream reach, such as at a stream passing through an individual farmer's property. While this survey can provide useful information on a specific stream segment, it is usually not done on a watershed basis.

The Maryland SCA survey has been designed to bridge the gap between these two approaches. The survey is designed to be done by a small group of well-trained individuals that walk the entire stream network in a watershed. While the individuals doing the survey are usually not professional natural resource managers, they do receive several days of training in both stream ecology and SCA survey methods.

While almost any group of dedicated volunteers can be trained to do a SCA survey, the Maryland Conservation Corps (MCC) has proven to be an ideal group to do this work in Maryland. The Maryland Conservation Corps is part of the AmeriCorps Program, which was started to promote greater involvement of young volunteers in their communities and the environment. The MCC program is managed by DNR's Forest and Park Service. Volunteers with the MCC are 17-25 years old and can have educational backgrounds ranging from high school to graduate degrees. With the proper training and supervision, these young, intelligent and motivated volunteers are able to significantly contribute to the State's efforts to inventory and evaluate water quality and habitat problems from a watershed perspective. For more information on the Maryland Conservation Corps call their main office in Annapolis at (410) 260-8166 or visit their web site at: www.dnr.state.md.us/mcc.

Prior to the start of the Middle Chester SCA Survey, the members of the MCC's Elk Neck Crew received a week of training. As part of this training, crewmembers learn how to identify common problems observable within the stream corridor, how to record problem locations on survey maps and how to fill out data sheets for specific problem. Procedures for documenting general stream conditions at reference sites were also reviewed during training. Reference sites are located at approximately 1/2-mile intervals along the stream. In addition to filling out a half page data sheet, field crews took photographs at all problem and reference sites to help document existing conditions. Detail information on the procedures used in the Maryland SCA survey can be found in, "Stream Corridor Assessment Survey – Survey Protocols" (Yetman, 2001). A copy of the survey protocols can found on DNR's web site at http://www.dnr.state.md.us/streams/pubs/other.html . Copies of the protocols can also be obtained by contacting the Watershed Restoration Division of the Maryland Department of

Natural Resources in Annapolis, MD.

Several weeks prior to the beginning of the survey, letters were sent out to individual that own land along the stream. The letter was used to inform property owners that the survey was being done and gave them a phone number to call if they did not want MCC crews surveying the stream on their property. In addition, survey crews were instructed not to cross fence lines or enter any areas that are marked “No Trespassing” unless they have specific permission from the property owner.

Field surveys of the Middle Chester River Watershed began in November 2001, and over the next several months, the survey teams walked much of the area’s drainage network collecting information on potential environmental problems. Potential environmental problems commonly identified during the SCA Survey include: channelized stream sections, inadequate stream buffers, fish migration blockages, excessive bank erosion, near stream construction, trash dumping sites, unusual conditions, and pipe outfalls. In addition, the survey records information on the location of potential wetlands creation sites and collects data on the general condition of in-stream and riparian habitats.

It is not unusual for an SCA survey to identify large number of problems in each problem category. For example, in an earlier survey of the Swan Creek Watershed in Harford County, a total of 453 potential environmental problems were identified along 96 miles of stream. The most frequently reported problem during the survey was stream bank erosion, which was reported at 179 different locations (Yetman et. al., 1996). Follow up surveys found that while stream bank erosion was a common problem throughout the watershed, the severity of the erosion problem varied substantially among the sites and that the erosion problems at many sites were fairly minor. Based on this experience the SCA survey has field crews evaluate and score all problems on a scale of 1 to 5 in three separate areas: problem severity, correctability, and accessibility. A major part of the crews training is devoted to how to properly rate the different problems identified during the survey.

While the ratings are subjective, they have proven to be very valuable in providing a starting point for more detailed follow-up evaluations. This is because in many cases, resource professionals such as fisheries biologists, foresters, hydrologists and engineers do not have the time to walk hundreds of miles of streams to determine where the problems are. What the SCA survey does is train the MCC and other groups to walk streams for them and collect some very basic information about commonly seen problems. Once the SCA survey has been completed, the data collected can then be used by different resource professionals to help target future restoration efforts. A regional forester for example can use data collected on inadequate stream buffers to help target future riparian buffer plantings, while the local fishery biologist can use the data on fish blockages to help target future fish passage projects to reestablish spawning runs. The inclusion of a rating system in the survey gives resource professional an idea of which sites the field crew believed were the most severe, easiest to correct and easiest to access. This information combined with photographs of the site can help resource managers focus their own follow up evaluations and fieldwork at the most important sites.

A general description of the rating system is given below. More specific information on the criteria used to rate each problem category is provided in the SCA – Survey Protocols (Yetman, 2000). It is important to note that the rating system is designed to contrast problems within a specific problem category. When assigning a severity rating to a site with an inadequate stream buffer for example, the rating is only intended to compare the site to other in the State with inadequate stream buffers. The rating is not intended to be applied across categories. A trash dumping site with a very severe rating may not necessarily be a more significant environmental problem than a stream bank erosion site that received a moderate severity rating.

The **problem severity** rating has generally been found to be the most useful rating and indicates how bad a specific problem is relative to others in the same problem category. The severity rating is used to answer questions such as, where are the worst stream bank erosion sites in the watershed, or where is the largest section of stream with an inadequate buffer. The scoring is based on the overall impression of the survey team of the severity of the problem at the time of the survey.

* A <u>very severe rating</u> of 1 is used to identify problems that have a direct and wide reaching impact on the stream's aquatic resources. Within a specific problem category, a very severe rating indicates that the problem is among the worst that the field teams have seen or would expect to see. Examples would include a discharge from a pipe that was discoloring the water over a long stream reach (greater than 1000 feet) or a long section of stream (greater than 1000 feet) with high raw vertical banks that appear to be unstable and eroding at a fast rate.

* A <u>moderate severity rating</u> of 3 is used to identify problems that appear to be having some adverse environmental impacts but the severity and/or length of stream affected is fairly limited. While a moderate severity rating would indicate that field crews did believe it was a significant problem, it also indicates that they have seen or would expect to see much worse problems in that specific problem category. Examples would include: a small fish blockage that was passable by strong swimming fish like trout, but a barrier to resident species such as sculpins; or a site where several hundred feet of stream had an inadequate forest buffer.

* A <u>minor severity rating</u> of 5 is given to problems that do not appear to be having a significant impact on stream and aquatic resources. A minor rating indicates that a problem was present but compared to other problems in the same category it would be considered minor. Examples would include: an outfall pipe from a storm water management structure that is not discharging during dry weather and does not have any erosion problem either at the outfall or immediately downstream, or a section of stream that has stable banks and some trees along both banks but the forest buffer is less than 50 feet.

The **correctability rating** provides a relative measure on how easily the field teams believe the problem can be corrected. The correctability rating can be helpful in determining which problems can be easily dealt with when developing a restoration plan for a drainage basin.

One restoration strategy would initially target the severest problems that are the easiest to fix. The correctability rating can also be useful in identifying simple projects that can be done by volunteers, as opposed to projects that require more significant planning and engineering efforts.

* A minor correctability rating of 1 is assigned to problems that can be corrected quickly and easily using hand labor, with a minimum amount of planning. These types of projects would usually not need any Federal, State or local government permits. It is a job that small group of volunteers (10 people or less) could fix in a day or two without using heavy equipment. Examples would be removing debris from a blocked culvert pipe, removing less than two pickup truck loads of trash from an easily accessible area or planting trees along a short stretch of stream.

* A moderate correctability rating of 3 is given to sites that may require a small piece of equipment, such as a backhoe, and some planning to correct the problem. This would not be the type of project that volunteers would usually do by themselves, although volunteers could assist in some aspects of the project, such as final landscaping. This type of project would usually require a week or more to complete. The project may require some local, State or Federal government notification or permits, however, environmental disturbance would be small and approval should be easy to obtain.

* A very difficult correctability rating of 5 is given to problems that would require a large expensive effort to correct. These projects would usually require heavy equipment, significant amount of funding ($100,000 or more), and construction could take a month or more. The amount of disturbance would be large and the project would need to obtain a variety of Federal, State and/or local permits. Examples would include a potential restoration area where the stream has deeply incised several feet over a long distance (i.e., several thousand feet) or a fish blockage at a large dam.

The **accessibility rating** is used to provide a relative measure of how difficult it is to reach a specific problem site. The rating is made at the site by the field survey team, using their field map and field observations. While factors such as land ownership and surrounding land use can enter into the field judgments of accessibility, the rating assumes that access to the site could be obtained if requested from the property owner.

* A very easy accessibility rating of 1 is assigned to sites that are readily accessible both by car and on foot. Examples would include a problem in an open area inside a public park where there is sufficient room to park safely near the site.

* A moderate accessibility rating of 3 is assigned to sites that are easily accessible by foot but not easily accessible by a vehicle. Examples would include a stream section that could be reached by crossing a large field or a site that was accessible only by 4-wheel drive vehicles.

* A very difficult accessibility rating of 5 is assigned to sites that are difficult to reach both on foot and by a vehicle. Examples would include a site where there are no roads or trails

nearby. To reach the site it would be necessary to hike at least a mile. If equipment were needed to do the restoration work, an access road would need to be built through rough terrain.

Following the completion of the survey, information from the field data sheets were entered into a Microsoft Access database and verified by the field teams. In addition, 88 photographs were taken during the survey were labeled and organized by site number in a binder so they can be easily worked with. The photographs were also digitized using a flat bed scanner and placed on a photo CD so they can be distributed to interested parties. Finally, all data collected during the survey was incorporated into an ArcView Geographical Information System (GIS). A final copy of the ArcView files were given to Kent County for their use in developing a Watershed Action Strategy for the Middle Chester Watershed.

RESULTS

A total of 42 problem data sheets, and 15 representative data sheets, were filled out during the survey. Included in the problem data sheets were 24 fish migration barrier sites, 6 bank erosion sites, 5 sites with inadequately vegetated stream buffers, 3 unusual condition sites, 3 pipe outfalls sites, and one trash dumping site. One comment data sheet was also completed during the survey to provide additional information about a specific problem.

An overall summary of survey results is presented in Table 1, while Table 2 summarizes the data by major stream segments. All data collected during the survey is presented in Appendices A and B. Appendix A provides a listing of information by problem number along with its location, using northing and easting coordinates. Information in this format is useful when working with maps showing the location of problem sites to determine what problems may be present along a specific stream reach. In Appendix B, the data is presented by problem type, with more detailed information about each problem. Presenting the data by problem type allows the reader to see which problems the field crews rated the most severe or easiest to fix within each category.

Table 1. Summary of results from Middle Chester River SCA Survey.

Potential Problems Identified	Number	Estimated Length	Very Severe	Severe	Moderate	Low Severity	Minor
Fish Blockages	24	NA	-	1	2	14	7
Erosion Site	6	2,790 feet (0.53 miles)	-	-	3	2	1
Inadequate Buffers	5	5,775 feet (1.09 miles)	-	-	2	1	2
Unusual Conditions	3	NA	-	1	-	-	2
Pipe Outfalls	3	NA	-	-	1	-	2
Trash Dumping	1	NA	-	-	1	-	-
TOTAL	**42**		**0**	**2**	**9**	**17**	**14**
Comments	**1**						
Representative Sites	**15**						

Table 2. Summary of survey results by major stream segments

Stream	Erosion	Fish Barrier	Inadequate Buffer	Pipe Outfall	Trash Dumping	Unusual Condition	Comment	Total
Morgan Creek	3	14	2	2	1	2	0	24
Radcliffe Creek	3	9	3	1		1	1	18
Urieville Lake		1						1

Fish Migration Barriers

Fish migration barriers are anything in the stream that significantly interferes with the free movement of fish upstream. Unimpeded fish passage is especially important for anadromous fish that live much of their lives in tidal waters but must move into non-tidal rivers and streams to spawn. Unimpeded upstream movement is also important for resident fish species, many of which also move both up and down stream during different parts of their life cycle. Without free fish passage, some of the sections in a stream network can become isolated. If a disturbance occurs in an isolated stretch of stream, such as a sewage line break, some or all fish species may be eliminated from that isolated section of stream. With a fish blockage present and no natural way for a fish to repopulate the isolated stream section the diversity of the fish community in an area will be reduced and the remaining biological community may be out of natural balance.

Fish blockages can be caused by man-made structures such as dams or road culverts, and by natural features such as waterfalls or beaver dams. Fish blockages occur for three main reasons. First, a vertical water drop such as a dam can be too high for fish to jump or swim over the obstacle. A vertical drop of 6 inches may cause a fish passage problem for some resident fish species, while anadromous fish can usually move through water drops of up to 1 foot, providing there is sufficient flow and water depth. The second reason a structure may be a fish passage problem is because the water is too shallow. This can often occur in channelized stream sections or at road crossing where the water from a small stream has been spread over a large flat area and the water is not deep enough for fish to swim through. Finally, a structure may be a fish blockage if the water is moving too fast through it for fish to swim through. This can occur at road crossings where the culvert pipe has been placed at a steep angle and the water moving through the pipe has a velocity that is higher than a fish's swimming ability.

Twenty-four fish migration barriers were reported during the survey, making it the most frequently reported problem. The locations of fish migration blockages are shown in Figure 5b and the data is presented in Appendix B. The blockages were due to a number of reasons including small dams (15), beaver dams (6 sites), a gauging weir (1 site), a road crossing (1 site) and a railroad crossing (1 site).

Most sites were given a low to minor severity ratings (Figure 5a). The two exceptions were Site 038505, which is the dam at Urieville Lake and Site 030101,which is a USGS gauging station. Urieville Lake (Site 038505) is located on a side branch of Morgan Creek and it was given a severity rating of severe. The gauging weir at Site 030101 is on the mainstem of Morgan Creek and it was given a moderate severity rating. Earlier surveys of anadromous fish spawning areas that were done by DNR in the late 1970's found yellow perch, white perch and river herring all spawn in Morgan Creek (O'Dell, et al., 1980). The study also reported that while Urieville Lake (Site 038505) blocked upstream migration of all anadromous fish, both river herring and white perch were collected above the USGS Gauging station (Site 30101).

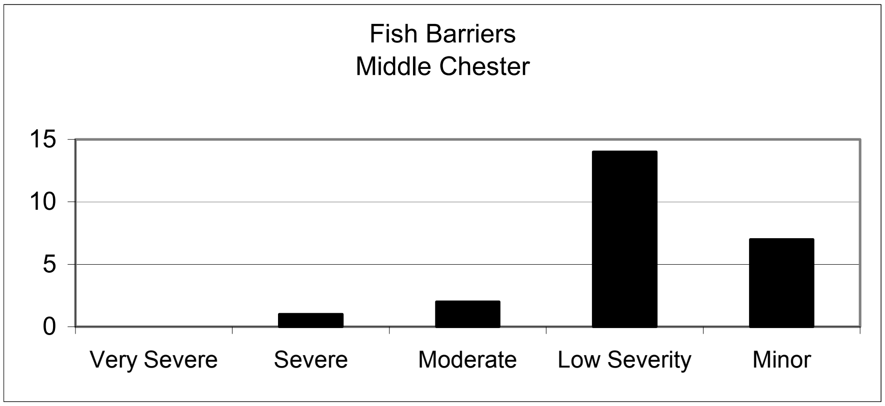

Figure 5a. Histograph showing the frequency of severity ratings given to fish migration barriers sites during the Middle Chester SCA survey.

Fish Barriers

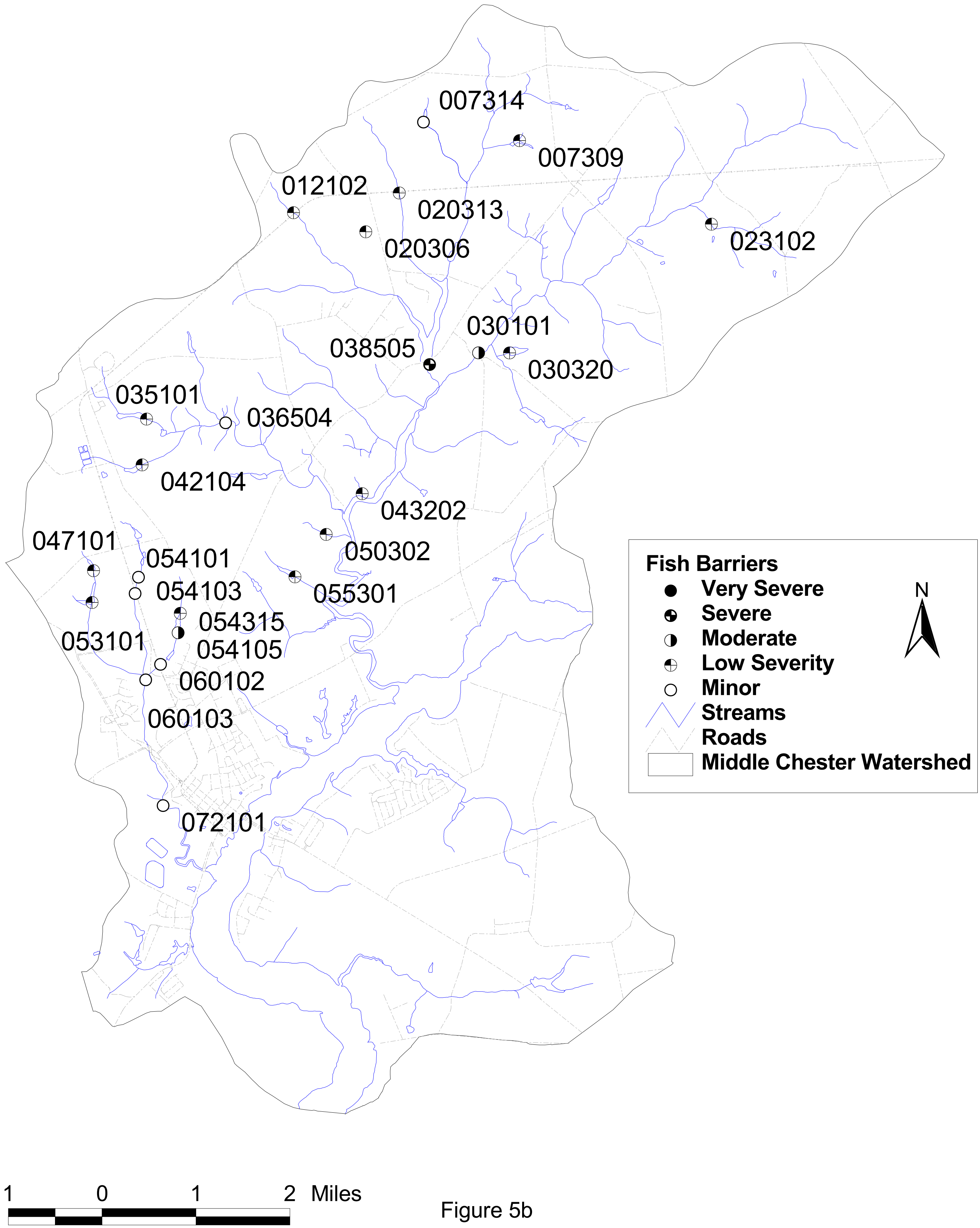

Figure 5b

Erosion Sites

Erosion is a natural process and necessary to maintain good aquatic habitat in a stream. Too much erosion, however, can have the opposite effect, destabilizing stream banks, destroying in-stream habitat and causing significant sediment pollution problems downstream. Severe erosion problems occur when either a stream's hydrology and/or sediment supply have been significantly altered. This often occurs when land use in a watershed changes. As a watershed becomes more urbanized, forest and agricultural fields are developed into residential housing complexes and commercial properties. As a result, the amount of impervious surfaces in a drainage basin increase, which then causes the amount of runoff entering a stream to also increase. The stream channel will, over time, adjust to the new flows by eroding the streambed and banks to increase its size. This channel readjustment can extend over decades, during which time excessive amounts of sediment from unstable eroding stream banks can have very detrimental impacts on the stream's aquatic resources.

Unstable eroding streams are areas where the stream banks are almost vertical and the roots from the vegetation along the stream's banks are unable to hold the soil on the banks. Unstable eroding stream banks were reported at six sites during the survey and there locations are shown in Figure 6b. All erosion sites were given moderate to minor severity rating (Figure 6a). The most significant erosion problems (Sites 055203, 055201 & 055202) were on a small unnamed tributary to Morgan Creek. At Site 055203 field teams reported that an active head cut was present.

The lengths of stream segments exhibiting signs of unstable banks varied from 15 feet to 1500 feet of stream (Appendix B). Overall, results indicate there are approximately 0.53 miles of unstable eroding banks in the Middle Chester watershed.

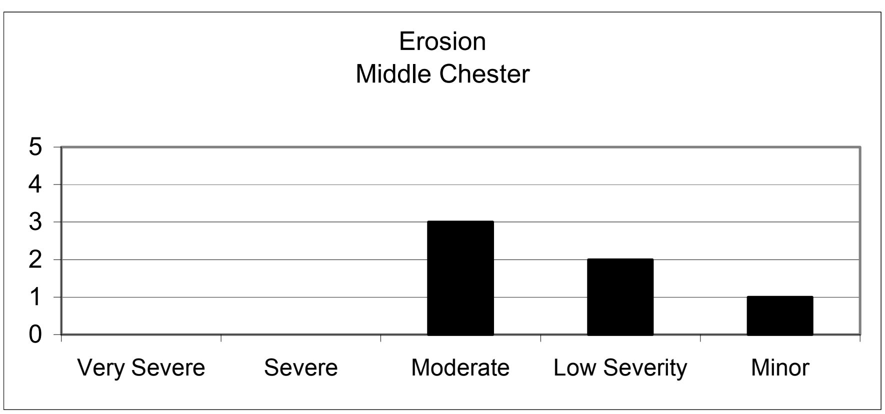

Figure 6a Histograph showing the frequency of severity ratings given to erosion sites during the Middle Chester SCA survey.

Erosion Sites

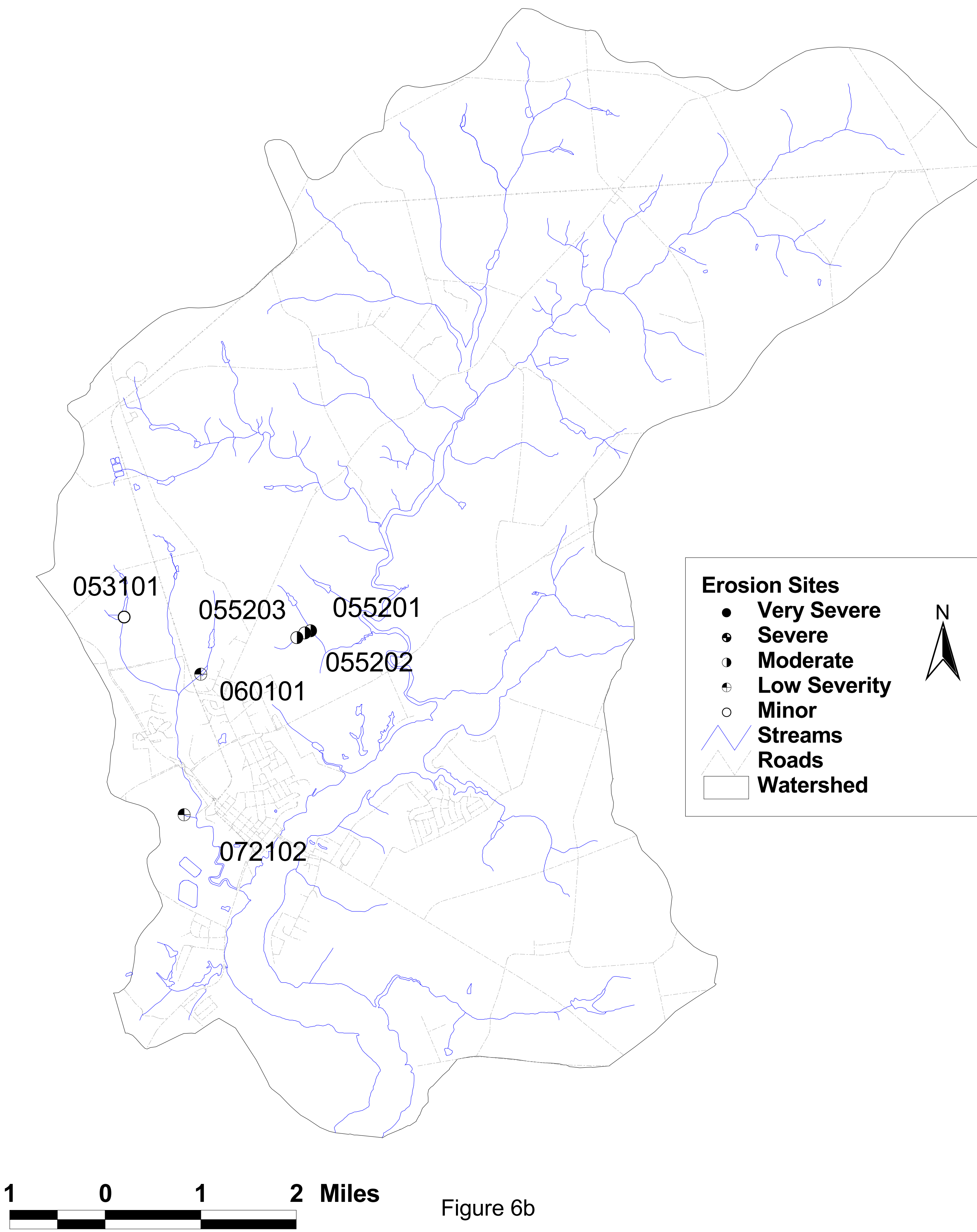

Figure 6b

Inadequate Buffers

Forested stream buffers are very important for maintaining healthy Maryland streams. They help shade the stream to prevent excessive solar heating and their roots stabilize the streams banks. Forest buffers also help remove nutrients, sediment and other pollutants from runoff and the leaves from trees are a major component of the stream's food web. Because of the importance of stream buffers, the state of Maryland has set a goal of recreating 1200 miles of forest stream buffers by the year 2010.

While there is no single minimum standard for how wide a stream buffer should be in Maryland, for the purposes of this study a buffer is generally considered inadequate if it is less than 50 feet wide, measured from the edge of the stream. Inadequate buffers were reported at five sites during the survey and there locations as shown in Figure 7b. The field crew provided a rough estimate of the length of the inadequate stream buffer at all sites (Appendix B). Based on the data that was collected, there are approximately 5,775 feet (1.09 miles) of inadequate buffer in the Middle Chester watershed. Field teams found inadequate buffers ranging in distance from 75 feet to 3000 feet. All sites received a moderate to low severity rating (Figure 7a). This would indicate that most of the stream reaches with inadequate buffers were not very long or some trees were already present at many of the sites.

Survey results indicate that there are a few possible locations on private lands where forested buffers could be reestablished or expanded. Sites MC011301 and MC024101 received moderate ratings. MC011301 is in a pasture, while site MC024101 is mixed crop and lawn.

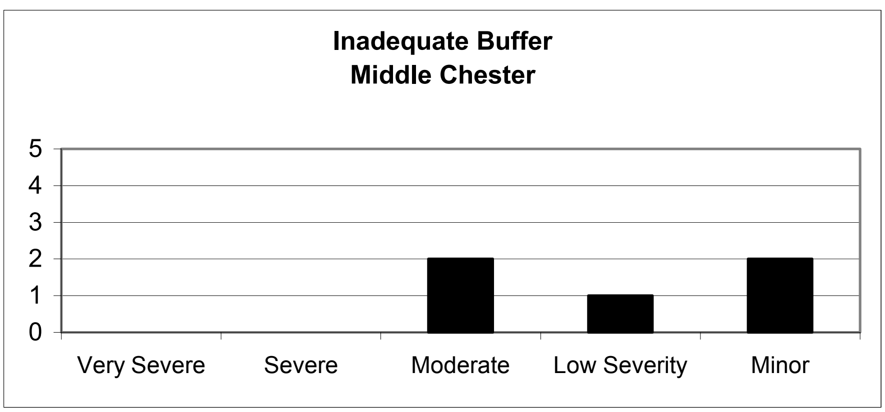

Figure 7a. Histograph showing the frequency of severity ratings given to inadequate buffer sites during the Middle Chester SCA survey.

Inadequate Buffers

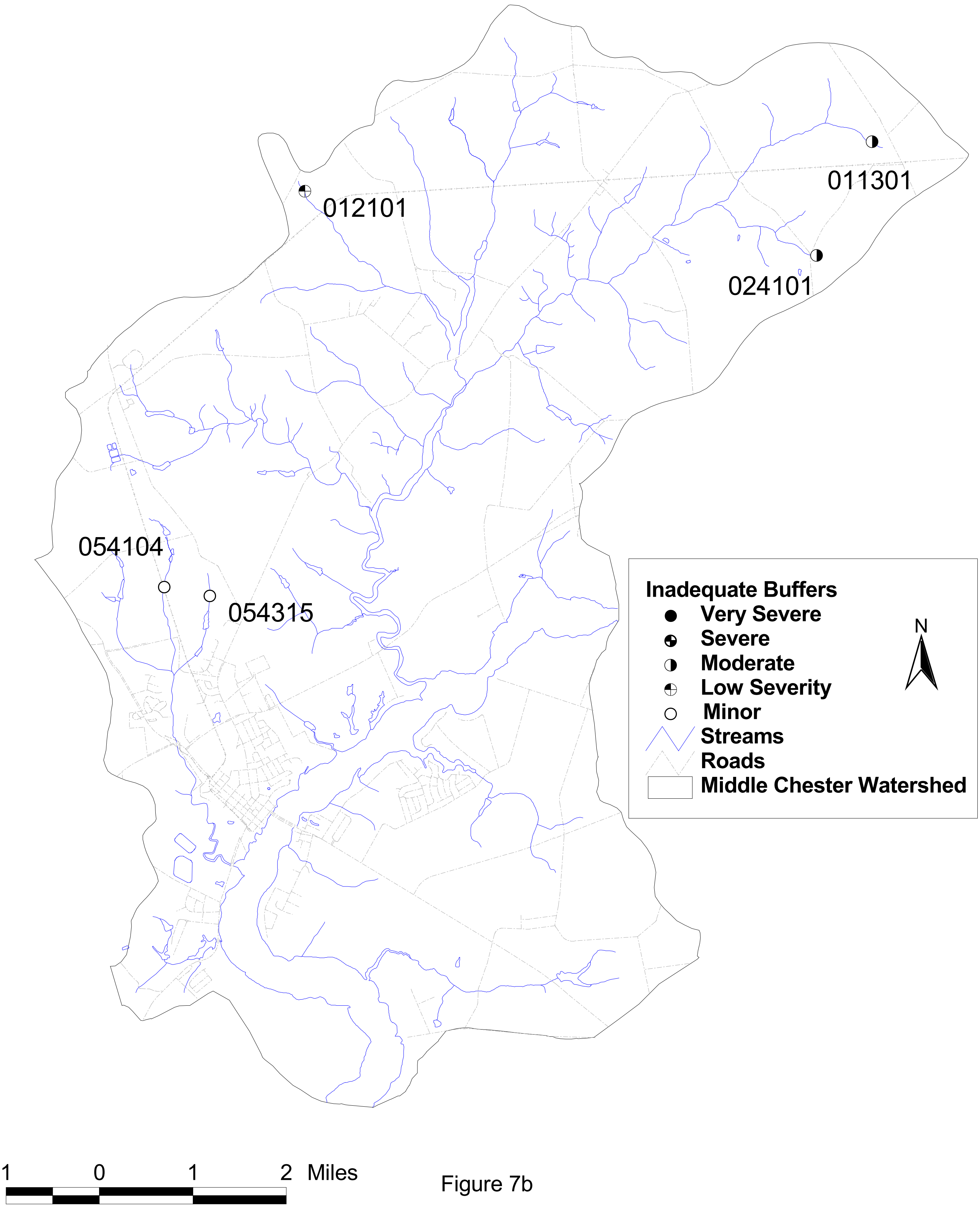

Figure 7b

Unusual Conditions

The unusual condition/comment data sheets are used by survey teams to record the location of anything out of the ordinary seen during the survey or to provide some additional written comments on a specific problem. Three unusual condition sites were found during the Middle Chester survey and their locations are shown in Figure 8. The only unusual condition site that was given a severe rating was Site 030307 which is at Urieville Lake. Field crews reported excessive algae present in the lake. Excessive algae grown problems in the watershed may also not be limited to Urieville Lake. During the helicopter survey of the watershed, the survey team reported seeing a number of headwater ponds with what appeared to be large amounts of algae growing in them.

The other unusual condition sites received minor severity ratings. The included an unprotected/exposed cable crossing the stream (Site 023101) and a cloudy discharge from one of the streams banks (Site 060105).

Unusual Conditions

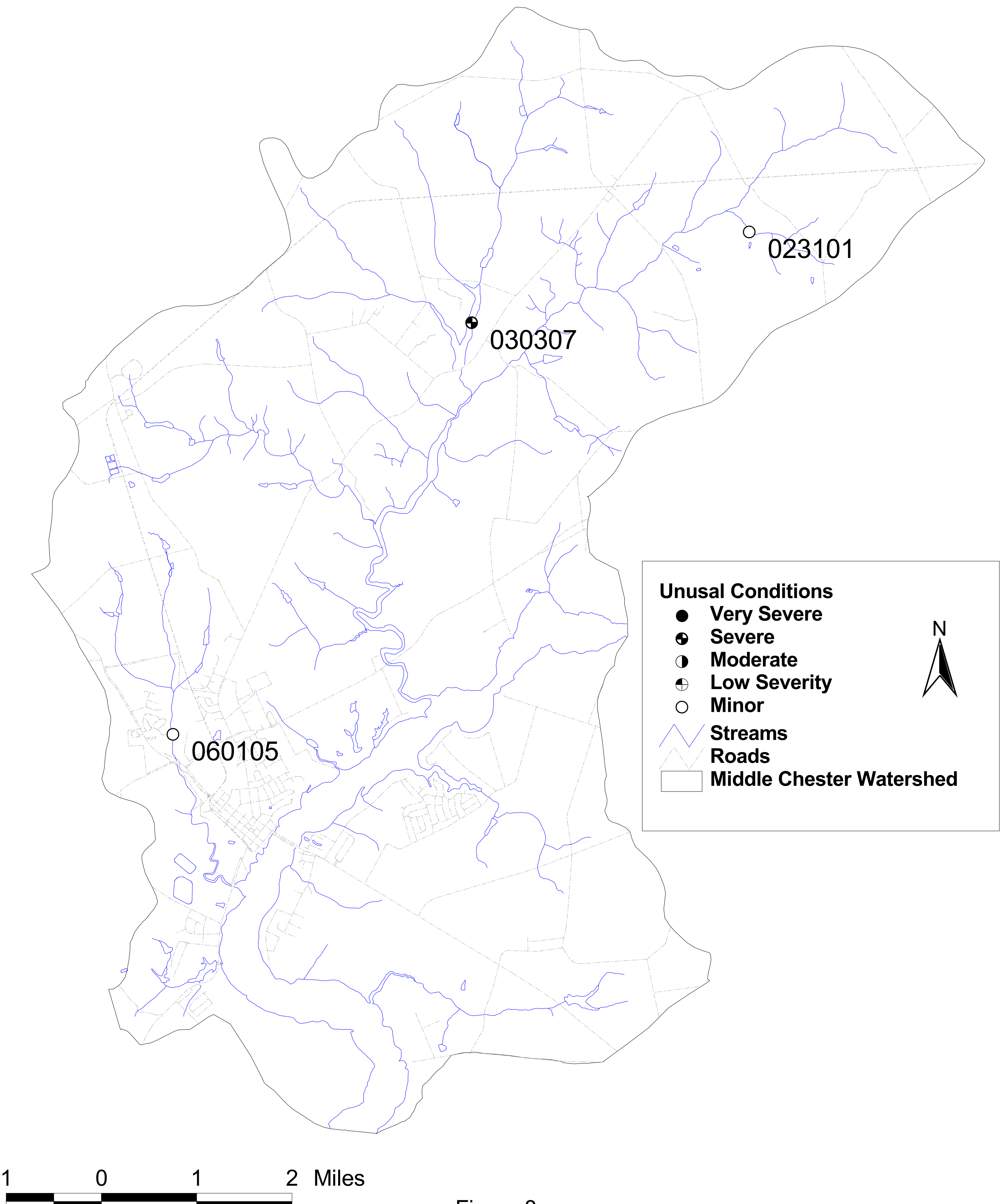

Figure 8

Pipe Outfalls

Pipe outfalls include any pipes or small man made channels that discharge into the stream through the stream corridor. Pipe outfalls are considered a potential environmental problem in the survey because they can carry uncontrolled runoff and pollutants such as oil, heavy metals and nutrients to a stream system. Three pipe outfalls were identified during the survey and their locations are shown in Figure 9b.

Site 042102 received a moderate rating while the other two sites (Sites 042101 and 066107) received minor rating (Figure 9). At Site 042102 the outfall pipe was reported to be discharging dark colored water that had a musky smell (Appendix B).

Pipe Outfalls

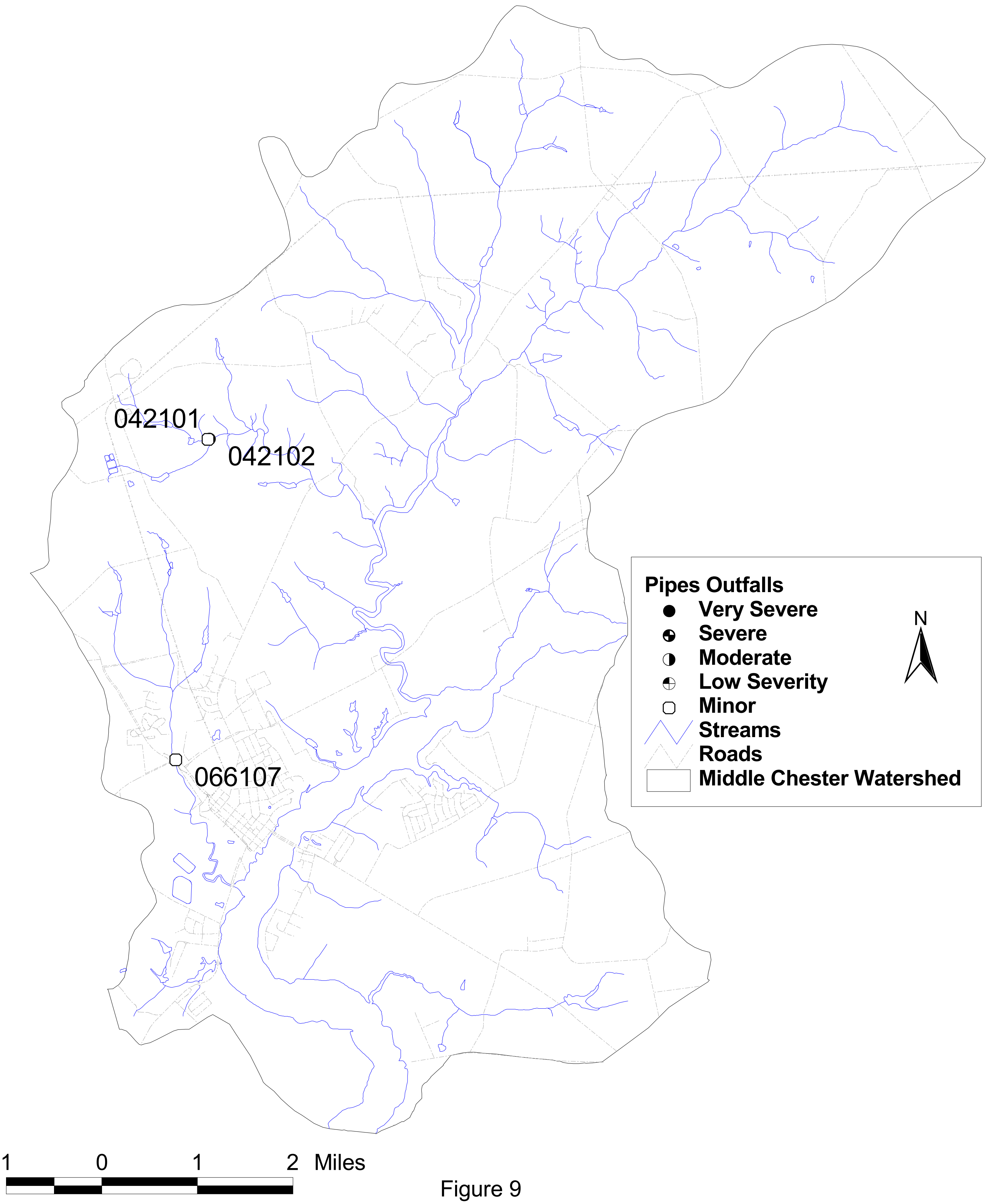

Figure 9

Trash Dumping Sites

The trash dumping data sheets are used to record the location of places where large amounts of trash has been dumped inside the stream corridor or to note places where trash tends to accumulate. The field survey crew found one site where there was excessive trash and its location is shown in Figure 10. The severity of the problem was reported as moderate. It was estimated to require seven pick-up truckloads to remove all the trash from this site.

Trash Dumping

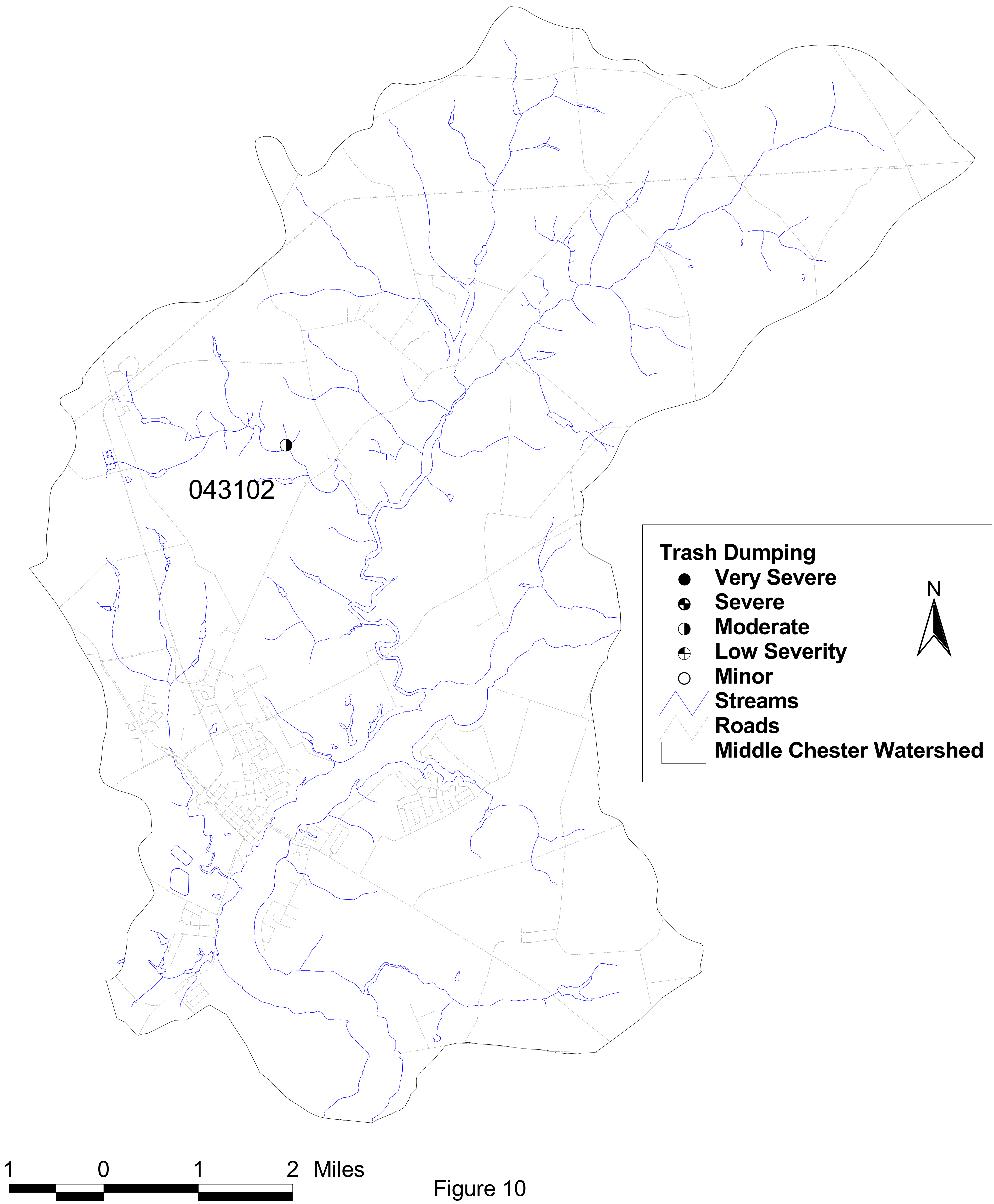

Figure 10

Representative Sites

Representative sites are used to document the general condition of both in-stream habitat and the adjacent riparian (stream bank) corridor. The representative site evaluations procedures used during the survey are very similar to the habitat evaluations done as part of the Maryland Save-Our-Stream's Heartbeat Program and are based on the habitat assessment procedures outlined in EPA's rapid bioassessment protocols (Plafkin, et. al., 1989). At each representative site, data was collected on 10 separate parameters. Habitat parameters that were evaluated include:

* Attachment Sites for Macroinvertebrates
* Shelter for Fish
* Sediment Deposition
* Channel Flow Status
* Condition of Banks
* Embeddedness
* Channel Alteration
* Stream Velocity and Depth
* Bank Vegetation Protection
* Riparian Vegetative Zone Width

For each of the above habitat parameters, a rating of optimal, sub-optimal, marginal or poor was assigned based on the grading criteria developed for each parameter. In addition to the habitat ratings, data was collected on the stream's wetted width and pool depths at both runs and riffles at each representative site. Depth measurements were taken along the stream thalweg (main flow path). At representative sites, field crews also indicated whether the bottom sediments in the area were primarily silts, sands, gravel, cobble, boulders, or bedrock.

Representative site evaluations were done at approximately ½ mile intervals along the stream. Fifteen representative data sheets were filled out during this survey. Locations of representative sites are shown in Figure 11 and the data is presented in Appendix B.

Overall, both Morgan and Radcliff Creeks received marginal or poor ratings for macroinvertebrate substrate, embeddedness, velocity and depth combination, and sediment deposition. This is not surprising since the streams are in the Coastal Plain on Maryland's Eastern Shore. Steams in this area naturally have sandy bottoms and may not have well formed riffles. The habitat evaluation sheets used in this survey were originally designed to be done on rocky bottom streams. Stream in the coastal plain usually score low in parameters like macroinvertebrate substrate and embeddedness. Other parameters such as channel alteration, channel flow, bank vegetation, bank condition and riparian vegetation tended to score optimal or sub-optimal. For the most part these results indicated that the streams in this area were generally stable with a forest buffer along the stream's banks.

Representative Sites

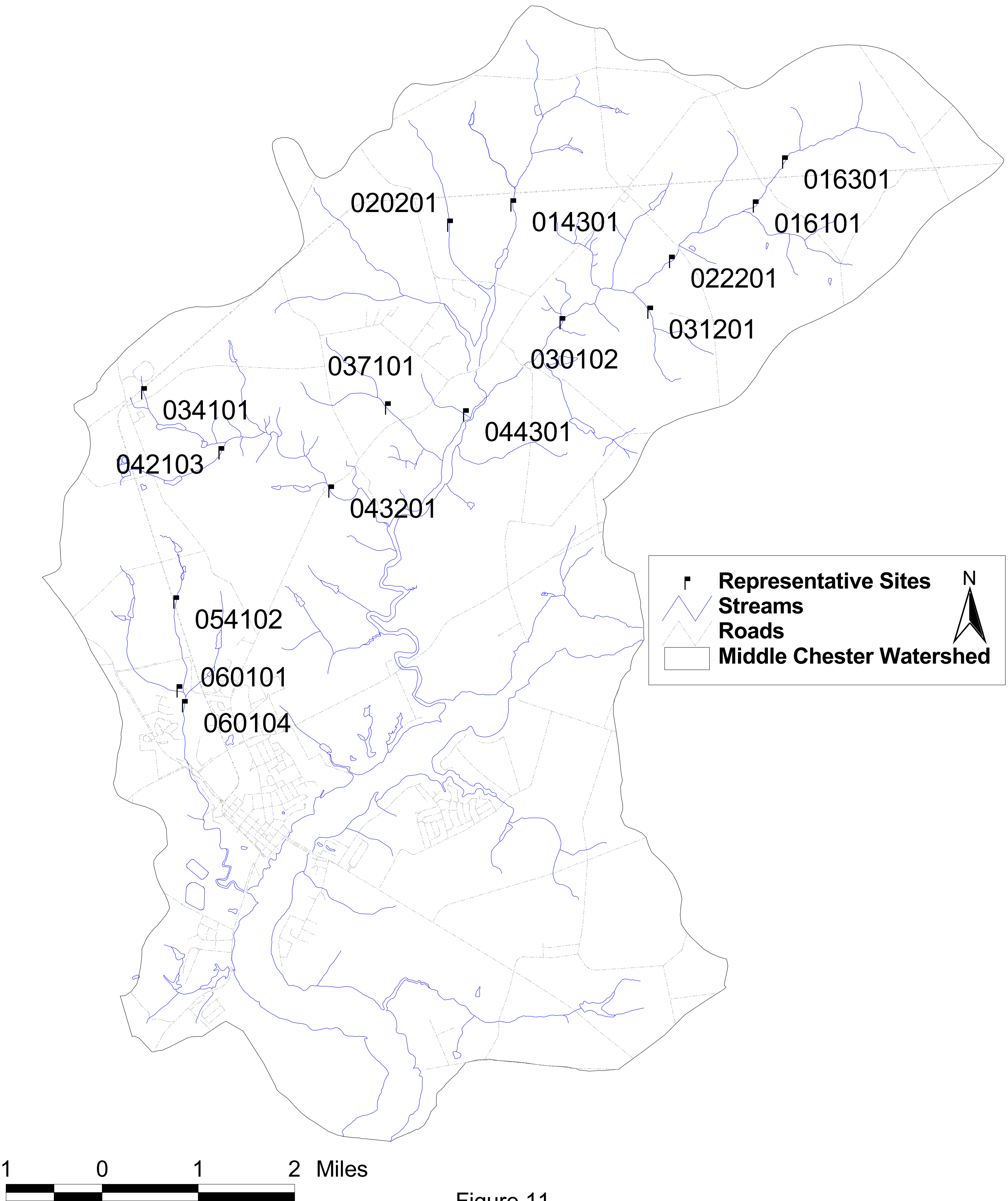

Figure 11

DISCUSSION

One of the main objectives of the Middle Chester Stream Corridor Assessment survey was to walk the stream network quickly in order to identify potential environmental problems in or along the edge of the stream. The survey was done from January 2001 to July 2001 and approximately 60 miles of stream were surveyed. During the SCA survey, 42 potential environmental problem sites were identified. This included 24 fish migration blockages, 6 bank erosion sites, 5 sites with inadequately vegetated stream buffers, 3 unusual condition sites, 3 pipe outfalls sites, and one trash dumping site.

Fish migration blockages were the most commonly reported potential problem during this survey. Many of the blockages were temporary structures such as beaver dams, or blockages associated with farm ponds in the headwaters of the stream system. Most fish blockages were given a moderate to minor severity rating. The most significant blockage was at Urieville Lake which is believed to be a total blockage to some anadromous species including river herring and yellow perch. Another significant fish migration blockage may be present at the USGS gauging station on Morgan Creek. Anadromous fish surveys done in the late 1970 did find that river herring were able to move above the gauging station.

Erosion and inadequate buffer sites were reported at a few locations but for the most part, were not seen as a major problem in the watershed. The survey also did not find any significantly altered or channelized stream sections in the areas surveyed. Unlike many areas of the lower Eastern Shore, there does not appear to be any large-scale canalization projects in the Kent County portion of the Middle Chester Watershed. Field teams also found one outfall pipe site that was discharging dark musky smelling water and another site were trash had been deposited near the stream.

Perhaps the most significant environmental problem that was reported during the survey was excessive algae growth in Urieville Lake and several other farm ponds in the watershed. The build up of algae in Urieville Lake is an indication of high nutrient levels in the lake and in the streams flowing into them. The build up of nutrients in a water body is called eutrophication. This in turn can leads to hypoxia or low oxygen levels in the lake during certain times of the year, especially the summer. Once a lake or pond becomes eutrophic, it is very difficult to rehabilitate the water body. Usually, three possible approaches can be taken. The first option is to reduce nutrient coming into the lake and use an iron or some other compound to sequester the nutrients in the lakes bottom sediments. The second approach is to remove the built up bottom sediment by dredging out the lake. The final approach is to decommission the lake's dam and restore the stream that use to be present. Each of these option have their own set of questions and problems associated with them. The one thing that they do have in common is they are all usually very expensive.

As mentioned earlier, the Maryland Dept. of Natural Resources has formed a partnership with Kent County to develop a Watershed Restoration Action Strategy (WRAS) for the Kent County portion of the Middle Chester River Watershed. Results from this survey will be combined with other information about the area to help establish priorities for the types and location of restoration projects that will be pursued in the Middle Chester River Watershed in the future.

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APPENDIX A

Listing of sites by site number

Middle Chester- Appendix A in Degrees

Site ID	Problem	Severity	Correctability	Access	Latitude	Longitude	Location
MC007309	Fish Barrier	4	4	4	76:00:20	39:18:45	Morgan Creek
MC007314	Fish Barrier	5	5	4	76:01:28	39:18:56	Morgan Creek
MC011301	Inadequate Buffer	3	3	1	75:56:25	39:18:42	Morgan Creek
MC012101	Inadequate Buffer	4	3	1	76:03:14	39:18:18	Radcliffe Creek
MC012102	Fish Barrier	4	3	3	76:03:02	39:18:06	Morgan Creek
MC014201	Representative Site				76:00:59	39:18:13	Morgan Creek
MC016101	Representative Site				75:58:10	39:18:11	Morgan Creek
MC016301	Representative Site				75:57:49	39:18:34	Morgan Creek
MC020101	Representative Site				76:01:43	39:18:02	Morgan Creek
MC020306	Fish Barrier	4	3	5	76:02:10	39:17:55	Morgan Creek
MC020313	Fish Barrier	4	2	3	76:01:46	39:18:17	Morgan Creek
MC022201	Representative Site				75:59:09	39:17:41	Morgan Creek
MC023101	Unusual Condition	5	2	3	75:58:02	39:17:56	Morgan Creek
MC023102	Fish Barrier	4	1	2	75:58:03	39:17:57	Morgan Creek
MC024101	Inadequate Buffer	3	2	2	75:57:06	39:17:39	Morgan Creek
MC030101	Fish Barrier	3	3	1	76:00:51	39:16:47	Morgan Creek
MC030102	Representative Site				76:00:25	39:17:09	Morgan Creek
MC030307	Unusual Condition	2	5	2	76:01:19	39:17:08	Morgan Creek
MC030320	Fish Barrier	4	3	2	76:00:28	39:16:47	Morgan Creek
MC031201	Representative Site				75:59:24	39:17:14	Morgan Creek
MC034101	Representative Site				76:05:18	39:16:33	Morgan Creek
MC035101	Fish Barrier	4	4	1	76:04:49	39:16:12	Morgan Creek
MC036504	Fish Barrier	5	2	2	76:03:52	39:16:10	Morgan Creek
MC037101	Representative Site				76:02:28	39:16:23	Morgan Creek
MC038505	Fish Barrier	2	5	1	76:01:26	39:16:41	Urieville Lake
MC042101	Pipe Outfall	5	4	3	76:04:23	39:16:05	Morgan Creek
MC042102	Pipe Outfall	3	3	3	76:04:23	39:16:06	Morgan Creek
MC042103	Representative Site				76:04:25	39:16:00	Morgan Creek
MC042104	Fish Barrier	4	3	2	76:04:52	39:15:47	Morgan Creek
MC043102	Trash Dumping	3	3	3	76:03:27	39:16:00	Morgan Creek
MC043201	Representative Site				76:03:08	39:15:38	Morgan Creek
MC043202	Fish Barrier	4	5	2	76:02:15	39:15:30	Morgan Creek
MC044301	Representative Site				76:01:33	39:16:19	Morgan Creek
MC047101	Fish Barrier	4	3	2	76:05:27	39:14:48	Radcliffe Creek
MC050302	Fish Barrier	4	5	4	76:02:41	39:15:07	Morgan Creek
MC053101	Erosion Site	5	3	2	76:05:29	39:14:31	Radcliffe Creek
MC053101	Fish Barrier	4	4	2	76:05:29	39:14:31	Radcliffe Creek
MC054101	Fish Barrier	5	2	2	76:04:55	39:14:45	Radcliffe Creek
MC054102	Representative Site				76:04:57	39:14:39	Radcliffe Creek
MC054103	Fish Barrier	5	2	3	76:04:58	39:14:36	Radcliffe Creek
MC054104	Inadequate Buffer	5	2	5	76:04:58	39:14:37	Radcliffe Creek
MC054105	Fish Barrier	3	4	2	76:04:27	39:14:14	Radcliffe Creek
MC054315	Fish Barrier	4	3	2	76:04:26	39:14:24	Radcliffe Creek
MC054315	Inadequate Buffer	5	3	2	76:04:25	39:14:32	Radcliffe Creek
MC055201	Erosion Site	3	4	4	76:03:18	39:14:22	Morgan Creek
MC055202	Erosion Site	3	4	4	76:03:22	39:14:21	Morgan Creek
MC055203	Erosion Site	3	4	4	76:03:28	39:14:19	Morgan Creek
MC055301	Fish Barrier	4	4	3	76:03:04	39:14:44	Morgan Creek
MC060101	Erosion Site	4	4	3	76:04:36	39:13:59	Radcliffe Creek
MC060101	Representative Site				76:04:56	39:13:51	Radcliffe Creek
MC060102	Fish Barrier	5	1	3	76:04:40	39:13:56	Radcliffe Creek

Middle Chester- Appendix A in Degrees

Site ID	Problem	Severity	Correctability	Access	Latitude	Longitude	Location
MC060103	Fish Barrier	5	1	4	76:04:51	39:13:47	Radcliffe Creek
MC060104	Representative Site				76:04:52	39:13:43	Radcliffe Creek
MC060105	Unusual Condition	5	1	3	76:04:52	39:13:25	Radcliffe Creek
MC066107	Pipe Outfall	5	5	1	76:04:49	39:13:10	Radcliffe Creek
MC066108	Comment				76:04:41	39:12:55	Radcliffe Creek
MC072101	Fish Barrier	5	2	2	76:04:39	39:12:38	Radcliffe Creek
MC072102	Erosion Site	4	5	5	76:04:48	39:12:42	Radcliffe Creek

APPENDIX B

Listing of sites by problem category

Middle Chester - Fish Barrier Sites

Problem	Site ID	Date	Blockage	Type	Because	Drop (in)	Depth (in)	Severity	Correctability	Access
Fish Barrier	MC038305	08/01/01	Total	Dam	Too High	120		2	5	1
Fish Barrier	MC030101	07/18/01	Partial	Dam	Too High	8		3	3	1
Fish Barrier	MC054105	01/16/01	Total	Dam	Too High	48		3	4	2
Fish Barrier	MC007309	08/01/01	Total	Dam	Too High	60		4	4	4
Fish Barrier	MC012102	07/20/01	Total	Road Crossing	Too High	5		4	3	3
Fish Barrier	MC020306	08/01/01	Temporary		Too High	36		4	3	5
Fish Barrier	MC020313	08/09/01	Total	Other	Too High	4		4	2	3
Fish Barrier	MC023102	06/06/01	Total	Instream Pond	Too High	36		4	1	2
Fish Barrier	MC030320	08/20/01	Total	Dam	Too High	60		4	3	2
Fish Barrier	MC035101	06/05/01	Total	Dam	Too High	120		4	4	1
Fish Barrier	MC042104	06/05/01	Total	Dam	Too High	120		4	3	2
Fish Barrier	MC043202	02/27/01	Total	Dam	Too High	96		4	5	2
Fish Barrier	MC047101	01/16/01	Total	Dam	Too High	60		4	3	2
Fish Barrier	MC050302	08/01/01	Total	Dam	Too High	36		4	5	4
Fish Barrier	MC053101	01/16/01	Total	Dam	Too High	30		4	4	2
Fish Barrier	MC054315	08/01/01	Total	Dam	Too High	48		4	3	2
Fish Barrier	MC055301	08/01/01	Total	Dam	Too High	48		4	4	3
Fish Barrier	MC007314	08/01/01	Total	Instream Pond	Too High	36		5	5	4
Fish Barrier	MC036504	08/01/01	Total	Beaver Dam	Too High	36		5	2	2
Fish Barrier	MC054101	01/16/01	Partial	Dam	Too High	24		5	2	2
Fish Barrier	MC054103	01/16/01	Temporary	Beaver Dam	Too High	30		5	2	3
Fish Barrier	MC060102	01/29/01	Temporary	Beaver Dam	Too High	12		5	1	3
Fish Barrier	MC060103	01/29/01	Temporary	Beaver Dam	Too High	24		5	1	4
Fish Barrier	MC072101	01/29/01	Temporary	Beaver Dam	Too High	24		5	2	2

Middle Chester- Erosion Sites

Problem	Site ID	Date	Type	Possible Cause	Length (ft)	Height (ft)	Land Use Right	Land Use Left	Infrastructure Threatened?	Describe	Severity	Correctability	Access
Erosion	MC055201	03/01/2001	Downcutting	Unknown	1500	4	Forest	Forest	No		3	4	4
Erosion	MC055202	03/01/2001	Headcutting	Bend at Steep Slope	15	10	Forest	Forest	No		3	4	4
Erosion	MC055203	03/01/2001	Headcutting	Unknown	20	12	Forest	Forest	No		3	4	4
Erosion	MC060101	01/29/2001	Widening	Below road crossing	900	2	Crop field	Forest	No		4	4	3
Erosion	MC072101	01/29/2001	Widening		300	4	Forest	Crop field	No		4	5	5
Erosion	MC053101	01/16/2001	Widening	Pipe outfall	55	3	Forest	Forest	No		5	3	2

Middle Chester- Inadequate Buffer Sites

Problem	Site ID	Date	Sides	Unshaded	WidthLeft(ft)	WidthRight(ft)	LengthLeft(ft)	LengthRight(ft)	LandUseLeft	LandUseRight	Recently Established Buffer	Livestock	Severity	Correctability	Access	Wetland
Inadequate Buffer	MC011301	07/17/2001	Both	Both	0	0	800	800	Crop field	Pasture	No	Cattle	3	3	1	1
Inadequate Buffer	MC024101	06/06/2001	Both	Both	0	0	3000	3000	Crop field	Lawn	No	No	3	2	2	4
Inadequate Buffer	MC012101	07/20/2001	Both	Neither	30	30	900	900	Crop field	Crop field	No	No	4	3	1	1
Inadequate Buffer	MC054104	01/16/2001	Both	Both	50	0	75	75	Multiflora Rose	Multiflora Rose	No	No	5	2	5	2
Inadequate Buffer	MC054315	08/01/2001	Both	Both	0	0	1000	1000	Lawn	Lawn	No	No	5	3	2	1

Middle Chester- Unusual Condition and Comment Sites

Problem	Site ID	Date	Type	Description	Potential Cause	Severity	Correctability	Access
Unusual Condition	MC030307	08/01/2001	Algae	Excessive algae on Uriville Lake.		2	5	2
Unusual Condition	MC023101	06/06/2001		Unprotected/exposed cable crossing stream.		5	2	3
Unusual Condition	MC060105	01/29/2001		Cloudy discharge from left bank.		5	1	3
Comment	MC066108	01/29/2001		Aproximately 200 ft. beaver dam.				

Middle Chester- Pipe Oufall Sites

Problem	Site ID	Date	Outfall Type	Pipe Type	Location of Pipe	Diameter (in)	Channel Width	Purpose	Discharge	Color	Odor	Severity	Correctability	Access
Pipe Outfall	MC042102	06/05/2001		Plastic	Right Bank	8		Unknown	Yes	Black	Musky	3	3	3
Pipe Outfall	MC042101	06/05/2001	unknown	Corregated metal		24		Unknown	Yes	Clear	none	5	4	3
Pipe Outfall	MC066107	01/29/2001	Stormwater	Concrete Pipe	Left Bank	24		Stormwater	No			5	5	1

Middle Chester- Trash Dumping Sites

Problem	Site ID	Date	Type	Truckloads	Other measure	Extent	Volunteer Project?	Owner Type	Owner Name	Severity	Correctability	Access
Trash Dumping	MC043102	02/27/2001	Other	7	50' * 12'		No	Private		3	3	3

Middle Chester- Representative Sites

Problem	Site ID	Macroinvertabrate Substrata	Embeddedness	Shelter For Fish	Channel Alteration	Sediment Deposition	Velocity and Depth	Channel Flow	Bank Vegetation	Bank Condition	Riparian Vegetaion
Morgan Creek											
Representative Site	MC014201	Suboptimal	Suboptimal	Optimal	Optimal	Suboptimal	Marginal	Optimal	Optimal	Suboptimal	Optimal
Representative Site	MC016101	Poor	Poor	Suboptimal	Optimal	Poor	Marginal	Optimal	Optimal	Optimal	Optimal
Representative Site	MC016301	Marginal	Marginal	Suboptimal	Optimal	Suboptimal	Suboptimal	Suboptimal	Optimal	Optimal	Optimal
Representative Site	MC020201	Marginal	Poor	Suboptimal	Optimal	Suboptimal	Marginal	Optimal	Optimal	Optimal	Optimal
Representative Site	MC022201	Poor	Marginal	Suboptimal	Optimal	Marginal	Marginal	Optimal	Optimal	Optimal	Optimal
Representative Site	MC030102	Suboptimal	Suboptimal	Suboptimal	Optimal	Suboptimal	Optimal	Suboptimal	Optimal	Optimal	Optimal
Representative Site	MC031201	Marginal	Marginal	Suboptimal	Optimal	Marginal	Marginal	Optimal	Optimal	Optimal	Optimal
Representative Site	MC034101	Marginal	Marginal	Marginal	Optimal	Poor	Marginal	Optimal	Optimal	Optimal	Optimal
Representative Site	MC037101	Poor	Poor	Optimal	Optimal	Marginal	Poor	Poor	Optimal	Suboptimal	Optimal
Representative Site	MC042103	Marginal	Poor	Poor	Optimal	Poor	Poor	Optimal	Optimal	Optimal	Optimal
Representative Site	MC043201	Optimal	Optimal	Optimal	Suboptimal	Suboptimal	Optimal	Optimal	Optimal	Suboptimal	Optimal
Representative Site	MC044301	Suboptimal	Marginal	Optimal	Optimal	Marginal	Marginal	Marginal	Suboptimal	Suboptimal	Optimal
Average		**Marginal**	**Marginal**	**Suboptimal**	**Optimal**	**Marginal**	**Marginal**	**Suboptimal**	**Optimal**	**Optimal**	**Optimal**
Radcliffe Creek											
Representative Site	MC054102	Marginal	Poor	Marginal	Optimal	Marginal	Marginal	Optimal	Suboptimal	Suboptimal	Optimal
Representative Site	MC060101	Marginal	Marginal	Marginal	Optimal	Marginal	Suboptimal	Optimal	Optimal	Optimal	Poor
Representative Site	MC060104	Marginal	Poor	Suboptimal	Optimal	Optimal	Suboptimal	Optimal	Optimal	Optimal	Optimal
Average		**Marginal**	**Poor**	**Marginal**	**Optimal**	**Suboptimal**	**Suboptimal**	**Optimal**	**Optimal**	**Optimal**	**Suboptimal**

Middle Chester- Representative Sites

Problem	Site Number	Width Riffle (in)	Width Run (in)	Width Pool (in)	Depth Riffle (in)	Depth Run (in)	Depth Pool (in)	Bottom Type
Morgan Creek								
Representative Site	MC014201		60	60		5	18	Sand
Representative Site	MC016101		120			6		Silts
Representative Site	MC016301	42	42	60	3	6	9	Silts
Representative Site	MC020201	18	18	18	2	2	3	Silts
Representative Site	MC022201		120	120		6	9	
Representative Site	MC030102	48	72	48	11	24	42	Silts
Representative Site	MC031201		36	36		4	4	
Representative Site	MC034101	36	24	2	2	2	2	
Representative Site	MC037101			7			12	Silts
Representative Site	MC042103		36			5		Silts
Representative Site	MC043201	60	120	180	4	12	24	Gravel
Representative Site	MC044301	10	100	36				Silts
Radcliffe Creek								
Representative Site	MC054102		36	24		6	6	Silts
Representative Site	MC060101		30	30		10	12	Silts
Representative Site	MC060104	48	54	54	5	8	12	Silts