STREAM CORRIDOR ASSESSMENT SURVEY OF THE LITTLE PATUXENT RIVER IN HOWARD COUNTY

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SUMMARY

The Little Patuxent River watershed encompasses over 66,200 acres and includes land in both Howard and Anne Arundel Counties. In 1998, the Maryland Clean Water Action Plan identified the Little Patuxent 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 Howard County Department of Public Works formed a partnership to do a Stream Corridor Assessment (SCA) survey of the Howard County portion of the Little Patuxent River Watershed. The Howard County portion of the watershed covers 28,000 acres and lies predominantly within the Piedmont of Maryland. In 1999/2000 a Stream Corridor Assessment of the Little Patuxent stream network was performed. This survey is not intended to be a detailed scientific evaluation of the watershed. Instead, the Little Patuxent 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 Little Patuxent Watershed to develop a Watershed Restoration Action Strategy.

Over 88 miles of stream in the Little Patuxent Watershed were surveyed. It is important to note that the survey teams did not have access to all the streams in the watershed. There were 1,090 potential environmental problems were identified. The most common environmental concern seen during the SCA survey was pipe outfalls, which were reported at 529 sites. Other potential environmental problems recorded during the survey include: 119 sites with inadequately vegetated stream buffers, 103 bank erosion sites, 66 fish migration blockages, 45 channelized stream sections, 46 exposed pipe sites, 25 unusual condition sites, 7 trash dumping sites, and 1 active construction site near the stream. The survey also recorded information on 229 ponds and 148 tree blockages.

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 89 representative sites that were spaced at approximately ½ to 1 mile intervals along the stream.

Based on the survey's initial results, a buffer planting has already been done at an inadequate buffer site inside of Altholton Park in October 2000. Two and a half acres of trees have been planted and additional plantings in other areas are being planned. Howard County has also incorporated the data from the SCA survey into the County's computerized Geographical Information System (GIS) and will prioritize areas for more detailed assessments and possible restoration.

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 hoped that once a list of environmental problems has been compiled, a dialog can be initiated among resource managers on the goals and targets of future environmental restoration efforts in the Little Patuxent Watershed. It is important to note that all of the problems identified as part of the Little Patuxent Stream Corridor Assessment survey 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.

ACKNOWLEDGMENTS

Without the hard work and dedication of the Chesapeake Bay Restoration Crew of the Maryland Conservation Corps, this survey would not have been possible. The crew chiefs during the survey were Tina Stevens and Aaron Brown. The crewmembers were Robin Pellicano, Melody Nevins, Sarah Crane, Elizabeth Sudduth, Kevin Osterman, David Booth and Kathryn Samuel.

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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 Little Patuxent River. The Little Patuxent River is a tributary to the Patuxent River, which in turn flows into the Chesapeake Bay. The watershed encompasses over 66,200 acres and includes land in both Howard and Anne Arundel Counties. In response to the findings of the Maryland Clean Water Action Plan, the Maryland Department of Natural Resources has formed a partnership with Howard County to work together to assess and improve environmental conditions in the Little Patuxent Watershed. The main goals of this partnership are to develop and implement a Watershed Restoration Action Strategy (WRAS) for the Howard County portion of the Little Patuxent Watershed.

The first step in developing a Restoration Action Strategy for the Little Patuxent 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 Little Patuxent Watershed (Shanks, 2001). While the watershed characterization provides good overall information on environmental conditions within the Little Patuxent 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 Howard County portion of the Little Patuxent 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 help 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 November 1999 through March 2000, with some follow up investigations of specific problems done during the winter of 2001.

The area targeted for a SCA survey includes about 43% of the total Little Patuxent Watershed and lies predominantly within the Maryland Piedmont. The targeted area encompasses 28,000 acres (43.7 square miles), with over 88 miles of stream within the watershed. This watershed lies within the Baltimore-Washington Metropolitan Corridor. Approximately 60% of the watershed is in urban land use and includes the communities of Columbia, Guilford, and Savage. Figure 1 shows the geographic location of the watershed targeted in this survey. A digital orthophoto map of the Little Patuxent watershed is shown in Figure 2. The map is based on aerial photographs taken in April 1993. Figure 3 shows the same watershed boundaries superimposed on a seven and ½ minute USGS topographic quadrangle map.

As mentioned earlier, data collected during the SCA survey will be combined with information compiled in the watershed's characterization report to develop a Watershed Restoration Action Strategy for the Howard County portion of the Little Patuxent 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.

Figure 1

Figure 2

Figure 3.

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 and the systematic implementation 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 a person need a degree in engineering to see that a sewage pipeline has been exposed by stream bank and/or bed erosion and could be 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 Natural 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 by President Clinton 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 Little Patuxent SCA Survey, the 10 members of the MCC’s Bay Restoration Crew received a week of training. As part of this training, crew members 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. For each site in a watershed there is a unique six-digit identification number assigned. The first three digits are the map number, the fourth digit is the team number, and the last two digits are a field site number starting with 01. The data sheets used in this survey are shown in Appendix A. 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 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). Copies of the survey protocols can be obtained by contacting the Watershed Restoration Division of the Maryland Department of Natural Resources in Annapolis, MD.

Field surveys of the Little Patuxent River began in November 1999, and over the next several months, the survey teams walked the stream's drainage network collecting information on potential environmental problems. Potential environmental problems commonly identified during the SCA Survey include: channelized stream sections, excessive bank erosion, exposed pipes, inadequate stream buffers, fish migration blockages, trash dumping sites, near stream construction, pipe outfalls and unusual conditions. In addition, the survey recorded information on the location of potential wetlands creation sites, the location of ponds and data on the general condition of in-stream and riparian habitats.

It is not unusual for an SCA survey to identify a large number of problems in each 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 occurred 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 was fairly minor at most sites. 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 the 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 others 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 ½ mile) or a long section of stream (greater than ½ mile) 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 and had stable banks with grass and low shrubs.

* 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 <u>minor correctability rating</u> 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 less than a day 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 <u>moderate correctability rating</u> 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 <u>very difficult correctability rating</u> 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 some access to the site could be obtained if requested from the property owner.

* A <u>very easy accessibility rating</u> 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. If heavy equipment was needed, the site is easily accessible using existing roads or trails.

* A <u>moderate accessibility rating</u> 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 <u>very difficult accessibility rating</u> of 5 is assigned to sites that are difficult to reach both on foot and by a vehicle. Examples would include a site on private land 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, 1,443 photographs taken during the survey were labeled and organized by site number in binders. The photographs were also digitized using a flat bed scanner and placed on a photo CD so they can be distributed to interested parties. This data was then incorporated into an ArcView application to produce the maps presented in this report.

RESULTS

A total of 1,090 problem data sheets, 89 representative data sheets, and 229 pond site data sheets were filled out during the survey. Included in the problem data sheets were 529 pipe outfalls, 148 tree blockages, 119 sites with inadequately vegetated stream buffers, 103 bank erosion sites, 67 fish migration blockages, 45 channelized stream sections, 46 exposed pipe sites, 25 unusual condition sites, 7 trash dumping sites, and 1 active construction site near the stream. Three comment data sheets were also completed during the survey to provide additional information about specific problems. A summary of survey results is presented in Table 1 and the data collected during the survey is presented in Appendices B and C. Appendix B provides a listing of information by problem number along with its location, using latitude and longitude 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 C, 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 Little Patuxent River SCA Survey.

Potential Problems Identified	Number	Estimated Length	Very Severe	Severe	Moderate	Low Severity	Minor
Pipe Outfalls	**529**	**NA**	1	2	35	245	246
Tree Blockages	**148**	**NA**	Na	Na	Na	Na	Na
Inadequate Buffers	**119**	**97,265 feet (16.7 miles)**	5	15	39	49	11
Erosion Site	**103**	**51,405 feet (9.7 miles)**	2	4	33	50	14
Fish Blockages	**67**	**NA**	-	4	17	21	25
Channel Alterations	**45**	**15,662 feet (3 miles)**	-	3	15	20	7
Exposed Pipes	**46**	**455 feet (0.08 mile)**	2	3	12	18	11
Unusual Conditions	**25**	**NA**	1	4	4	15	1
Trash Dumping	**7**	**NA**	-	1	1	3	2
In/Near Stream Construction	**1**	**NA**	-	-	1	-	-
TOTAL	**1090**		**11**	**36**	**157**	**420**	**317**
Pond Sites	**229**						
Representative Sites	**89**						

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. A total of 529 pipe outfalls were identified during the survey, making it the most frequently reported problem (Figure 4a). This is not surprising since much the Little Patuxent River flows through the communities of Columbia, Guilford and Savage and much of the land in the watershed has been urbanized. The locations of pipe outfalls are shown in Figure 4 a & b. As expected, most of the pipe outfalls are located in the more urbanized central portion of the watershed.

Sixty percent or 320 of the 529 outfall pipes observed during the survey were found to have some type of discharge coming out of them. Of these, only 38 were reported to have a discharge that had some coloration or smell associated with it (Appendix C). The remaining discharges were recorded as clear with no odor. The survey was done during the late fall and winter of 1999/2000. Snow was on the ground during part of the survey and snowmelt could account for the high percentage of discharging pipes.

Figure 4c shows the frequency of the severity rating given to pipe outfalls during the survey. As can be seen from the graph, the majority of the pipe outfalls were given either a very low or minor severity rating. Only one problem at Site LP110234 received a very severe rating. During the survey, field crews found an open manhole that was discharging sewage at a rapid rate at this site. This problem was reported to Howard County and was corrected immediately. Two other sites (Sites LP022308 and LP082342) received a severe rating and at both of these sites, a colored discharge and a sewage smell were reported. There were no estimates of the amount of fluid coming from the pipes. No immediate follow up actions were taken as part of this study to determine the source of the color or smell coming from any of the pipes. In some cases, coloration or smell from a storm drainpipe may be a sporadic occurrence. This is especially true in areas where there is no stormwater management system present.

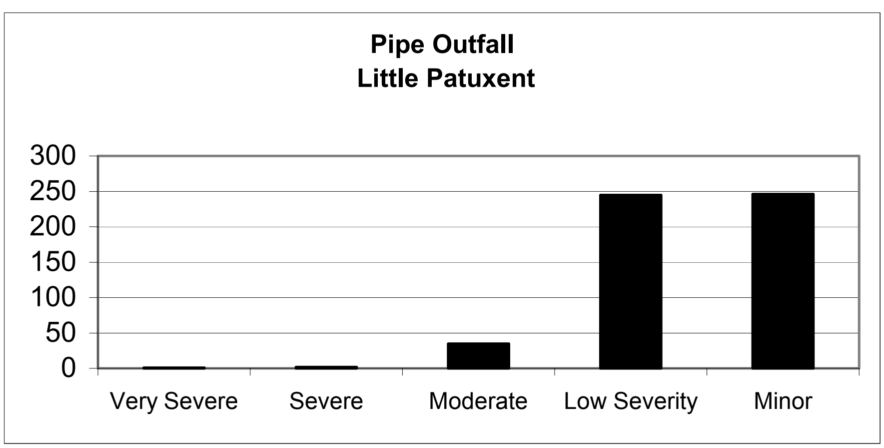

Figure 4c

Figure 4a.

Figure 4b.

Tree Blockages

The locations of tree blockages were recorded as part of the Little Patuxent SCA survey at the request of Howard County. While fallen trees can provide a refuge for fish and other animals, large blockages can also trap debris, creating a temporary dam and causing flooding of adjacent land. In a high water event, a breach of a debris dam could also cause extensive damage downstream. If a blockage occurs at or near a road crossing, an increase in flow could overtop the road. Debris clogging of road culverts is one of the main causes of road failure during large rain events. Proximity of tree blockages to road crossing, the amount of the channel effected by the blockage, and the surrounding land use were noted during the field survey (Appendix C).

The survey crew recorded one hundred forty-eight tree blockage sites. The locations of tree blockages are shown in Figure 5. Thirty-two of these blockages were within 250 feet of a bridge or culvert and 30 were within 1000 feet. Severity was recorded as “bad” at 28 sites, “moderate” at 82 sites, and “minor” at 38 sites. This severity rating is based to the size of the blockage and the amount of debris present at a site. Most of the tree blockages are concentrated in the central portion of the watershed. This area is much more developed and has a larger amount of erosion that can lead to trees slumping down into the stream. Only 15% of the tree blockages were located in an area described as “natural”. “Natural” areas were forested areas without development of any kind. The remaining 85% occurred in areas that were considered partially to fully developed. No serious debris jams of road crossings were observed during this survey.

Figure 5.

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. In the Little Patuxent watershed, 26% of the landscape surface is impervious (Weller, personal communication, Shanks, 2001). 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 103 sites during the survey (Figure 6a). The majority of the erosion sites showed moderate to minor erosion that extended over long distances. The lengths of stream segments that were recorded as having unstable banks varied from 6 feet in some areas, to other areas where up to 2 miles of stream was found to have an erosion problem (Appendix C). Overall, results indicate approximately 9.7 miles of unstable eroding banks in the Little Patuxent watershed. Figure 6b shows the frequency of the severity rating given to erosion sites. Only two sites received a very severe rating and five other sites were rated as severe.

A number of significant erosion problems were seen in the Columbia area including along Jonestown Tributary, Columbia Tributary # 3 and the mainstem of Little Patuxent River. A total of twenty erosion sites were identified in the Jonestown tributary including Site LP039314, which received the highest severity rating. On Columbia Tributary # 3, an additional seven erosion problems reported. Jonestown Tributary and Columbia Tributary # 3 both join the mainstem of the Little Patuxent River just upstream of Site LP105101. Stream bank erosion at Site LP105101 was given a severity rating of 1 (i.e., very severe) and erosion problems at that site were reported to extend over 2 miles. The erosion problems in these areas are believed to be related to the large amount of development that has occurred in the Columbia area over the last 40 years.

The survey also showed many erosion sites at or directly downstream of inadequate buffer sites. In some cases, riparian buffer plantings could help reduce erosion over time at some of these sites. However, in areas where streams are going through major readjustments, tree planting alone will not solve the problem.

Head cuts were also reported at several sites during the survey. Head cuts are areas where the streambed drops suddenly and indicate continuing readjustment of the stream channel. An example of an active head cut can be seen at Site LP039308.

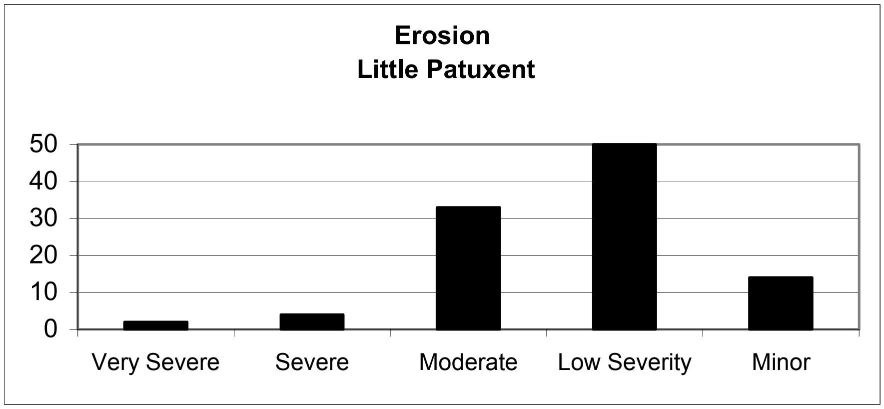
Erosion
Little Patuxent
50
40
30
20
10
0
Very Severe
Severe
Moderate
Low Severity
Minor

Figure 6b

Figure 6a

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 not only in maintaining healthy streams, but also in reducing nutrient loadings to the Chesapeake Bay, Maryland is committed to recreating forest buffers along streams.

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 119 sites during the survey as shown in Figure 7a. The field crew provided a rough estimate of the length of the inadequate stream buffer at all sites (Appendix C). Based on the data that was collected, there are approximately 97,265 feet (16.7 miles) of inadequate buffer in the Little Patuxent watershed. Field teams found inadequate buffers ranging in distance from 75 feet to 6,900 feet. This survey was done in a highly urbanized area, with mowed lawn reported as the dominant adjacent land use at inadequate buffer sites, accompanied by a small amount of agricultural land and parkland. While a large number of inadequate buffer sites were identified, most sites received a moderate to low severity rating (Figure 7b). 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 several possible locations on both public and private lands where forested buffers could be reestablished. Sites LP097230 and LP091120 received the highest severity rating possible and should be investigated to determine if establishing a forested buffer would be possible. In some locations, including Sites LP041304, LP042310, and LP128106, bike paths come close to the stream and there may be opportunities to plant trees between the bike path and the stream to allow for larger buffers in these areas. Another area that should be further investigated is site LP162204, which is above Centennial Lake. A vegetated stream buffer in this area could help reduce nutrient input to the lake. Centennial Lake was constructed in the early 1980's and algae growth, which could be caused by excess nutrients, is a problem in the lake. Based on the survey's initial results, a buffer planting has already been done at site LP128106 and site LP128105, inside of Altholton Park in October 2000.

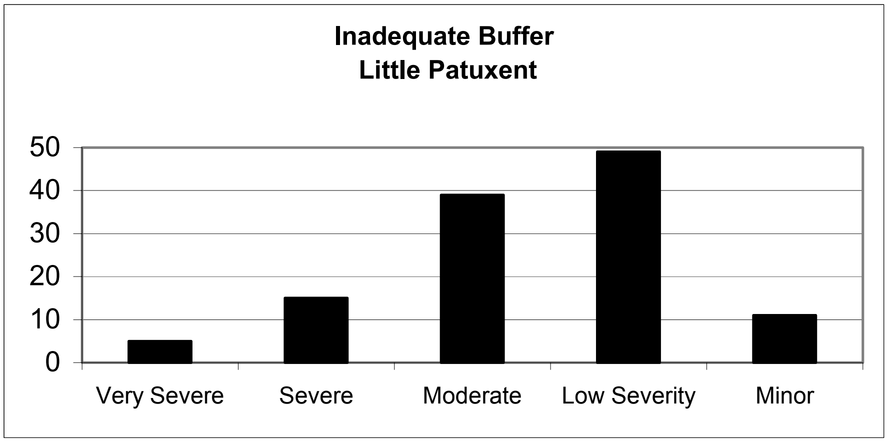
Inadequate Buffer
Little Patuxent
50
40
30
20
10
0
Very Severe
Severe
Moderate
Low Severity
Minor

Figure 7b

Figure 7a

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 that discharges a large amount of raw sewage into a small tributary, 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.

Sixty-seven fish migration barriers were reported during the survey. The locations of fish migration blockages are shown in Figure 8a. The blockages were due to a number of reasons including small dams (10), road crossings (17), pipe crossings (5), channelized stream sections (5), natural falls (8), ponds (7), and debris dams (11). Of the remaining fish blockages, gabion baskets and a weir were reported to cause one fish migration blockage each. Most of the sites were given moderate to minor severity ratings (Figure 8b). Overall, the mainstem of the Little Patuxent River is relatively barrier free. The only man made structures on the River's main stem are two small dams (Sites LP110121 and LP105106), which were in the upper portion of the watershed. Downstream of the area that was surveyed there is a dam at the Fort Meade Wastewater Treatment plant. This dam, however, does have a working fish ladder and the migration of Blueback herring and alewife through the ladder has been documented. Once these anadromous fish pass through the fish ladder at Fort Meade, there are no presently known blockages to their migration until they reach Savage Mill. Savage Mill is located at the fall line between the Coastal Plain and Piedmont physiographic provinces and there is a natural waterfall present at Site LP049501. The waterfalls is composed of a series of greater than 1-foot water drops and it is presently believe that alewife and herring would have difficulty migrating upstream through this area. This site was given a minor ranking because it is a natural barrier.

Any strategy to remove fish migration barriers in the Little Patuxent River should first attempt to keep the mainstem of the River as barrier free as possible. In addition, barriers that isolate large sections of tributaries from the mainstem, such as Site LP121109, or barriers that isolate significant portions of the upper portion of a tributary, such as Site LP099247, should also be targeted.

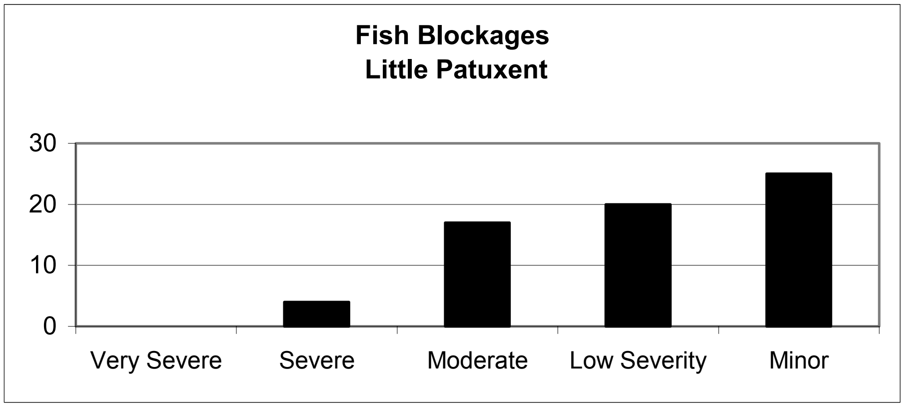

Figure 8b

Figure 8a.

Channel Alterations

Channel alteration is found in stream sections where the stream's banks and channel have been significantly altered from a natural condition. This includes areas where the stream may have been straightened and/or where the stream banks have been hardened using rock, gabion baskets or concrete over a significant length (usually 100 feet or more). It does not include road crossings unless a significant portion of the stream above or below the road has also been channelized. In addition, places where a small section of only one side of the stream's banks may have been stabilized to reduce erosion were not reported as channel alterations. For the purposes of this survey, channel alteration also does not include tributaries where storm drains were placed in the stream channel and the entire tributary is now piped underground. While these stream sections have been significantly altered, it is not possible to tell by walking the stream corridor precisely where this was done.

Results of this survey indicate that the stream has been recognizably altered in 45 areas and their locations are shown in Figure 9a. The total length of stream affected by channelization was estimated to be 14,262 feet or about 2.7 miles miles. There were no major stream systems reported in the survey as being extensively channelized and most of the sites were given a moderate to minor severity rating (Figure 9b). Most of the sites identified were also on small channels. Over half of the sites were channelized with concrete (25), while 9 were earthen channels that had been straightened, 8 were armored with rip-rap, 1 channel was lined with gabion baskets, and 2 were lined with wood. The correctability rating given for most of these sites were high because of the difficulty and expense of removing concrete. At one site, LP125301, it appears that the concrete channel is failing and the stream is beginning to flow underneath the concrete. Though this site received a low severity rating because of its short length, extensive gullying could occur beneath the concrete if it is not fixed.

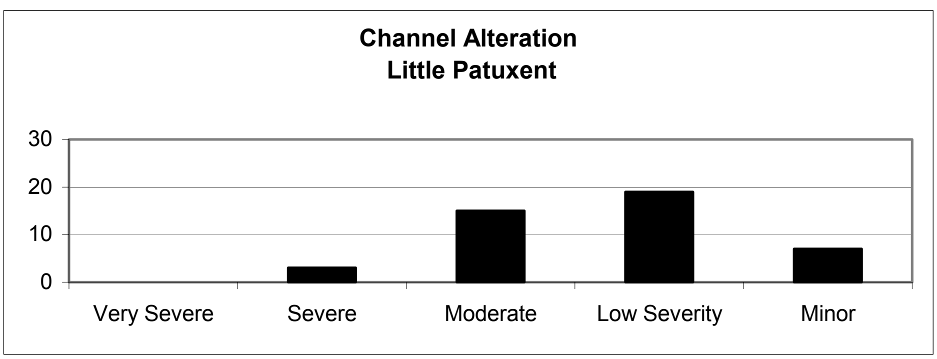

Figure 9b

Figure 9a.

Exposed Pipes

Exposed pipes are any pipes that are in the stream or along the stream's immediate banks that could be damaged by a high flow event. It does not include pipe outfalls where only the open end of the pipe is exposed. Exposed pipes do include: 1) manhole stacks in or along the edge of the stream channel, 2) pipes that are exposed along the stream banks, 3) pipes that run under the stream's bed and have been exposed by stream down-cutting, and 4) pipes that are built over a stream but are low enough that they could be affected by frequent high storm flows.

In urban areas, it is very common for pipelines and other utilities to be located in the stream corridor. This is especially true for gravity sewage lines that depend on the continuous downward slope of the pipeline to move sewage to a pumping station or treatment plant. Since streams are located at the lowest points of the local landscape, engineers often build sewage lines paralleling streams to collect sewage from adjacent neighborhoods. While the pipelines are stationary, streams can migrate and over time can expose previously buried pipelines. When this occurs, the pipeline becomes vulnerable to being punctured by debris in the stream. Fluids in the pipelines can be discharged into the stream, causing a serious water quality problem.

Exposed pipes were reported at forty-six sites during the survey. Locations of these sites are shown in Figure 10a. Of those, thirteen were manhole stacks, twenty-three were places where pipelines crossing the bottom of the stream had been exposed, seven sites had pipes exposed along the edge of the stream channel, and pipes were located crossing above the stream at 3 sites. Field survey teams reported 2 sites as having very severe problems. Sites LP039303 and LP064305 had discharges with a sewage odor and should be investigated further.

No other discharges were reported during the survey and most sites were give a moderate to low severity rating (Figure 10b). All exposed pipe photos should be reviewed by public works officials and follow-up visits should be done based on their evaluations.

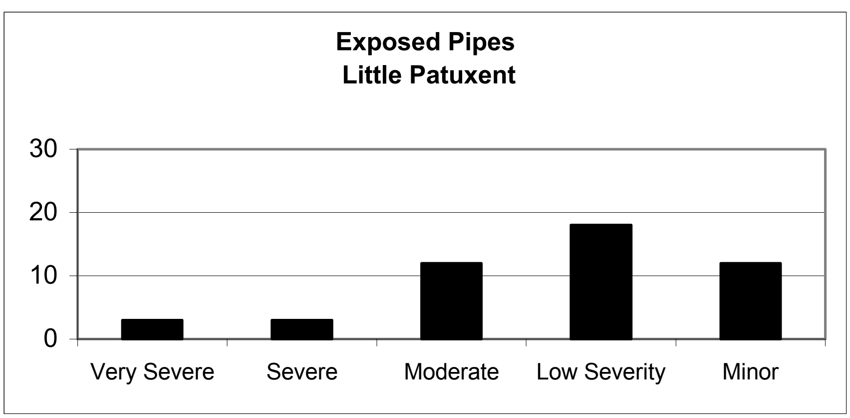

Figure 10b

Figure 10a

Unusual Conditions/Comments

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. Twenty-five unusual condition sites were found during the Little Patuxent survey (Figure 11a) and two comment data sheets were filled out. Site LP110234, a manhole discharging sewage, was given the highest severity rating. Three other sites were reported to have a sewage odor, but were not associated with an exposed pipe or pipe outfall. The other problems frequently recorded were red flock and large amounts of algae. These were give lower severity ratings (Figure 11b).

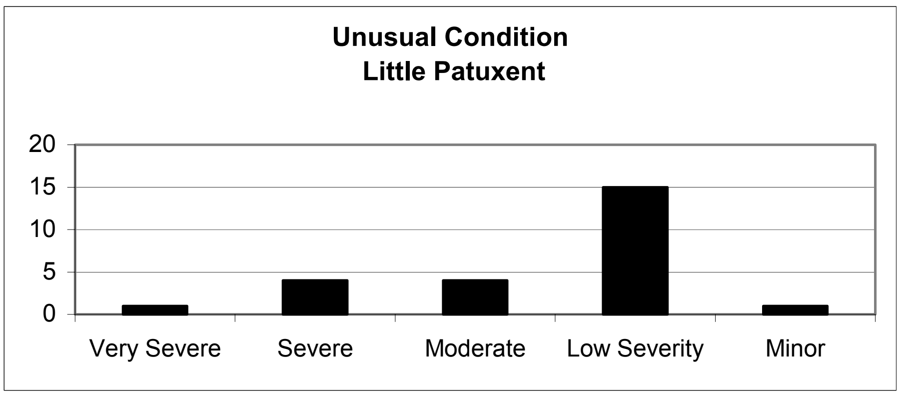

Figure 11b

Figure 11a

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 seven sites where there was excessive trash and their locations are shown in Figure 12a. Only one was recorded as severe, Site LP031320, which is a construction site. It was estimated to require 15 pick-up truckloads to remove all the trash from this site. Four sites were recorded as having yard waste, one had residential waste and one had industrial waste. These sites were given severity rating ranging from moderate to minor (Figure 12b).

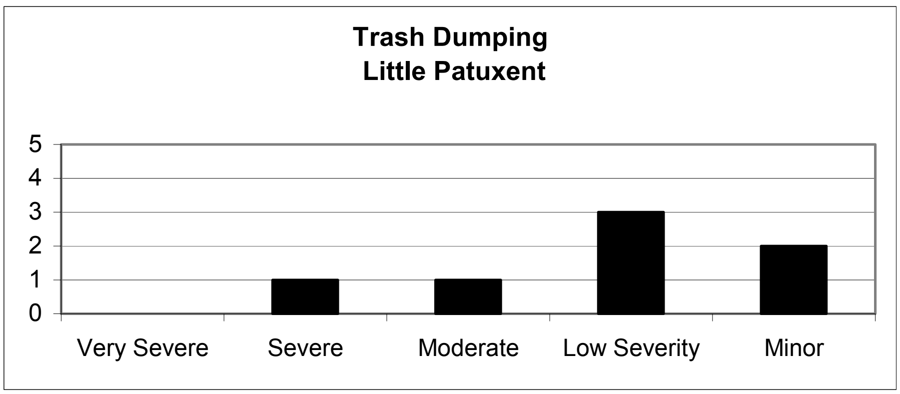

Figure 12b

Figure 12a.

In/Near Stream Construction Sites

In or near stream construction data sheets are used to document the locations where major disturbances are occurring inside or near the stream corridor at the time of the survey. Survey teams report evidence of inadequate sediment control measures or if sediment pollution from the site has affected the stream. In or near stream construction was only reported at one site during the Little Patuxent survey (Figure 13). Site LP073218 was reported to have excess sediment in the stream channel and the field survey crew was unaware of any sediment control measures.

Figure 13

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. Eighty-nine representative data sheets were filled out during this survey. Locations of representative sites are shown in Figure 14 and the data is presented in Appendix C.

Results indicate that the main stem of the Little Patuxent River is in fairly good condition, with average ratings of optimal and suboptimal in all categories except for embeddedness. However, many stream segments had a bottom substrate that consisted of gravel or cobble.

The three tributaries flowing through the community of Columbia, one of the most urban sections of the watershed, tended to have higher rating for conditions such as channel alteration and riparian vegetation indicating that the channel had not been altered significantly and most areas did have an adequate riparian buffer. Other parameters, including macroinvertebrate substrate, embeddedness, sediment deposition, and bank condition were all given either a poor or marginal rating. This indicates that erosion is a problem in these sections of the watershed. This is not surprising considering the large amount of impervious surface present in this highly developed portion of the watershed.

The remaining tributaries showed similar ratings in most habitat categories. Riparian vegetation received marginal ratings for most tributaries, as did macroinvertebrate substrate, embeddedness, and bank condition. These stream segments have stresses related to surrounding urban and agricultural land use. The main stem of the Little Patuxent appears to be the most stable and in the best condition overall.

Figure 14.

Pond Sites

This category was added at the request of Howard County to records information on the general condition of ponds observed during the survey. Since survey teams walk only along the stream corridor during the survey, any ponds located outside of the stream corridor, such as storm water management ponds inside of housing developments away from the stream would not be included in this survey. As part of the survey, field survey crew looked at whether or not eutrophic conditions were apparent and if routine maintenance was being performed on the embankment. This involved looking to see if the embankment is regularly mowed to prevent large trees from growing on it. Tree roots create weak spots that could lead to a possible breach. If large trees or animal burrows were present on the embankment, the field survey crews also record this information. However, due to a misunderstanding by the field crew on what constituted a poorly maintained pond site, all sites with trees growing anywhere around the pond were recorded as having trees on the embankment.

Two hundred twenty-nine pond sites were found during this survey, and their locations are shown in Figure 15. Of those, 167 were recorded as having trees or animal burrows on the embankment (Appendix C). It is not clear how many of those sites actually had trees or burrows on the embankment, or if they were mistakenly recorded. What was apparent from the photographs that were taken was most of the sites were adequately maintained storm water management ponds. However, it was not possible from the photographs to determine if all sites were adequately maintained, but had trees present on some pond embankments. Only 11 ponds were recorded as abandoned and 12 ponds were reported as un-maintained.

Figure 15.

DISCUSSION

One of the main objectives of the Little Patuxent 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 in the Winter/Spring of 2000 and 88 miles of stream were walked. During the SCA survey, 1,090 potential environmental problem sites were identified. This included 529 pipe outfalls, 148 tree blockages, 119 sites with inadequately vegetated stream buffers, 103 bank erosion sites, 67 fish migration blockages, 45 channelized stream sections, 46 exposed pipe sites, 25 unusual condition sites, 7 trash dumping sites, and 1 active construction site near the stream.

Pipe outfalls were the most commonly reported potential problem during this survey. Though most were given a low to moderate severity rating, several pipes were discharging a fluid with an odor and color, and should be investigated further. Howard County's Illicit Discharge Program incorporates four programs to meet the objectives: prevention, detection, removal and compliance, and program management and reporting. Information from the present survey will be given to Howard County's Illicit Discharge Program for appropriate follow up.

Results of the Stream Corridor Assessment survey indicate that there are a number of stream segments that could be enhanced by restoration projects. As mentioned earlier, the Maryland Dept. of Natural Resources has formed a partnership with Howard County to develop a Watershed Restoration Action Strategy (WRAS) for the Howard County portion of the Little Patuxent 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 Little Patuxent River Watershed in the future.

In preliminary discussions between Howard County and DNR representatives, restoring riparian areas by planting trees was identified as a County priority. Based on the early findings of the this survey, Howard County staff has already mapped buffer restoration opportunities using the County's computerized GIS and have begun prioritizing areas for more detailed assessment and restoration. Based on the County's early analysis one inadequate stream buffer site in Altholton Park has already been targeted. A tree planting was held in October 2000, and native trees and shrubs were planted along the stream edge. Employees of the Howard County Department of Public Works, Recreation and Parks, Howard County Forestry Board, Maryland DNR, area residents and a local Girl Scout troops spent the morning planting trees at the park. Approximately 2.5 acres were planted along the stream.

As mentioned earlier, the SCA survey has been developed by DNR's Watershed Restoration Division as a watershed management tool to both quickly assess the general condition of a stream corridor and to provide a list of potential environmental problems present within the corridor. One of the main goals of the SCA survey is to provide some basic information about each problem so that future restoration efforts can be better targeted. It is hoped that now that a SCA survey has been completed for the Little Patuxent watershed, a dialog can continue among resource managers on the goals and targets of future restoration efforts in the watershed. It is important to note that all of the problems identified in this survey can be addressed through existing State and Local Government programs. The value of the survey is that it can help place the problems in a watershed context and can be used by a variety of resource managers to plan future restoration work.

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