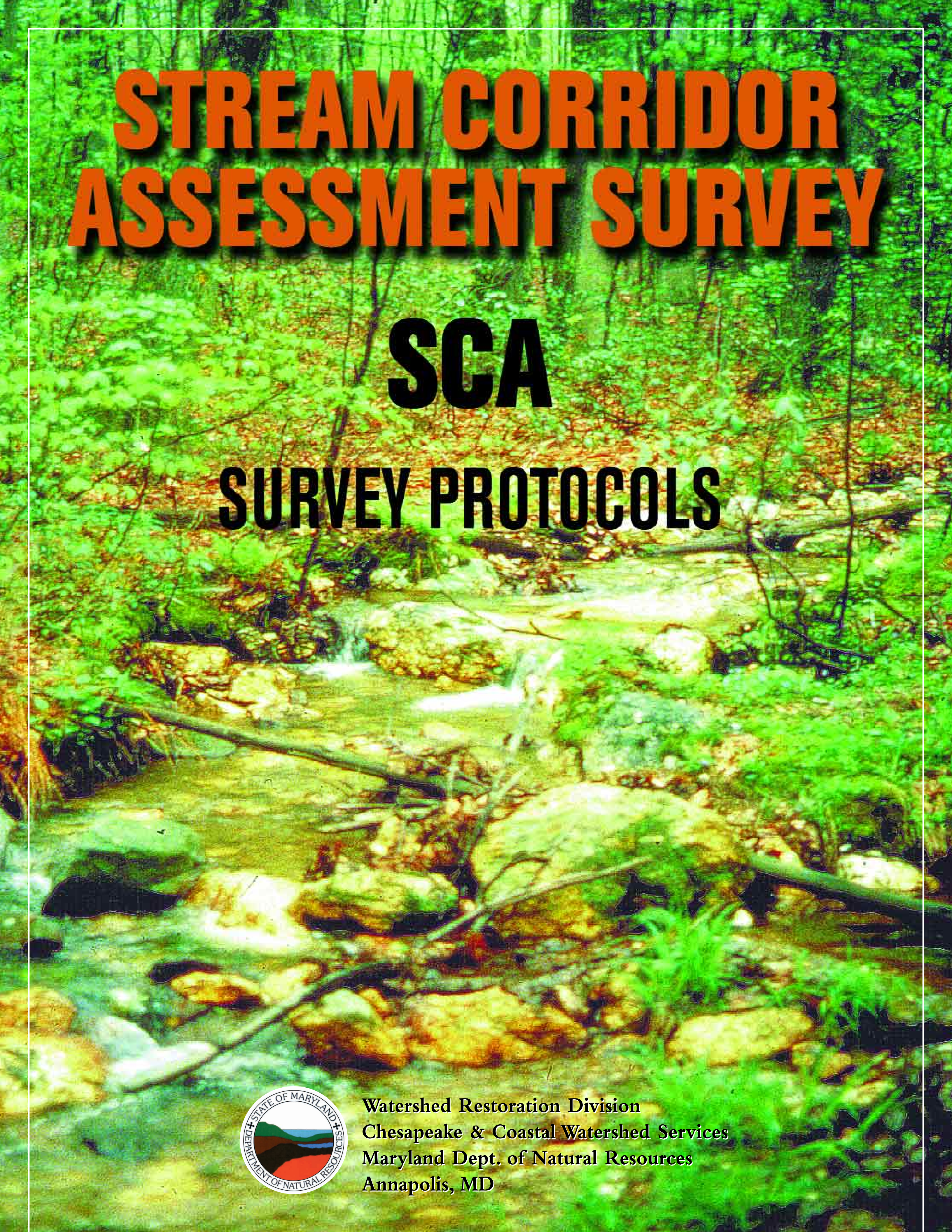
STREAM CORRIDOR ASSESSMENT SURVEY

SCA

SURVEY PROTOCOLS



Watershed Restoration Division
Chesapeake & Coastal Watershed Services
Maryland Dept. of Natural Resources
Annapolis, MD

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Secretary

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Maryland Department of Natural Resources
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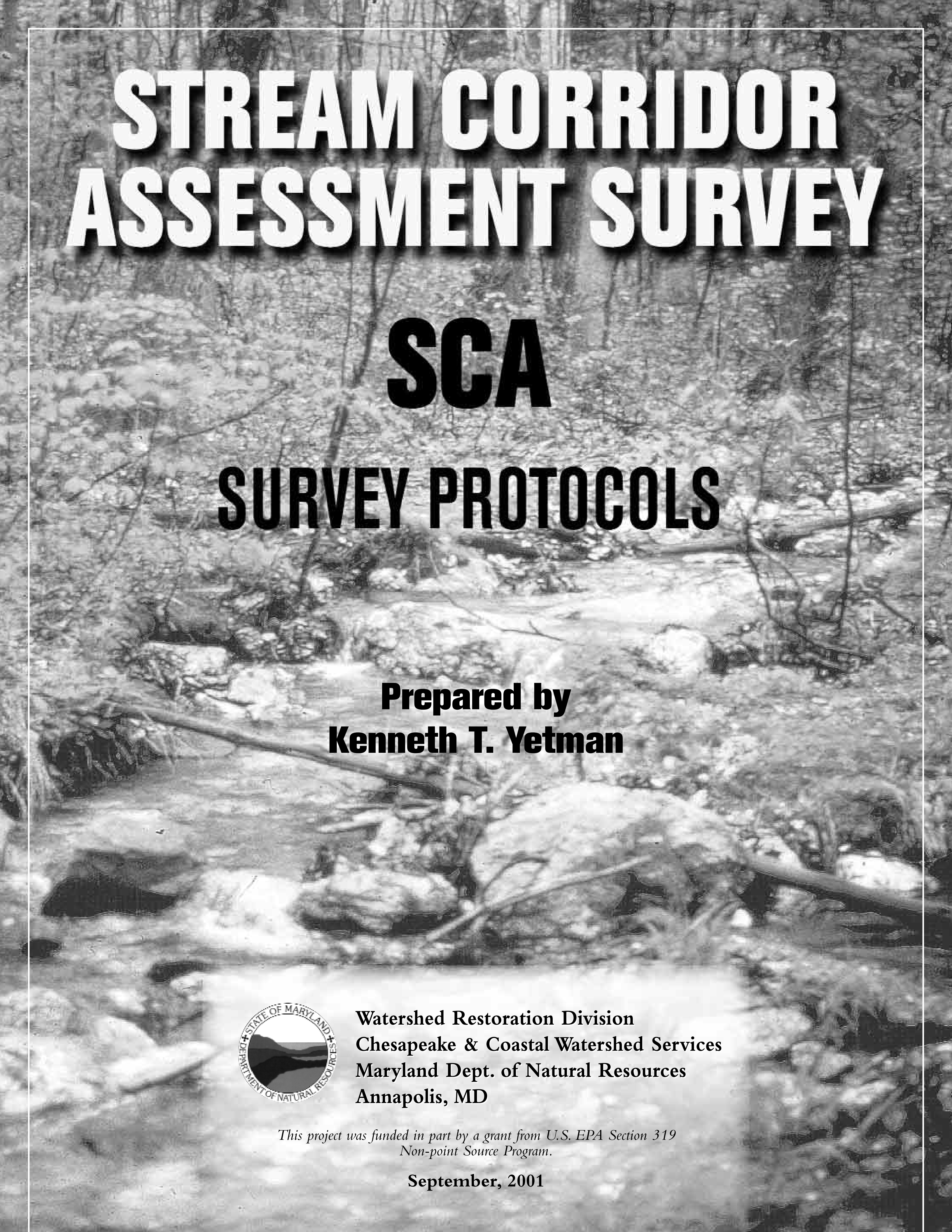

STREAM CORRIDOR ASSESSMENT SURVEY

SCA

SURVEY PROTOCOLS

Prepared by
Kenneth T. Yetman

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Annapolis, MD

This project was funded in part by a grant from U.S. EPA Section 319 Non-point Source Program.

September, 2001

TABLE OF CONTENTS

FORWARD

Over the years, the focus of environmental managers has expanded from initially trying to control discharges from sewage treatment plants and factories, to our present efforts to manage non-points source pollution and restore degraded stream systems. As the focus of environmental managers has expanded over the years, there has been a growing need to improve survey methods and provide new tools to identify and assess a variety of environmental problems over fairly large geographic areas. In response to this need, the Watershed Restoration Division of the Maryland Department of Natural Resources developed the Stream Corridor Assessment (SCA) survey as a tool that environmental managers can use to quickly identify a variety of environmental problems within a watershed's stream network. The survey is not intended to be a detailed scientific survey nor will it replace the more standard chemical and biological surveys. Instead, SCA is intended to provide a rapid method of examining an entire drainage network so future monitoring, management and/or conservation efforts can be better targeted. This report provides background on the survey's development and the methods that are used.

These protocols were developed over several years with the help of a number of individuals. Special recognition is extended to Christine Buckley, Paul Sneeringer, Mark Colosimo, Linda Morrison and Betsy Weisengoff who helped organize and implement some of the first SCA surveys. In addition special recognition is extended to Larry Lubbers and Frank Dawson who helped provide the necessary push and support to have these protocols printed. Special recognition is also extended to the Maryland Conservation Corp and its corp members who have walked thousand of miles of streams over the years and who have often provide valuable input onto ways to improve the survey's implementation.

The printing of these protocols were made possible through a grant from U.S. EPA Section 319 Non-point Source Program. Although this project is funded in part by the EPA, it does not necessarily reflect the opinion or position of the EPA.

1.0 INTRODUCTION

1.1 PURPOSE OF SURVEY AND PROTOCOLS

In the 1970s it became widely recognized that the aquatic resources of the Chesapeake Bay were in decline. Later studies found that pollution, especially excessive loading of sediments and nutrients, were having a significant adverse impact on the Bay's fisheries and wildlife. Initially, clean up and restoration efforts concentrated on point source discharges and resource issues in the tidally influenced portions of the Bay. While significant progress has been made in addressing point source pollution problems, it is also recognized that greater attention needs to focus on non-point pollution sources and on the rivers and streams that flow into the Bay. In order to accomplish this, a broader ecosystem-based approach is needed to manage, protect and restore Maryland's natural resources.

The Stream Corridor Assessment (SCA) survey is designed to provide a method which can be used to both rapidly assess the general physical condition of a stream system and identify the location of a variety of common environmental problems within the stream's corridors. It is intended to be a tool that can help resource managers identify not only the location of environmental problems but also restoration opportunities that exist within a drainage network. Potential environmental problems identified as part of the SCA survey include:

- ☐ Erosion Sites
- ☐ Inadequate Stream Buffers
- ☐ Fish Migration Blockages
- ☐ Exposed or Discharging Pipes
- ☐ Channelized Stream Sections
- ☐ Trash Dumping Sites
- ☐ In or Near Stream Construction
- ☐ Unusual Conditions

In addition, the survey also collects information on potential wetlands creation/water quality retrofit sites, as well as data on the general condition of both in-stream and riparian corridor habitats. The survey can also be used to assist in the identification of healthy stream sections that may be in need of environmental protection.

The SCA survey has been used to survey both small and large watersheds in Maryland during the last several years. A short history of the development of the SCA survey is provided in Section 1.3. Overall, the survey has proven to be very useful in obtaining an initial overview of environmental conditions in a number of Maryland watersheds and in prioritizing future restoration efforts. In the last several years, more than 2000 miles of stream have been surveyed using SCA, and over one million dollars of restoration work have been targeted based on the surveys' results.

The data sheets and methods used in the SCA survey have been developed over several years. During that period, some of the data sheets have changed in response to needs of the survey's sponsors which have usually been county and city government agencies. While these survey protocols represent the data sheets and methods that are now being used, it is possible that additional changes will be made in the future. Any suggestions on additional information or methods that could be included in the SCA survey should be directed to Ken Yetman at the Maryland Department of Natural Resources in Annapolis, Maryland (e-mail: kyetman@dnr.state.md.us).

This document was written to provide a set of standard protocols for DNR surveys using the Maryland Conservation Corps (MCC). Some of the terms such as crew and crew chief refer directly to the way the MCC is organized in Maryland. We have found the MCC to be both an efficient and cost-effective group to implement the SCA survey. For more information on the MCC see Section 1.5. This does not mean that the methods described in this protocol document cannot be easily adapted for surveys by other groups in Maryland or in other parts of the country.

1.2 SURVEY OBJECTIVES

The SCA survey has four main objectives:

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 SCA is not intended to be a detailed scientific survey of a stream system nor will it replace the more standard chemical and biological surveys. Instead SCA is intended to provide a rapid method of examining an entire drainage network so future monitoring, management and/or conservation efforts can be better targeted. The survey was developed because most existing scientific surveys are time consuming, expensive to do on a wide scale and often collect information for a relatively small section of stream at any one time. In contrast, the SCA survey is designed so that teams of two or three individuals will be able to survey an average of two to three stream miles per day, at a relatively low cost.

1.3 BACKGROUND ON SURVEY DEVELOPMENT

The 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. The survey is based on the fact that 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. With the proper training most people can identify these common environmental problems.

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 good guides for citizens that are interested in looking at their community streams, the data collected during these surveys can vary significantly due to the limited training most citizen volunteers receive before doing the survey.

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 a stream passing through an individual farmer's property. While this survey can provide useful information on a specific stream segment, they are 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 before beginning the survey. The intention of the survey is to identify and collect some basic information about potential environmental problems so that future restoration and management activities can be better targeted.

The Maryland SCA survey is based on the stream walk survey that was originally developed for DNR's Adopt-A-Stream Program by Maryland Save-Our-Streams (SOS). The Maryland Adopt-A-Stream Program was initiated by DNR in the late 1980s to help promote environmental stewardship in neighborhood communities throughout Maryland. The program is administered by Maryland Save-Our-Streams, a non-profit environmental organization that works with schools, community groups and individuals to protect and restore Maryland's aquatic resources. The stream walk survey is one of several activities in the Maryland Adopt-A-Stream Program designed to help Maryland residents learn more about their community streams and how to improve them. For more information on the Maryland Adopt-A-Stream Program contact DNR's Education, Bay Policy & Growth Management Division at (410) 260-8710. For more information about Maryland Save-Our-Stream call (800) 448-5826.

While the stream walk survey had been part of DNR's community-based Adopt-A-Stream Program for several years, it was not until 1994 that the survey was used in a more formal study by managers within DNR. In 1994, working with Harford County Government, U.S. Army Corps of Engineers, Maryland Department of the Environment, the City of Aberdeen and Aberdeen Proving Grounds, a stream walk survey of Swan Creek was done. Swan Creek is located in eastern Harford County, Maryland, and its watershed encompasses 26.5 square miles. Unlike earlier stream walk surveys that used community volunteers, the Swan Creek survey was done by 45 volunteers from the various local, state and federal agencies. In August 1994 government agency volunteers gathered in a meeting room at Aberdeen Proving Grounds and viewed a 45 minute slide show presentation on how to do the survey. After the slide presentation, agency volunteers broke up into 17 survey teams. Over a 3-day period they walked 105 stream miles and recorded 580 potential environmental problems.

The information collected during the survey was entered into a database and site locations were entered into Harford County's Geographical Information System. Reviewing the data collected during the Swan Creek Survey provided a number of insights. First, there was a large degree of inconsistency in the data collected by the various survey teams. For example, one team may have been lead by a forester and recorded very good information on the buffer along the stream but tended to record limited information on problems in the water. Another survey team that may have been lead by a fishery biologist who recorded detailed information about fish barriers but only minimal information about problems in the stream corridor away from the stream. Inconsistencies in the data were attributed mainly to the limited training provided to a large group of people in a very short period of time.

The second insight obtained from the initial Swan Creek survey was that while the survey identified potential environmental problems, it usually did not provide sufficient information to prioritize problems for future restoration activities. This in part is due to the fact that the survey was designed to be done by community volunteers, who usually were trained and did the survey all in one day. In many ways, the survey was primarily intended to be a community education activity that alerted residents to the presence of potential pollution problems in their community stream.

The final important insight from the survey of Swan Creek was that despite the above problems, the survey did provide a good general overview of the environmental problems in the stream corridor. A number of follow-up surveys were done by a much smaller group over several months and a rating system was developed to rate the severity, correctability and accessability of problem sites. Once the follow-up surveys were completed and all of the problem sites rated, a number of restoration projects were initiated to begin to address the problems identified along Swan Creek. Over the last several years more than a million dollars of environmental restoration work has been done in the Swan Creek watershed. The paper entitled "Swan Creek Restoration Partnership," published as part of the proceedings of EPA's Watershed 96 conference, provides additional information on the Swan Creek survey and restoration efforts (Yetman et al., 1996).

While the Swan Creek survey demonstrated the usefulness of a stream walk survey in identifying environmental problems within the stream corridor, experience gained during the survey also found that changes were needed in survey methodology. In 1996, working with Harford County and the Army Corps of Engineers, the Watershed Restoration Division of DNR developed a new survey called the Stream Corridor Assessment (SCA) and recruited the Maryland Conservation Corps to help implement it. The Maryland Conservation Corps is part of the AmeriCorps Program and managed by DNR's Forest and Park Service. For more information on the MCC, see Section 1.5.

To avoid problems experienced during the Swan Creek survey, the new SCA survey has been designed to be done by smaller specially trained groups who walk an entire steam network in a watershed collecting information on potential environmental problems. MCC survey crew members receive several days of training in stream ecology and how to conduct an SCA survey. As part of this training, survey crew members learn how to identify common problems, record the location of problems on survey maps, and how to fill out data sheets properly. In addition, the data sheets have been modified to record specific information about each problem. The new SCA survey also rates all problems in the field in three categories: problem severity, the correctability of the problem, and the accessability of the problem site. Photographs are taken at all sites to document existing conditions and to aid in follow-up analysis. Finally, a representative site data sheet has been added to the survey to collect information on habitat conditions in the stream corridor.

The first watershed to undergo the new SCA survey was Bynum Run in eastern Harford County, Maryland. In 1996 the MCC's Bay Restoration Crew walked more than 150 stream miles and identified 780 potential environmental problems (Harford Co. DPW, 1999). Harford County is now using the information from the Bynum Run SCA survey to target future storm water management improvement in the watershed. Harford County has also incorporated the SCA survey into their non-point source pollution NPDES program and plan to use the SCA survey to examine all the streams in Harford County.

Since 1996, the SCA survey had been done in a number of Maryland watersheds including: Winters Run in Harford County, Herring Run in Baltimore City and County, Fair Hills State Park in Cecil County, Carroll and Rock Creeks in Frederick City and County and the Upper Patuxent River in Howard and Montgomery Counties. The survey has proven to be a very useful tool in both assessing the general environmental conditions of stream systems and in targeting future restoration and conservation efforts.

1.4 RESPONSIBILITIES OF SURVEY PARTICIPANTS

The duties and responsibilities of the main participants in an SCA survey can be separated into six primary areas. Depending on the size of the survey and the expertise of the people involved, two or more of these duties may be done by a single individual or group. The primary areas of responsibility are:

Survey Sponsor - The survey sponsor is usually a Federal, State or local government agency, although there is no reason why a watershed association or other citizen group could not sponsor a SCA survey. The main responsibilities of the survey sponsors are to help finance the survey, to work with the survey manager to notify watershed residents of the survey and to work with watershed stakeholders after the survey is completed to address the problems identified.

Survey Manager - The survey manager is the individual that is responsible for making sure the SCA survey is done properly and that information collected during the survey is compiled in a way that will be useful to the survey's sponsor. The survey manager will oversee all aspects of the survey. The individual is usually responsible for data analysis and producing a final product for the survey's sponsor.

Data Manager - The data manager is the individual responsible for overseeing management of the data collected during an SCA survey. While the survey crew will usually be responsible for entering survey data into the project database including scanning all photographs into a digital photo album, it is the responsibility of the data manager to insure that this work is done properly. The data manager is also responsible for making sure that the data, scanned photographs and maps have been properly verified and all the information entered into the project digital databases are accurate. The data manager is also responsible for insuring that the original data sheets and maps are properly archived and that all digital data is not only properly stored, but also backed up. In general, the data manager is responsible for overseeing all data quality assurance work.

GIS Manager - The GIS manager is responsible for providing the map products for the initial field survey work and for producing the finished maps that are used to analyze the data collected. At the beginning of the survey the GIS manager will usually produce a base map of the entire watershed and a series of field survey maps to be used by field teams during the survey. After the field work has been completed and the information entered into the project database, the GIS manager will make sure that station location data is entered correctly into the GIS system and verified. The GIS manager will then work with the survey manager to produce a series of maps to display the information collected during the survey so that it can be analyzed and used by the survey's sponsor.

Survey Crew Chief - The survey crew chief (usually the MCC crew chief) oversees the daily work of the field teams during the survey. The crew chief is responsible for determining when and where the field teams will be working, making sure that the field teams have all the equipment that they need and coordinating travel logistics. The crew chief is also responsible for overseeing data entry and data verification. One of the main duties of the crew chief is to act as a conduit between the field teams and both the survey manager and sponsor to resolve any questions or problems that might arise during the survey.

Field Teams - Field teams are composed of two to four trained individuals. Each field team will have a team leader who will work with the survey crew chief to coordinate the activities of their team with those of the other survey teams. Team leaders are responsible for making sure that the team has everything that it needs before the survey begins each day and for reviewing the data sheets and map at the end of the day to make sure they are complete.

1.5 MARYLAND CONSERVATION CORPS AND OTHER SURVEY VOLUNTEERS

While almost any group of dedicated volunteers can be trained to do an 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 is a federal program started in the early 1990's to promote greater involvement of young volunteers in their communities and the environment. The MCC program is managed by the Forest and Park Service within the Maryland Department of Natural Resources. 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. In addition, once the locations of specific types of environmental problems are known, the MCC represents a resource to help correct some of these problems. 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.

In addition to the Maryland Conservation Corps, a number of government and community based environmental groups have also received some training and have participated in the SCA survey over the last few years. Usually this training has been done as part of a specific watershed restoration effort. Depending on the circumstances, government and/or community volunteers have received from one hour to several days of training. The amount of training will depend on both the volunteers' level of participation in a survey and their previous experience. In most past cases, volunteers have received 1 to 2 hours of training to introduce them to the survey. The volunteers will then accompany a fully-trained field team on the survey. This short introductory training, followed by the volunteers accompanying an experienced field team, has worked very well with community and government agencies who are interested in participating in the SCA survey but do not plan to do the survey on a regular basis by themselves. For a group to be able to conduct the survey on their own, more extensive training is usually needed. MCC crew members receive several days of training, which is discussed in Section 2.1. Individuals who have a background in stream ecology and correcting environmental problems can usually be trained to do the survey in 1 or 2 days. It is important that even after an individual has been fully trained on how to do the SCA survey, they initially accompany a more experienced individual for several days so they gain experience in consistently rating different types of environmental problems. In conducting an SCA survey it is also very important to remember that collecting good quality data is only the first step. The data collected as part of this survey is of limited value unless the necessary work is also done to compile, examine, and communicate results. Record keeping, data analysis, and report writing are all unglamourous but very necessary steps that are all needed to make the SCA survey truly useful.

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2.0 HEALTH, SAFETY AND RESPECTING PRIVATE PROPERTY

2.1 TRAINING

As discussed in Section 1.3, the SCA survey is based on an earlier "Stream Survey," developed for DNR's Adopt-A-Stream program. The Adopt-A-Stream "Stream Survey," was designed to be done by community-based watershed associations and training was usually limited to viewing a 45 minute slide show just prior to going out into the field. While the survey remains a good exercise to get citizens to go out and take a critical look at their local stream, in most cases the information provided is insufficient to fully characterize and prioritize future restoration activities. Citizen volunteers with limited training can learn to recognize that a certain environmental problem may exist along a stream, but are usually unable to fully describe the problem or evaluate its severity.

To avoid the problems that can result from using a large number of volunteers with limited training, the SCA survey is designed to be done by a smaller, well-trained groups. It is not necessary for those conducting an SCA survey to be an expert in stream ecology and/or fluvial hydrology, and almost any dedicated group of individuals can be trained to do the survey. It is important, however, that as part of that training individuals receive a basic understanding of how streams function and the impact that human activity can have on aquatic resources so that they can properly record data and rate different problems. Most of the large watershed surveys that have been done over the last few years have been done by the Maryland Conservation Corps although other groups have participated in SCA surveys (See Section 1.5).

For individuals with a limited background and understand of stream ecology, several days of training and practice is usually necessary prior to the beginning of an SCA survey. The training includes both inside lectures and outside field exercises. During the first day of training , survey crew members learn about the biota that lives in streams and what is important for their survival. A morning lecture is followed by an afternoon field visit to a healthy stream to examine the fish, macro-benthic invertebrates, and instream habitat. On day two, the physical aspects of how streams function are examined. During the afternoon of day two, trainees visit a stream in poor condition usually with severe channel stability problems. On day three of the training, survey crew members review the survey protocols and discuss the survey. On the fourth day, the class is broken up into several groups and trainees practice conducting an SCA survey while being monitored by the instructors. On the final day of formal training, the class will practice organizing the data collected during the previous field day and learn how to enter survey data into an Access database. A final review of the survey field procedure will also be done at this time. After the formal training is completed, less experienced personnel will be paired with veteran surveyors and will continue their training in the field. Training also includes an initial review of survey results after the survey teams have been in the field for approximately 1 to 2 weeks.

2.2 SAFETY

When conducting this or any other field study it is imperative that safety be the number one concern of all involved. The information collected during this survey is not worth endangering either yourself or others. The basic rule you should always follow is: **If you have serious concerns about the safety of an activity - <u>DON'T DO IT</u>!** If you have a question about your safety or the safety of others, you should immediately talk to your supervisor or the survey manager.

The SCA survey involves spending extended periods of time walking, both in and along a stream, in a variety of different weather conditions. It is very important, especially during cold weather periods, that survey members wear the proper clothing and take the proper steps to insure that they are both safe and comfortable. All survey crew members should have a good pair of hip boots to wear while doing the survey. Hip boots are usually worn during most of the year; however, some individuals may prefer to wear hiking boots and long pants during the summer. Be especially careful when walking over wet rocks that are covered by algae. Avoid standing on the top of the rocks and do not go into water greater than waist deep, especially if there is a strong current present.

Survey teams should always carry backpacks with a first aid kit, drinking water and rain gear if there is a possibility that it may rain. During hunting season all survey team members must wear blaze orange and avoid any areas where there are indications that hunting is occurring. Finally, survey teams should always be made up of at least two crew members and should carry a radio so that they can contact the survey crew chief in case of an emergency.

Not all safety concerns can be identified before hand and it is very important that you use your best judgement. **Remember, it is better to be safe than sorry!** In conducting an SCA survey you should always put safety first.

2.3 RESPECTING PRIVATE PROPERTY

In conducting the SCA survey it is extremely important that everyone involved in the survey is respectful of the private property of the people who live along the stream. One very helpful way of doing this is to notify by mail all of the property owners along the stream where a survey is being done. More information on notifying private property owners is given in Section 3.7.

While conducting an SCA survey, field teams will often meet people who will want to know what you are doing. While you do not have the time to engage in an extended conversation with them, you should always take the time to briefly explain what you are doing and why. If the person wishes to obtain additional information, you should give them a copy of a letter that you will be provided by the survey sponsor. The letter will explain why you are doing the survey and also provide a contact number of someone they can call for additional information. Example of a contact letter is shown in Appendix A.

If you are approached by someone who is upset that you are out on the stream you should be respectful of the person and answer any of their questions. You should also provide them with the sponsor's contact letter and apologize for any inconvenience the survey may have caused them. **Under no circumstances will you engage in an argument with the individual.** If the property owner asks you to leave their property you should do so immediately. If the property owner asks to speak to your supervisor, you should contact him or her immediately by radio.

3.0 PREPARING FOR A SURVEY

3.1 SELECTING A WATERSHED TO SURVEY

Over the past several years, the SCA survey has been done on fairly small stream systems, such as the streams flowing through State Parks and on larger watersheds which involved surveying more than 200 miles of stream. While the SCA survey can be done on any size non-tidal waterway, it is important that whenever possible, the survey be done on a watershed basis. One of the main goals of the survey is to develop a prioritized list of problems to be corrected throughout the entire watershed. When prioritizing stream restoration or recommending improved storm water management, it is important that the area be looked at as a complete ecological system and that management activities be targeted at those areas where they can do the most good.

The main consideration in selecting a watershed for an SCA survey is whether there is a local sponsor that can help correct the problems identified in the survey. Almost all of the problems identified in the SCA survey have solutions. Implementation of those solutions, however, takes time and commitment.

Past SCA surveys in Maryland have usually been done in a partnership with county governments. In a few small SCA surveys the sponsor has been the Maryland Park Service or a local environmental organization. Whoever the local sponsor is, it is important that after the survey is completed, someone has been identified as taking the lead in working with watershed stakeholders to correct the problems identified.

3.2 PARTNERING WITH WATERSHED STAKEHOLDERS

In addition to working with a local sponsor, it is also very important that a variety of government and non-government groups be contacted during the planning stages of the survey. The main purpose in contacting these groups is to let them know that an SCA survey is being done and to solicit their assistance in correcting the environmental problems identified.

The groups to contact about an SCA survey will vary depending on the watershed and who are the major stakeholders in that watershed. Some very important partners in any SCA survey will be the local county, city and town governments. In most of DNR's past surveys local governments have been the study's sponsors. It is very important that if local governments are not the survey's sponsor that they at least be a very active participant in it.

In watersheds where agriculture is a dominant land use, it is very helpful if the local Soil Conservation Districts (SCD) are involved in the survey. SCD agents often know most of the farmers in the watershed and can assist survey teams in gaining access to the streams that run through farms. In addition, SCDs are usually the lead agencies working with farmers to correct agricultural pollution problems. SCDs administer a number of programs that can assist farmers in installing Best Management Practices (BMPs) on their farms.

Other groups that may be contacted and/or have been involved in past SCA surveys in Maryland are:

Federal Government
- ☐ U.S. Army Corp of Engineers
- ☐ U.S. Fish and Wildlife Service
- ☐ U.S. Department of Agricultural
- ☐ U.S. Department of Defense

State Government
- ☐ Maryland Department of Natural Resources
- ☐ Maryland Department of the Environment
- ☐ Maryland Department of Agricultural
- ☐ State Highway Administration

Local Government
- ☐ County, City and Town Environmental, Public Works and Planning Agencies

Environmental Groups
- ☐ Watershed Associations
- ☐ Maryland Save-Our-Streams
- ☐ Trout Unlimited
- ☐ Audubon Naturalist Society
- ☐ Izaak Walton League
- ☐ Chesapeake Bay Foundation
- ☐ Alliance for the Chesapeake Bay

3.3 MAPS & GEOGRAPHICAL INFORMATION SYSTEMS

During an SCA survey, field teams walk a watershed's entire stream network and record the location of environmental problems on field survey maps. Information collected during the field surveys is later entered into computer databases and the location of sites entered into a Geographical Information System (GIS). Modern GIS systems have proven to be very important in not only producing a good set of field survey maps at the beginning of the SCA survey, but also for displaying survey findings.

While a variety of different types of maps have been used in past surveys, we have found that a series of 200 scale (1 inch = 200 ft.) topographic maps printed on 11" x 17" paper works the best. Using the GIS systems that are available in many of Maryland's urban counties, a grid system is set up and a series of field survey maps are produced for the entire watershed. Each map is given a unique 3-digit number and a master map is also produced that shows the location of all the maps in the map grid system. In most surveys two sets of field survey maps are produced and the maps are laminated for field use. A Sharpie pen is used to record field information on the laminated maps.

While the information on the field survey maps will vary depending on the capabilities of the GIS system being used, it is important that only information that will be useful to the survey teams be printed on the maps. Maps with too much information are often difficult to read. It is also helpful if the maps are printed in color. However, color printing can be expensive, and black and white maps in which the streams are highlighted with a marker prior to being laminated have also worked well.

When producing a series of 200 scale GIS maps is not possible, enlarged versions of the United States Geological Service's 7.5 minute quad maps have been used. These maps can be produced using many GIS systems and commercially available map display programs. It is important when altering the size of the map that a scale bar also be enlarged at the same time and affixed to the map before laminating. Field survey teams will often use the map scale when they have to estimate long distances.

3.4 SURVEY EQUIPMENT

The equipment used in the SCA survey is divided into three categories: survey crew equipment, survey team equipment, and survey member equipment. Survey crew equipment is the equipment and supplies that are shared by all of the survey teams and will usually be left in a vehicle while crew members are doing a survey. Survey team equipment is the equipment and supplies that are shared by the members of a survey team and carried with them during the survey. Finally, survey member equipment is the equipment and supplies that are the responsibility of individual crew members. A list of equipment used by field teams in the SCA survey is shown in Table 3.4-1.

Table 3.4-1. SCA Field Equipment List.

Survey Crew Equipment

- ☐ vehicles with 2-way radios
- ☐ filled large water container
- ☐ soap (wash hands after survey to reduce exposure to poison ivy)
- ☐ boot repair materials
- ☐ road map of watershed

Survey Team Equipment

- ☐ survey protocols
- ☐ backpack
- ☐ clip board with a compartment to store data sheets
- ☐ data sheets and a spare set of data sheets in a sealed plastic bag
- ☐ survey maps (laminated)
- ☐ watch
- ☐ waterproof pens
- ☐ pencils
- ☐ camera (internal light meter and clock)
- ☐ extra film (400 ASA)
- ☐ spare camera battery
- ☐ site number board
- ☐ tape measure
- ☐ first aid kit
- ☐ portable 2-way radio
- ☐ brush clippers (to help get through multiflora rose)
- ☐ bug spray and tick repellant
- ☐ boot repair material
- ☐ compass

Survey Member Equipment

- ☐ hip boots
- ☐ proper clothing (always wear long sleeve shirts and long pants)
- ☐ rain gear
- ☐ spare set of clothes in vehicle (optional)
- ☐ lunch and other snacks
- ☐ filled water bottle (especially in warm weather)
- ☐ allergy and other medicines

3.5 LOGISTICS

The SCA survey works best if each survey team has two vehicles. First, the survey team will identify which stream segment will be surveyed that day and where they are going to enter and exit the stream. The entire team will then go to the exit point and park one of the vehicles. Everyone will get into the second car and travel to the stream entry point, where they will park the second car. The team will then survey the stream until they reach their exit point, where they will pick up the vehicle left there. The team will then travel back to the point where they entered the stream and retrieve the second vehicle.

While having two vehicles per survey team does work best, it is very rare that an MCC crew will have sufficient vehicles to place one at the entrance and exit for each team. In fact, for most of the SCA surveys done in Maryland the MCC has had three or more teams surveying a stream and only one or two vehicles to work with. Under this situation, one of the MCC crew members will usually stay with a vehicle during the survey to pick-up and drop-off survey teams. Between the morning drop-offs and afternoon pick-ups the crew member in the car will monitor the progress of the survey teams. This is done by both waiting at road crossings survey teams will pass during their survey and by contacting survey teams periodically using radios.

3.6 TEAM MEMBER ASSIGNMENTS

Survey teams should be established at the beginning of the survey and given a team identification number between one and nine. The members of each survey team remain the same during the entire survey. Past surveys have found doing this to be very helpful when organizing photographs and resolving questions about the data collected. When the survey methods were first being developed, crew members rotated between survey teams and organization of the data was put off until the end of the survey. Survey crew members found organization of the photographs and correction of occasional discrepancies on data sheets to be both difficult and time consuming. In some cases, areas had to be resurveyed because of unanswered questions about the data. By maintaining the same people on each survey team, it is much easier to identify who collected the data. It is also important that the photographs be organized and the data sheets entered into a database routinely during the survey. The sooner this is done after the data is collected, the fresher the memories of those involved will be, and the greater the likelihood that any problems can be resolved quickly.

In each team, one person will usually be assigned as the team leader who will be responsible for making sure that the team has all the equipment and supplies that it will need each day. The team leaders from each team will coordinate between themselves and the survey crew chief to determine which sections of stream will be surveyed each day and where individual teams will enter and exit the stream.

3.7 IDENTIFYING AND NOTIFYING PROPERTY OWNERS IN SURVEY AREA

During the initial planning stage, a list of property owners along the streams to be surveyed should be compiled. This can be done fairly easily using a Geographical Information System (GIS) database of State tax maps. Both the DNR's GIS system and many county GIS systems have electronic files of the State's tax maps on their systems.

Once a list of property owners has been compiled, a letter should be sent to every property owner notifying them that the Stream Corridor Assessment (SCA) survey is being done in their area. It is usually best if the letter is sent by the local government agency sponsoring the survey. An example of a property owner notification letter used in a past survey is presented in Appendix B. Stream reaches on the property of anyone who objects to having survey members cross their property will be excluded from the survey. In addition, survey members will not cross fenced areas or enter areas marked "no trespassing" without obtaining permission from the land owners. These are the same procedures that were used during the Swan Creek survey in Harford County. Of the five hundred and seven property owners that were notified prior to the survey, only six individuals notified the County that they did not want survey teams on their land. The restriction on crossing these areas was not a major impediment to performing the stream survey.

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4.1 IDENTIFYING ENVIRONMENTAL PROBLEMS

One of the main objectives of the SCA survey is to identify environmental problems present within the stream corridor that can be seen by walking along a stream and being observant. As mentioned in the introduction (Section 1.0) the SCA survey is not intended to be a detailed scientific investigation, but a quick survey of the drainage network in a watershed. The problems identified in the SCA survey are, for the most part, fairly obvious. It does not require an advanced college degree to identify a stream reach that does not have any trees along it, or a place where trash is being dumped near a stream. For some problem categories such as erosion sites or fish barriers, there can be cases where there is a question whether a specific problem is present and should be included in the survey. For example, erosion is a natural process and even on healthy streams there will be some evidence of erosion, especially in a stream's bends. It is not the purpose of the SCA survey to map every site where natural stream erosion is occurring. Survey members must use their best professional judgement to determine if the bank erosion they see on a stream is an indication of an unstable stream channel and if it is an environmental problem. For the most part, these judgement calls only result when the problem is considered borderline. In instances where there is a significant environmental problem present, it is usually very obvious.

While identifying an environmental problem is usually not difficult, properly characterizing the severity and correctability of a problem does require some experience. Survey crew members receive several days of training, which includes both slide presentations of the different problems identified in the SCA survey and field visits to problem sites. Whenever possible, experienced survey members are paired with less experienced individuals to receive additional training during the survey. Because the level of experience can vary among survey teams, it is important that the survey crew chief monitor the survey teams on a daily basis to be sure the survey is done in a consistent manner. The photographs that are taken at each site can also help monitor the work of each team and adjustments to the ratings can be made based on review of the photographs by the survey manager or other experts.

4.2 ASSIGNING A SITE NUMBER

It is very important that before beginning an SCA survey, a system is established to assign field identification numbers to problem and representative sites. In order to enter the information into a database, each survey site must be given a unique number that will distinguish it from all other sites in the survey. Several numbering schemes have been used over the years and most have worked fairly well. At present, a 6-digit number is being used in most of the SCA surveys done by the Maryland DNR. In our present numbering system, the first three numbers of the field identification number are the map numbers. Prior to beginning the survey one or more complete sets of maps of an area's drainage network are produced and each map is given a Map ID number (Section 3.3). The fourth number in the field identification number is the team number which is given to each team at the beginning of the survey (Section 3.6). The last two digits are the site numbers which are assigned to each field site starting with the number 01 on each map (Figure 4.2-1). We have found that this numbering system has several advantages. First, survey teams do not have to remember the last site number that they used, but can begin with site 01 on each map. Second, if two teams are using the same map to cover different stream segments, the field identification number will be different because the team numbers (4th digit) will be different.

Figure 4.2-1. Photograph showing site number board at a site with an inadequate stream buffer.

Some problems such as erosion or inadequate stream buffer can extend over fairly long reaches of a stream. In assigning field identification numbers to these problems and noting their location on field maps, it is important that the site ends where it joins with another stream. For example, if surveying a small tributary that has an erosion problem and you come to the point where it enters a larger stream, you should end the erosion site at the tributary's mouth even if there is an additional erosion problem downstream. The erosion problem in the larger stream would be given a separate field identification number because the erosion problem may not only extend downstream but also upstream of where the smaller tributary enters the larger stream (Figure 4.2-2). This does not mean, however, that when surveying a stream that has an inadequate buffer or erosion problem along the stream mainstem that you must stop and assign a new field identification number where each small tributary enters the stream. In this case, a new field identification number would only be needed where two similar size streams come together and both streams have the same problem.

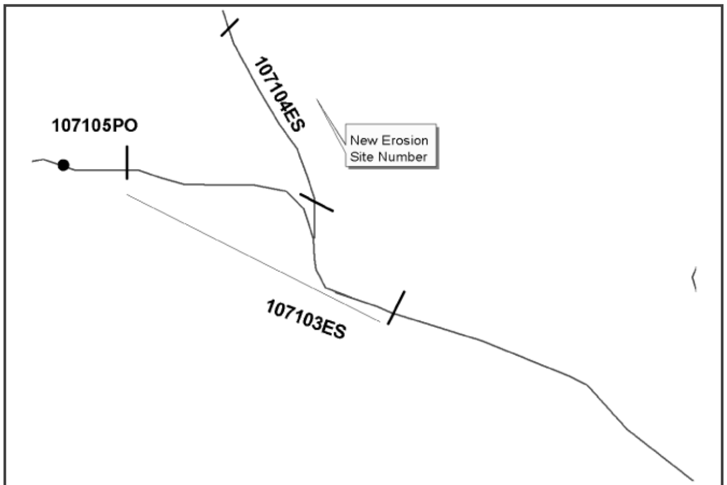

Figure 4.2-2. Example showing how field maps should be notated when tributary and mainstem have the same problem.

While each site must have a unique site number, it is not uncommon to identify two or more environmental problems at one site. For example, a survey team may find an area with an inadequate stream buffer, an erosion problem and a fish barrier all along the same stream reach. As long as all the problems are within the same limited area, it is not necessary to give each problem its own field identification number. A single field identification number will be sufficient for the site with separate data sheets filled out for each problem. It is possible to assign two or more different problems to the same field identification number because each problem is given a two-letter problem identification code when it is entered into the database. The problem identification codes can be seen on the upper right-hand corner of the data sheets (Appendix C). The combination of the field identification number and problem identification code provide a unique identification code for each identified problem in the database.

When assigning two or more problems the same field identification number, each problem should be located within the same limited area. For example, a trash dumping site that also has a discharge pipe present at the same location could be given the same field identification number. If however one of the problems, such as erosion, extends over a long reach of stream and within that stream reach there is a fish barrier, the fish barrier should be given a separate field identification number. This is because in follow up investigations, surveyors need to be able to relocate problem sites quickly and should not have to search over a long stream reach to find a previously identified problem.

While two or more different problems can have the same field identification number, if there are two or more of the same problems at a site then each problem must be given its own field identification number. For instance, in urban areas there occasionally may be two or more pipe outfall discharging to the same site. When this occurs, each pipe outfall must be given its own individual field identification number.

In addition to assigning field identification numbers to problem sites, the same numbering system will be used for representative sites. Representative sites (Section 4.6.11) are used to document general conditions of both in-stream and riparian corridor habitat. The sites are premarked on survey maps at the beginning of the study and spaced at approximately 1/4 to1/2 mile interval along the stream. When survey teams reach a predesignated representative site they should assign the next field identification number to that site. If any other environmental problems are present, they can also be given the same field identification number.

4.3 RECORDING PROBLEM LOCATION ON A MAP

It is very important that survey members accurately record the location of all environmental problems on their survey maps so that follow up studies will be able to locate problem sites. Problems such as pipe outfalls, trash dumping, exposed pipes, fish barrier, and representative sites are usually represented on the survey map by a large dot. Next to the large dot the field identification number and two letter problem code should be written on the field map. Other problems such as channel alteration, erosion sites, and inadequate buffers (which can extend over fairly long stream reaches) are usually represented by a line on the map showing where the problem is located. Next to the line, both the field identification number and two letter problem codes should be clearly written. In some cases the problem will extend from one map onto an adjacent map. When this occurs, you should not change the field identification number simply because the map number has changed. The field identification number will be the same on both maps and should be clearly written on both maps.

4.4 PHOTOGRAPHING A SITE

At all problem sites one or more photographs should be taken. Photographers should keep in mind that the photographs will be reviewed by the survey manager and other experts, and should clearly show the problems at the site. At all representative sites photographs should be taken looking both up and downstream. In general, these photographs should be long view photos that show the general condition of the stream and adjacent riparian zone. In all photographs, a number board should be present that clearly shows the site's field identification number. It is important, especially when photographing long view shots, that the number board be close enough to the camera so that the numbers on the board are clearly visible. Past studies have found that when a number board was not used, photo identification and sorting was much more difficult. In addition to a numbering board, it is helpful if a person or measuring stick is also present in the photograph to help provide a sense of scale to the photograph. If asked to stand in a photograph to help provide a sense of scale, look at the camera and act professionally. Please remember that these photographs will be reviewed by several people and may be included in both talks and publications.

The camera used to photograph problems and representative sites must have an accurate internal light meter. It is also helpful if the camera is fairly small, light weight, water resistant and has an internal clock. The majority of the photographs taken during a normal SCA survey will be under poor light conditions. Earlier attempts to use disposal cameras which do not have light metering systems produced very poor quality pictures. Because of the usual poor lighting conditions, 400 ASA print film should always be used. Try to avoid aiming the camera directly into the sun or at highly reflective surfaces. Finally, it is helpful if the camera has an internal clock and is able to print the date on the photograph. Having the date printed on the photograph has proven to be very helpful in sorting photographs. Of course, the date should be checked at the beginning of the survey each day to make sure it is accurate.

One or more photographs are taken at all problem sites and two photographs (one looking upstream and another looking downstream) are taken at all representative sites. You should take as many photographs as you need to properly document a problem or set of problems without wasting film. After the photographs are taken you should indicate the film exposure numbers on the data sheets (Appendix C).

4.5 FILLING OUT DATA SHEETS

All data sheets should be filled out completely using either a pencil or waterproof pen. Do not use regular pens because the ink will run if the data sheets get wet. The data sheets have been designed to provide a selection of most likely answers whenever possible. If an appropriate choice is not given, you should circle "**O**ther" and write in an appropriate answer to that question. On questions that do not provide a selection of possible answers, simple write in the appropriate answer. If you do not know the answer to a question you should write "**U**nknown" in the appropriate space and at the end of the day talk to the survey crew chief for clarification on what the correct response should be. If a correction to the data sheet is needed, it should be done as soon as possible.

When asked to provide a length or height measurement, the number you write down on the data sheet should be the most accurate value you can provide without spending an inordinate amount of time collecting the data. A tape measure or ruler should be used to make most measurements. For moderately long distances it may be necessary to pace off the stream length to provide an accurate distance estimate. If very long distances are involved, you can use you field maps to estimate the length of stream affected by the problem. Please remember, you want to provide the most accurate data possible; however, SCA is not a detailed survey and accurate estimates of some measurements are permissible.

All measurements done during an SCA survey will be in standard English units. On the data sheets the appropriate unit will be shown to the right of the space provided for the data. The data must be provided in the units indicated to be properly entered into the database. For example, if asked to measure the diameter of a pipe with a 4 feet wide opening in inches, you should always write 48 inches, not 4 feet. All pipe diameter measurements will be done in inches and the measurement required is the inside diameter. In some cases, such as when recording an exposed pipe, you will not be able to measure the inside diameter of the pipe directly. In these cases you should measure the outside width of the pipe if possible and estimate the internal diameter. Bank height and length are always measured in feet. In the case of bank height, the measurement is taken from the base flow water level to the top of the bank. If the height of the bank involves a fraction of a foot, the value should be recorded in 10ths of feet. For example, a stream bank that was 1 foot 6 inches high would be recorded on the data sheets as 1.5 feet.

4.5.1 SEVERITY, CORRECTABILITY AND ACCESS RATINGS

To help prioritize future restoration work, all problem sites are evaluated and scored by field crews on a scale of one to five for three separate areas: problem severity, correctability and accessability. These scores are subjective and based on the field crew's evaluation at the time of the survey. While the Maryland Conservation Corps members receive a week of training on how to do the survey, the overall experience of individual Corps members is usually limited. Often they do not have the background to provide a definitive evaluation of the severity or correctability of a particular problem. The rating should therefore be viewed as the field team's opinion of the worst problem within a specific problem category and which problems they believed would be the easiest to correct. The scores provide a starting point for more detailed follow up evaluations by individuals that are more experienced dealing with specific problem categories. This is initially done by reviewing the data and photographs collected by the field teams and can involve follow-up field visits as well. As additional information about a specific problem site is obtained, the site's severity, correctability and/or accessability ratings can change.

While the criteria for rating problem severity, correctability and access can vary among different problem categories, the general guidelines used by survey teams to assign these values are as follows:

Severity Rating

The severity rating is a rating on how bad a specific problem is relative to other problems in the same problem category. It is used to answer questions such as, where did field crews believe the worst erosion problems were, or where was the largest section of stream with an inadequate buffer? In general, the scoring is based on the overall impression of the survey team of the severity of the problem.

Rating of 1 is for the most severe problems that appear to have a direct and wide reaching impact on the stream's aquatic resources. Within a specific problem category, a 1 rating indicates that the problem is among the worst that the field teams have seen or would expect to see. Rating is based on comparison to good and bad reference sites seen during training. Examples would include a discharge from a pipe that was discoloring the water over a long stream reach (greater than 1/2 mile) or a long section of stream (greater than 1/2 mile) that had incised several feet with unstable banks that are showing signs of eroding at a fast rate.

Rating of 3 is for moderately severe problems that appear to be having some adverse impacts at a specific site. While a rating of 3 would indicate that field crews did believe it was a significant problem, it also indicates that they have either seen or would expect to see much worse problems in that specific category. Examples would include: a small fish blockage that may be passable by strong swimming fish like trout, but was a barrier to resident species such as sculpins; or a site where several hundred feet of stream has an inadequate forest buffer but the banks do have vegetation on them and are stable.

Rating of 5 is for minor problems that do not appear to be having a significant impact on stream and aquatic resources. A rating of 5 indicates that a problem was present but compared to other problems in the same category it would be considered minor. An example 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.

Correctability Rating

Correctability ratings provide a relative measure on how easily the field teams believe it would be to correct a specific problem. The correctability rating can be helpful in determining which problems to initially examine when developing a restoration plan for a drainage basin. One restoration strategy would be to 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 engineering efforts.

Rating of 1 is for minor problems that could 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 a 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 truck loads of trash from an easily accessible area or planting trees along a short stretch of stream.

Rating of 3 is for moderate size problems that may require a small piece of equipment, such as a backhoe, and some planning to correct. This would not be the type of project that volunteers would do by themselves, although volunteers could assist in some aspects of the project, such as final landscaping. This type of project would usually require several days 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.

Rating of 5 is for major restoration problems which would require a large expensive effort to correct. These projects would usually require heavy equipment, significant amount of funding ($100,000.00 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.

Accessibility Rating

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

Rating of 1 is for a site that is easily accessible both by car or 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, it could easily access the site using existing roads or trails.

Rating of 3 is for 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.

Rating of 5 is for 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 over a mile. If equipment were needed to do the restoration work, an access road would need to be built over a long distance through rough terrain.

4.6 DATA SHEET DESCRIPTIONS

The data sheets for the SCA survey are provided in Appendix C and are designed to record basic information about a problem that can be collected quickly. These data sheets have been developed over several years and have been modified several times. There are a total of 10 separate data sheets used in this survey. There are 9 problem data sheets including an Unusual Condition/Comment data sheet, which can be used to record information on problems not addressed by the other data sheets. The last data sheet is the representative site data sheet which is filled out at 1/4 to1/2 mile intervals during the survey to help document the general condition of both in-stream habitat and the condition of the adjacent stream corridor.

The data sheets presented in the protocols represent a core set used in the Maryland's SCA survey; however, additional data sheets may be added to a survey when a particular problem is known to exist in the area and collecting data on the problem is of special interest to the survey's sponsor. For example, in a survey of Neff Run in western Maryland, acid mine drainage was known to be a problem in the area. While an acid mine seep could be reported as an Unusual Condition, a special data sheet was developed and survey crews used litmus paper to measure the pH of the stream and discharges during the survey. Adding special data sheets to address problems that may be unique to an area does help to refine the information that is collected by survey teams. When developing new data sheets, it is important to remember that the SCA survey is not intended to be a detailed scientific investigation. Instead, the SCA survey is designed to quickly identify potential environmental problems along a stream corridor.

4.6.1 CHANNEL ALTERATION

Channelization refers to the once common practice of dredging, straightening and/or widening stream channels in an attempt to reduce flooding or to lower the ground water table. The use of channelization to control flooding has been historically referred to as "stream improvement." It was given this name because the engineers who designed these projects were attempting to improve the hydraulic capacity of the stream to transport flood waters through an area. This was done using a number of different approaches, including: widening the stream channel so it would hold more water, building berms along the edges to the stream to hold the flood flow in the channel, straightening the stream to increase the slope of the water to move it faster through an area and/or reducing the roughness of the stream channel by constructing a smooth channel out of concrete. A channelized stream section is shown in Figure 4.6.1-1. In addition to flood control projects, channelization has also been done in some areas to help lower the ground water table to drain adjacent wetlands and crop land.

While channelization can be partially effective at reducing flooding or lowering the ground water table in an area, it can also have a variety of negative environmental impacts. Channelized steams often have poor instream habitat for aquatic organisms. They can be a barrier to fish migrations, and in areas where the riparian buffer has been removed, the water in the stream can be heated by the sun during the day reducing its oxygen holding capacity and raising water temperatures

Figure 4.6.1-1. Photograph of a channel alteration site.

above the tolerance limits of some fish species. In addition, while channelization may be able to reduce flooding in one specific stream reach, often it increases flooding downstream.

In the past, channelization was a common practice in many areas. For example, in one Maryland county there is estimated to be more than100 miles of stream that have been replaced with concrete trapezoid channels. Fortunately, because of the high cost, limited benefits, and significant environmental impacts, widespread stream channelization is not done any more. In fact, in recent years there have even been several projects in Maryland to remove concrete channels and restore them to a more natural stream shape.

While widespread stream channelization does not occur anymore, small projects to relocate a section of stream as part of a highway or development project still occur. These projects, however, do receive a significant amount of oversite by State and Federal government agencies that issue waterway construction and wetlands permits for this work. New techniques also have been developed that can help minimize adverse environmental impacts of these projects.

Survey teams should look not only for stream reaches that are in concrete channels but for any areas where the stream has been significantly altered. A good indication of this is an unusually straight stream channel for a fairly long stretch. Unless the area has a lot of large rock (bedrock, boulders or large cobble) and/or the stream is moving down a fairly steep slope (usually > 4%), the stream should have some meander pattern or sinuosity.

Channelized stream reaches are sections of streams where most of the stream's channel is affected over a significant length (greater than 50 feet) of the stream. In conducting an SCA survey it is important that survey teams concentrate on identifying and recording important stream problems. It is common when doing a stream survey to find short sections of stream where stone has been placed along the stream's banks to stabilize an area. This is often done to stabilize the portion of the stream's banks disturbed during construction of a pipeline that passes under a stream. In most cases, if only one side of the stream is impacted and/or the length of stream affected is less than 50 feet with no other environmental problems present, then there is no need to fill out a channel alteration data sheet. For the purposes of this study, channel alteration does not include road crossing unless a significant amount of stream channelization has occurred either up or down stream of the road crossing. 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. Finally, the term channel alteration would normally not apply to some of the more recent stream restoration projects that have been built in the last few years. In areas where a stream restoration project has been recently done, the team should fill out an Unusual Condition/Comment data sheet briefly describing the area as well as estimating the length of stream that was restored.

DATA SHEET FOR CHANNEL ALTERATION

Map, Team, Site, Date and Photo Numbers:

Fill in the appropriate site identification information on the top of the data sheet and on the field maps. Also, record the date and film exposure numbers for the photographs taken at the site.

Type:

Indicate on the data sheet if the channelized stream section is constructed of concrete, rip-rap, gabion baskets or an earthen channel. These are the most common types of channelized stream sections that will be encountered. If the channel is constructed by some other means or using a combination of construction materials, then indicate it in the space provided. Also fill out an unusual condition/comment sheet and give additional information on the channel design.

Bottom Width:

Measure the width of the stream channel in inches. If the channel varies in width then indicate the average or best representative width for the portion of stream that is channelized. If the channelized stream reach is divided into two sections of significantly different widths, then you may need to fill out two or more Channel Alteration data sheets and possibly an Unusual Condition/Comment data sheet.

Length:

Indicate the length of stream that has been affected by channel alteration in feet. One value that is usually calculated in the final report is the total number of stream miles that have been altered. It is important that this number be as accurate as possible. Whenever possible, you should measure the length of stream impacted using a tape measure. If very long distances are involved, you should estimate the distance by pacing it off or measuring the distance on your field survey maps.

Sediment Deposition:

Indicate if there is a significant amount of sediment deposition in the channelized stream section. A significant amount of sediment deposition occurs in areas where the stream has been over widened and the stream is attempting to go back to a smaller more natural channel. Large stable bars inside the channelized stream reach would be an indication of sediment deposition.

Vegetation in the Channel:

Indicate if the bars inside the channelized stream reach have stable vegetation on them. The vegetation must be inside the channel and not simply along the channel's banks. The vegetation can be either woody vegetation such as shrubs and trees, a large amount of grass or emergent wetland vegetation such as cattails. If only a few wildly scattered clumps of grass are present, then indicate **"no"** on the data sheet, because a small amount of grass on channel bars is usually only temporary and will probably be washed away during the next large storm event. Indicating whether stable vegetation is present is important. It is an indication that the stream is in the process of restoring itself by reestablishing a more natural stream channel inside the overly widened channelized stream reach.

Is it part of a road crossing?

Channel alteration is very common above and below road crossings. The channel alteration is done in an attempt to stabilize the stream channel near the road, preventing erosion that could threaten the road and to help move the water quickly under the road crossing to avoid flooding. Indicate on the data sheets if the channel alteration is part of a road crossing and how much of the stream is channelized above and below the road.

Severity

The severity rating of a channelized stream section will depend on the amount of stream affected and the significance of the impact. Factors that should be taken into consideration in assigning your severity rating are:

- ☐ The condition and amount of good instream habitat for fish and macroinvertebrates.
- ☐ Is the water depth so shallow that it blocks the passage of some fish?
- ☐ Length of stream channelized.

- ☐ Is the channelized stream well-shaded or does it contribute to significant temperature increases in the stream?

Figure 4.6.1-2. Severe Channel Alteration

Following are several examples of this rating system.

<u>Severe rating (1):</u> A concrete channel where water is very shallow (less than an inch deep) with no natural sediments present in the channel, and a significant section of stream (i.e., >1000 ft.) has been channelized. An example of a severe Channel Alteration problem is shown in Figure 4.6.1-2.

<u>Moderate rating (3):</u> A stream channel where a moderate length of stream (i.e., > 500 ft.) has been channelized, but the channel has stabilized over time and is beginning to show signs that it is functioning as a natural stream channel. Bars may have formed in the channel and vegetation may be present on the bars. An example of a moderate channel alteration problem is shown in Figure 4.6.1-3.

Figure 4.6.1-3. Moderate Channel Alteration Problem

<u>Minor rating (5):</u> An earthen channel of less than 100 feet with good water depth, a natural sediment bottom and with a channel size and shape similar to the unchannelized stream reaches above and below the impacted area.

Correctability

Once a stream has been channelized, it can be both difficult and expensive to correct the problem. In recent years there have been a few cases where small concrete channels have been removed and a more natural stream channel established. Photographs taken of a restored stream channel before and after restoration work was done are shown in Figure 4.6.1-4. There have also been a few cases where gabion basket or rip-rap channels have been partially restored by sediment covering the artificial channel and a more natural stream bottom formed inside the channelized reach. Factors that should be taken into consideration in assigning your Correctability rating are:

Figure 4.6.1-4. Channelized stream before and after restoration

- ☐ The length of stream impacted.
- ☐ The adjacent land use and whether construction staging or access would be a problem.
- ☐ The need for heavy equipment.
- ☐ How much earth, stone or other material would have to be moved?
- ☐ How much funding would be needed to do this project?
- ☐ Would permits, detailed surveys and detailed construction plans be needed?

Following are examples of this rating system.

Best Correctability (1): A short stream reach (< 100 ft.) that is already beginning to revert into a natural stable channel and only a small amount of work is needed. The new stream channel should have a similar sinuosity and channel dimensions as natural stream reaches up and down stream.

Moderate Correctability (3): A short section of either concrete or stone channel that could be removed or altered fairly quickly using a backhoe, or a longer section of earthen channel that could also be modified fairly quickly using a backhoe. Unless the channel is overly widened and sediment deposition is naturally correcting the problem, the correctability rating will usually be 3 or above.

Worst Correctability (5): A long concrete trapezoid channel with limit space for any restoration work.

Access

The ratings for access are discussed for all problems in section 4.5.1.

4.6.2 EROSION SITE

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. A photograph of a stream section with a stream bank erosion problem is shown in Figure 4.6.2-1. 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 increases, which in turn causes the amount of runoff entering a stream to also increase. The stream channel will adjust over time to the new flows by eroding the stream bed and banks to increase its size. This channel readjustment can extend over decades during which excessive amounts of sediment from unstable eroding stream banks can have very detrimental impacts on the stream's aquatic resources.

Figure 4.6.2-1. Photograph of a stream erosion site.

While a very unstable stream channel with a severe erosion problem is fairly easy to recognize, it is not unusual when conducting an SCA survey to find many areas where only minor or moderate bank erosion is occurring. It is not the purpose of the survey to identify the location of every stream bend where minor bank erosion is occurring. Erosion is a natural process. Even in the most undisturbed watershed you can find 3 to 4 foot high banks on the outside bend of a stream. This is especially true when the stream channel has naturally migrated to the edge of its flood plain and the stream is beginning to erode into an abandoned terrace. When conducting an SCA survey, you are primarily interested in identifying unstable stream reaches that are experiencing a significant amount of erosion along the stream's banks.

DATA SHEET FOR EROSION SITE

Map, Team, Site, Date and Photo Numbers:

Fill in the appropriate site identification information on the top of the data sheet and on the field maps. Also, record the date and film exposure numbers for the photographs taken at the site.

Type:

When a stream channel becomes unstable it will normally undergo a period of readjustment. During this readjustment period, which can last for several decades, the stream channel may deepen and widen to accommodate the change in flow or sediment input that has occurred in the watershed. In some cases, the stream may also show signs of headcutting which appears as an abrupt drop in the bed of the stream. Headcutting will often occur in a stream system's tributaries when the mainstem of the stream has eroded downward and the bed of the tributaries no longer meet the mainstem's stream bed at an even grade. Under these conditions the stream will often form a headcut on the lower end of the tributary and over time the headcut will work its way up the tributary.

It is often very difficult to know exactly where an unstable stream is in the readjustment process without monitoring the stream at several points over an extended period of time. During the SCA survey you will only have a brief look at the unstable stream channel, so you will need to depend on your training, experience and best professional judgement to indicate if you think the stream is still downcutting, widening or headcutting. We realize that this is a judgment call and that even with the most experienced individual some follow up monitoring would be necessary to verify any answer.

Cause:

It is often very difficult to know exactly what is causing an erosion problem in a stream, especially if the problem is caused by a change in hydrology or sediment input from another part of the watershed. At other times, however, a cause of an erosion problem may be obvious. An example would include livestock in the stream or erosion at the end of a discharge pipe. Indicate if there is some obvious cause to the erosion problem. If there is no obvious cause for the erosion problem, indicate that the cause of the problem is "**U**nknown."

Length:

Indicate the length of stream in feet that appears to be unstable and has an erosion problem. This very important measurement will be used in the final report to calculate the total length of stream that has an erosion problem. Whenever possible measure the length of stream impacted using a tape measure. If very long distances are involved, you should estimate the distance by pacing it off or measuring the distance on your map.

Average Exposed Bank Height:

Exposed bank height refers to the height of the exposed stream bank above the water line during base flow conditions. Bank height is measured from the water line to the top of the bank. To estimate average exposed bank height, several quick measurements should be taken of the height of the bank within the erosion site and a rough estimate of the average bank height made. Extensive time should not be taken to obtain this value. Measurement should be recorded in feet.

Land Use:

Indicate the dominant (> 50%) land use in the stream's corridor on both the left and right sides of the stream. The left and right sides of a stream are determined when you are facing downstream. Land use choices on the data sheets include "Crop fields, Pasture, Lawn, Paved, Shrubs and Small Trees, Forest, Multiflora Rose." In making your determination, the area closest to the stream (ie., within 50 feet) is the area of greatest interest. If more than one land use type is present on the bank, choose the one that best describes the area's overall land use. Pick only one land use category because the database will only accept one land use entry for each side of the stream. If none of the listed categories accurately describes the land use near the stream, circle "**O**ther" and enter an appropriate answer.

Is infrastructure threatened?

Indicate if infrastructure is or will be threatened by stream bank erosion at the site. For the purpose of this study, the term infrastructure refers to both public works systems such as roads and pipe lines, as well as any man made structure, such as a shed or a fence that could be affected by continued erosion at the site in the near future (within 10 years). If you answer yes, make sure you take a photograph of the infrastructure element that is being threatened and describe it in the space provided on the data sheet.

Severity

Accurately rating the severity of an erosion site can be one of the more difficult parts of the SCA survey for individuals who have not walked many streams. There is a tendency for inexperienced individuals to overrate moderate erosion problems and to totally ignore minor erosion problems. It is important during the SCA training that survey members visit several sites with varying levels of erosion problems. In many cases, individuals need to see and walk a severely eroding stream to see how bad an erosion problem can be. Please keep in mind that if you rate the severity of an erosion problem as either a 1 or 2, it is very likely that someone will do a follow-up visit to the site. Reducing sediment inputs to the Chesapeake Bay is one of the main restoration goals of the Chesapeake Bay program. There is a lot of interest in identifying severe stream erosion problems so that these areas can be targeted for possible stream restoration and/or improved storm water management.

The severity rating for erosion sites will depend on the length of stream that appears to be unstable and how significant the erosion problem is in the stream. The most severe erosion problems occur in areas where there are soft unconsolidated sediments and the stream has downcut several feet forming an incised stream channel. Factors that should be taken into consideration in assigning your severity rating are:

- ☐ What is the length of stream impacted?
- ☐ What is the height of stream banks?
- ☐ Does erosion appear to be a problem in both the bend and run sections of the stream?
- ☐ Is there evidence of high erosion rates along the stream's banks?
- ☐ Is there evidence that the stream channel is unstable and readjusting?
- ☐ Is there unconsolidated gravel, sands and silts in the banks?
- ☐ Are the soils in the banks stratified?
- ☐ Has the stream channel eroded below the root zone of the vegetation along its banks?

Examples are:

<u>Severe rating (1):</u> A long section of stream (> 1000 ft.) that had incised several feet, with banks on both sides of the stream that are unstable and eroding at a fast rate. Usually this occurs in areas where there are soft unconsolidated sediments (gravel, sand and/or silts) and the stream has eroded below the root zone of the bank vegetation. An example of a very severe stream bank erosion problem is shown in Figure 4.6.2-2.

Figure 4.6.2-2. Severe eroding stream bank.

<u>Moderate rating (3):</u> Either a long section of stream (> 1000 ft.) that has a moderate erosion problem, or a shorter stream reach (between 1000 and 300 ft.) with very high banks (> 4 ft.), and evidence that the stream is eroding at a fast rate.

<u>Minor rating (5):</u> A short section of stream (< 300 ft.) where the erosion is limited to one or two meander bends or a site where an erosion problem is being caused by a pipe outfall and the area affected is fairly limited. An example of a minor erosion problem is shown in Figure 4.6.2-3.

Figure 4.6.2-3. Example of a minor eroding stream bank problem.

Correctability

Minor erosion problems in open areas can often be corrected using some fairly simple bioengineering techniques. This is especially true in areas where the instability of the stream channel is caused by livestock having unlimited access to the stream. In order for most bioengineering approaches to be successful, the eroded area will need to be unshaded during most of the day. The need for substantial light levels at bioengineering sites stems from the fact that most of the vegetation used in these projects, such as willows, need high light levels to survive. While some shade tolerant species like mountain laurel can be used for some projects, these plants are usually slow growing.

Areas with minor erosion problems on public land, or with fairly easy access, that could be corrected using a bioengineering approach should be highlighted in the survey by filling out an unusual condition/comment data sheet in addition to an erosion site data sheet. These areas are important because they are excellent sites for community-based stream bank stabilization efforts.

The erosion problems you will see during an SCA survey in Maryland are often due to a general instability

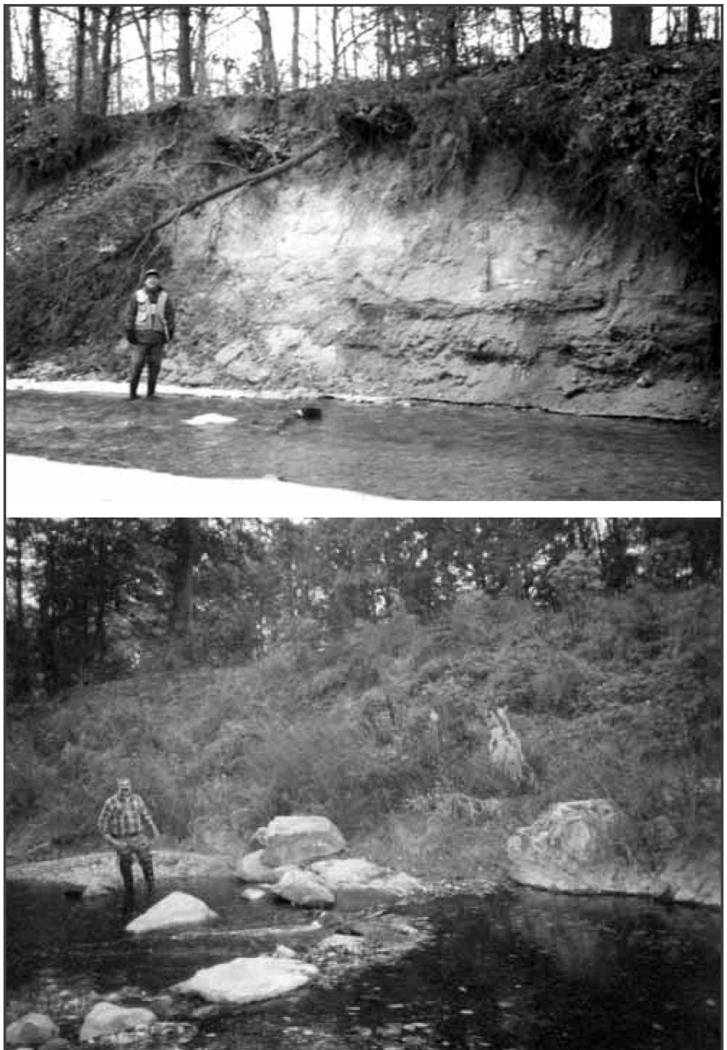

Figure 4.6.2-4. Severely eroding bank prior to and after stabilization.

of the stream channel resulting from land use changes in the watershed. In these cases, long reaches of stream are often affected. New techniques have been recently developed to analyze a stream's erosion patterns and correct the problem by reconstructing the stream channel into a stable form. Photographs of a stream channel before and after stream restoration work was done is shown in Figure 4.6.2-4. These tend to be very complicated restoration efforts costing hundreds of dollars per linear foot of stream. Factors that should be taken into consideration in assigning your correctability rating are:

- ☐ The length of stream impacted.
- ☐ The adjacent land use, and whether construction staging or access is a problem.
- ☐ Will heavy equipment be needed?
- ☐ How much earth, stone, or other material needs to be moved?
- ☐ How much funding would be needed for the project?
- ☐ Would permits, detailed survey, and detailed construction plans be needed?

Examples of this rating system are:

Best Correctability (1): A short stream reach (< 200 ft.) where the erosion problem can be corrected by simple bioengineering techniques using volunteers in one or two days.

Moderate Correctability (3): An erosion problem that could be corrected by a work crew over several weeks, using primarily a backhoe or other small piece of construction equipment. The project may involve using some small rock (< 100 lbs.) to stabilize the toe of a stream bank but most of the work would rely on vegetation and biodegradable material to stabilize the stream banks.

Worst Correctability (5): A long reach of stream (i.e., several thousand feet) that had deeply incised several feet and any attempt to actively restore the stream channel would require not only significant funding (i.e., several hundred thousand dollars) but would also involve a large amount of earth moving and disturbance to the riparian corridor.

Access

See section 4.5.1.

4.6.3 EXPOSED PIPES

Exposed pipes are any pipes that are either in the stream or along the stream's immediate banks that could be damaged by a high flow event. An example of an exposed pipe is shown in Figure 4.6.3-1. 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's 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 occasional high storm flows. Pipes that are placed along the support beams of bridges or suspended high enough above the stream to not be affected by very large storm events should not be included in this survey unless they are leaking.

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 sewer lines which depend on the continuous downward slope of the pipeline to move sewage to a pumping station or treatment plant.


Figure 4.6.3-1. Example of an exposed pipe.

Since streams are located at the lowest points in the local landscape, engineers often build sewer lines parallel to 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 then be discharged into the stream causing a serious water quality problem.

DATA SHEET FOR EXPOSED PIPES

Map, Team, Site, Date and Photo Numbers:

Fill in the appropriate site identification information on the top of the data sheet and on the field maps. Also, record the date and film exposure numbers for the photographs taken at the site.

Pipe is:

Indicate if the exposed pipe is across the bottom of the stream, along the stream banks or an exposed man-hole stack. If these selections do not properly describe the exposed pipe's location, circle "**O**ther" and describe the location.

Type of Pipe:

Indicate if the pipe is made out of concrete, smooth metal, corrugated metal or plastic. If the pipe is made from some other material, or the pipe is incased in concrete and you do not know what type of pipe it is, circle "**O**ther," and describe the pipe in the space provided.

Pipe Diameter:

Pipe diameter refers to the inside diameter of the pipe and in the United States the measurement is usually in inches. In some exposed pipe situations you may not be able to directly measure the inside diameter of the pipe, but should be able to guess fairly closely by observing or measuring the outside diameter of the exposed pipe. Large pipes are usually made in 1/2 foot sizes (12 inches, 18 inches, 24 inches, etc.)

Length Exposed:

Indicate the length of pipe that is exposed in feet.

Evidence of Discharge?

Indicate whether there is any evidence that the pipe is cracked or leaking. If there is evidence of a discharge describe the color and/or odor. A strong odor, even if you do not see any discharge coming out of the pipe, is an indication of a discharge. If the discharge appears to be a significant health or environmental problem, you should contact your supervisor or survey manager as soon as possible.

Color & Odor:

Indicate the color and/or odor of any discharge. The choices provided are the same used by several state and county governments when investigating unknown discharges. Circle the most appropriate answer. If none of the choices accurately describe what you are seeing or smelling, then circle "**O**ther" and describe the discharge in your own words.

Severity

The severity rating for an exposed pipe will depend on the amount of pipe that is exposed, where the pipe is located in the stream, how badly the erosion problem threatens the structural stability of the pipe, and whether or not the pipe is leaking. The primary concern is that the pipe will either break or be punctured, allowing whatever is in the pipe to leak into the stream. Exposed pipes can also create barriers to fish migration, and when this occurs a fish migration data sheet should also be completed. Factors that should be taken into consideration in assigning the severity rating are:

- ☐ What is the length of pipe exposed and where is it located?
- ☐ Has the pipe been reinforced with concrete?
- ☐ Is there evidence of leaking from the pipe?
- ☐ How likely is it that the pipe will either collapse or be punctured?

Examples of this rating system are as follows:

<u>Severe rating (1)</u>: Any pipe that is leaking will usually be given a severity rating of 1 or 2 depending on the amount and type of fluid that is coming out of the pipe. Other exposed pipe problems that could receive a 1 or 2 severity rating include: a section of pipe that is being undermined by erosion and could collapse in the

Figure 4.6.3-2. Example of a sever exposed pipe problem.

near future; a pipe running across the bed of the stream where part of the pipe is suspended above the stream bed: a long section along the edge of the stream where nearly the entire side of the pipe is exposed: and a manhole stack that is located in the center of the stream channel and there is evidence that the stack is beginning to crack and/or break apart. An example of a very severe exposed pipe problem is shown in Figure 4.6.3-2.

Moderate rating (3): A moderately long section of pipe is partially exposed but there is no immediate threat that the pipe will be undermined and break in the immediate future. The primary concern is that the pipe may be punctured by large debris during a large storm event.

Minor rating (5): Minor exposed pipe problems include the following: a small section of the top of a pipe is exposed and the stream bank near the pipe appears to be stable; the pipe is across the bottom of the stream but only a small portion of the top of the pipe is exposed; the pipe is exposed but has been reinforced with concrete and it is not causing a blockage to upstream fish movement; a manhole stack that is at the edge of the stream and does not extend very far out into the active stream channel.

Correctability

Once a portion of a pipe is exposed in a stream channel, there is a real threat that the pipe will be breached and whatever is in the pipe will contaminate the stream. Correction of exposed pipe problems usually involves either reinforcing the area around the pipe with concrete or stone to prevent the pipe from being punctured, moving the pipe or diverting the stream away from the pipe. Photographs of an exposed pipe taken before and after the stream was diverted to pro-

Figure 4.6.3-3. Exposed pipe before and after stream restoration project.

tect the pipe are shown in Figure 4.6.3-3. These projects are usually very expensive, involving the use of heavy equipment. Factors that should be taken into consideration in assigning your Correctability rating are:

- ☐ What length of stream would be impacted by the work?
- ☐ What is the adjacent land use and would construction staging or access be a problem?
- ☐ Will heavy equipment be needed?
- ☐ How much earth, stone or other material would have to be moved?
- ☐ How much funding would be needed to do this project?
- ☐ Would permits, detailed survey and detailed construction plans be needed?

Examples of this rating scheme follow:

Best Correctability (1): A short stream reach where only a small portion of the pipe has been exposed. The stream in this area appears to have fairly stable banks and is in a place where a small amount of stone could be used to cover the exposed pipe and direct high flows in the stream away from the pipe.

Moderate Correctability (3): A section of pipe that is exposed and can be fixed by placing rock or other material around the pipe. The exposed pipe is in an area with fairly easy access. The stream is wide and has fairly low banks, so material placed in the stream to protect the pipe will not seriously effect the passage of storm flows through the site.

Worst Correctability (5): A long section of pipe is exposed in numerous areas and the bed of the stream has eroded down close to or below the bottom of the pipe. The most likely options to correct the problem would be either a major stream restoration effort to move the stream away from the pipe or relocate at least a section of the pipeline.

Access

See section 4.5.1.

4.6.4 PIPE OUTFALLS

Pipe outfalls include any pipes or small manmade channels that discharge into the stream through the stream corridor. An example of a typical pipe outfall site is shown in Figure 4.6.4-1. 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. State and local governments have become interested in pipe outfalls, as they are required by recent revisions of the Clean Water Act to address non-point source pollution sources.

Any pipes or manmade channels that are designed to discharge into the stream are considered pipe outfalls and must be included in the survey. This includes pipes with openings outside of the immediate stream corridor, but which discharge into a channel which eventually enters the stream.

The team should especially be on the lookout for any pipe outfalls that have a discharge coming out of it. Do not touch the discharge and try to avoid getting any of the discharge on your skin or clothes since you cannot always be sure what may be in the discharge. On your data sheets, indicate the color and smell of the discharge. Any pipe outfall discharge with a color and/or smell should be especially noted by the survey team. At the end of the day, notify your supervisor and/or the survey manager of the discharge, so that immediate follow up action can be taken if warranted. Use the Unusual Condition/Comment data sheet to better describe the discharge if you feel that the Pipe Outfall data sheets are insufficient.

Figure 4.6.4-1. Photograph of a pipe outfall.

If you are surveying the stream while it is raining, shortly after it has rained or while snow is melting, then you will not be able to determine it the pipe outfall has a dry weather discharge. If you are not sure if a discharge is coming out of a pipe outfall you should indicate "**U**nknown" on your data sheets.

In many cases you will not be able to determine the reason for a discharging pipe outfall during the SCA survey. You should simply indicate that a potential problem does exist so that follow up investigations can be done.

DATA SHEET FOR PIPE OUTFALL

Map, Team, Site, Date, and Photo Numbers:

Fill in the appropriate site identification information on the top of the data sheet and on the field maps. Also, record the date and film exposure numbers for the photographs taken at the site.

Type of Outfall:

As you gain experience doing the SCA survey, you should begin to recognize the different types of outfalls that are commonly seen along a stream. The most common are storm water outfalls. The storm water pipes usually have fairly large diameter pipes (i.e., 24 inches or greater) and are usually made of concrete. Other outfall pipes you may see include sewage plant discharges, industrial discharges, overflow pipes, and agricultural drainage pipes. If you do not know the purpose of the outfall pipe, circle "**U**nknown." If you think you know the purpose of the outfall but it is not listed as a possible choice, circle "**O**ther" and fill in the appropriate answer in the space provided.

Type of Pipe:

Indicate whether the pipe outfall is an earth channel, concrete channel, concrete pipe, smooth metal pipe, corrugated metal pipe or plastic pipe. If the pipe outfall is made from some other material than the choices listed, circle "**O**ther" and record the appropriate answer in the space provided.

Location (facing downstream):

Indicate whether the pipe outfall is located on the left stream bank, right stream bank or at the head of stream channel. If the three above choices do not adequately describe the location of the pipe outfall, then circle "**O**ther" and fill in the appropriate answer in the space provided.

Pipe Diameter:

Measure the inside diameter of the pipe outfall and record the information in inches in the space provided. In the SCA survey, pipe diameter always refers to the inside diameter of the pipe opening.

Channel Width:

If the pipe outfall is not a pipe but an open channel, measure the width of the channel and record the information in feet. Do not use inches. The channel width is measured across the bottom of the channel. If it is an uneven earth channel, estimate the average width of the bottom of the channel.

Evidence of Discharge:

Indicate whether there is any evidence that the pipe is cracked or leaking. If there is evidence of a discharge, record the color and if there is an odor. A strong odor, even if you do not see any discharge coming out of the pipe, is an indication of a discharge. If the discharge appears to be a significant health or environmental problem, contact your supervisor or survey manager as soon as possible.

Color & Odor:

Record the color and/or odor of any discharge. The choices provided are the same used by several state and county governments when investigating unknown discharges. Circle the most appropriate answer. If none of the choices describe what you are seeing and/or smelling accurately, then circle "**O**ther" and describe the discharge in your own words.

Severity

When determining the severity rating for a pipe outfall, you should only be considering the immediate environmental problems that a specific outfall pipe is creating. The rating should be independent of whether there are other outfall pipes on the stream or whether the stream has an erosion problem. If there is an erosion problem at the outfall you should fill out an erosion site sheet. The severity rating for pipe outfalls will primarily depend on whether there is a discharge from the pipe outfall, how much of a discharge, the discharge color or smell and how much of an impact the discharge appears to be having on the stream. Factors that should be taken into consideration when assigning the severity rating are:

- ☐ Is there a discharge coming from the pipe outfall?
- ☐ Does the discharge appear to be just water or does it have a color and/or smell associated with it?
- ☐ How large is the discharge compared to the stream's usual base flow?
- ☐ Is the discharge discoloring the stream and how far can it be seen downstream?
- ☐ Is the discharge affecting the stream's biota?

Examples of the rating system are as follows:

<u>Severe rating (1):</u> A pipe outfall that has a strong discharge with a distinct color and/or a strong smell. The amount of discharge is large compared to the amount of normal flow in the stream that is receiving it, and the discharge appears to be having a significant impact downstream. An example of a severe pipe outfall is shown in Figure 4.6.4-2.

<u>Moderate rating (3):</u> A pipe outfall that has a small discharge coming out of it but the discharge is usually clear and has no odor associated with it. If the discharge has a color and/or odor, the amount of discharge is very small compared to the stream's base flow and any impact appears to be minor and localized.

Figure 4.6.4-2. Example of a severe pipe outfall.

Minor rating (5): Storm water outfall pipes or other channels and/or pipes that appear to be designed to carry storm water runoff and does not have dry weather discharge nor does it appear to be causing any erosion problems. An example of a minor pipe outfall is shown in Figure 4.6.4-3.

Figure 4.6.4-3. Minor pipe outfall site.

Correctability

In assigning a severity and correctability rating for pipe outfalls, look at a single pipe outfall and the immediate problems that outfall may be causing. You should not take into consideration how many other outfall pipes there are along the stream or whether the stream has an erosion problem. Erosion problems are evaluated separately using the Erosion Site data sheets.

Pipe outfalls with no discharge and/or smell, or pipe outfalls with minor discharges of clear water will usually be given the best correctability rating. In most cases, these pipe outfalls are not considered environment problems by themselves and nothing needs to be done at the site. Pipe outfalls with significant discharges that have a color and/or smell associated with it will get a high correctability rating. Any work to correct problems involving storm drain systems, or discharges from sewage or industrial sites, are usually a major engineering undertaking involving significant funding. Factors that should be taken into consideration in assigning your Correctability rating are:

- ☐ Is there a discharge coming from the outfall pipe and is it an environmental problem?
- ☐ If excavation needs to be done, will local land use be a problem?
- ☐ Would construction staging or access be a problem?
- ☐ How much funding would be needed to do this project?
- ☐ Would permits, detailed survey and detailed construction plans be needed?

Examples of the rating system are as follows:

Best Correctability (1): A pipe outfall that does not have a dry weather discharge or odor will usually have a correctability rating of 1. If there is a discharge but the discharge is small and appears to be only water, give it a correctability rating of 2.

Moderate Correctability (3): A pipe outfall that does have a discharge, but the cause of the discharge is known and can be fixed by a public works crew in a few days.

Worst Correctability (5): A significant discharge that has a color and/or odor associated with it from a storm water or other discharge pipe. You may not know the exact source of the discharge, but you assume that any attempt to correct the problem will require both engineering designs and a significant amount of funding.

Access

See section 4.5.1.

4.6.5 FISH BARRIER

Fish migration barriers are anything in the stream that significantly interferes with the upstream movement of fish. An example of a fish migration barrier is shown in Figure 4.6.5-1. Unimpeded fish passage is especially important for anadromous fish which live much of their lives in tidal waters but must move into non-tidal rivers and streams to spawn. Anadromous fish species, including American shad, white perch, yellow perch, blueback herring and alewife migrate from the Chesapeake Bay into Maryland rivers and streams in early spring 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 sections in a stream network can become isolated. If a disturbance occurs in an isolated stretch of stream, such as a sewage spill on 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

Figure 4.6.5-1. Perched culvert causing fish migration blockage.

such as waterfalls or beaver dams. Fish blockages occur for three main reasons. First, there is a vertical water drop such as a dam that it is too high for fish to swim over. A vertical drop of 6 inches may cause fish passage problems 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 crossings where the water from a small stream has been spread over a large flat area and the water is not deep enough for fish. Finally, a structure may be a fish blockage if the water is moving too fast. 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 higher than a fish's swimming ability.

DATA SHEET

Map, Team, Site, Date and Photo Numbers:

Fill in the appropriate site identification information and on the top of the data sheet and on the field map. Also, record the date and film exposure numbers for the photographs taken at the site.

Fish Blockage:

Indicate on the data sheet whether you believe the structure is a Total, Partial or Temporary fish barrier. In determining if a structure is a total fish barrier, ignore the migration abilities of the American eel. American eels can migrate over large dams and even through wet grass at night. There are few, if any, structures in Maryland considered a migration barrier to the American eel. A total fish barrier is a barrier that prevents almost all fish species, except American eels, from moving upstream. Usually, if the structure has a water drop of greater than 1 foot it is considered a total fish blockage in Maryland. A partial fish barrier may be an area with shallow water that is deep enough for small fish to move through but which would impede the migration of larger fish. A partial fish barrier may prevent fish from migrating through the structure during base flow conditions, but will usually be deep enough for fish to pass through after a small rain event. When designating a structure a partial fish barrier, you must consider not only what the water depth may be during elevated flows but also the velocity of the water moving through a structure during the higher flows. Finally, a temporary fish blockage is usually either a beaver dam or debris dam. While these structures may totally or partially block the upstream movement of the fish, the structure is only temporary and should be gone in a few years. Tree falls across streams are usually not fish barriers because very often the fish can move through water flowing both under and over the tree.

If you are not sure if a structure is a Total, Partial or Temporary fish barrier, make an educated guess as to which category best describes the fish barrier. Only circle the "**U**nknown" choice if you cannot even guess if it is a Total, Partial or Temporary fish barrier.

Type of Barrier:

Record on the data sheet if the fish barrier is a Dam, Road Crossing, Pipe Crossing, Natural Falls, Beaver Dam, or Channelized stream section. If the fish barrier is present due to a structure other than the ones listed, circle "**O**ther" and record the appropriate answer in the space provided.

Blockage Because:

Indicate on the data sheet that a fish barrier exists at this site because the water drop is too high, the water is too shallow or the water is moving too fast. Only circle one answer. If a structure is a fish blockage for more than one of the three choices, circle the one you believe is the most important.

Water Drop:

If a fish barrier is present because there is a structure with a water drop too high for the fish to swim through, record the height, in inches, of the water drop on the data sheets. Height of the water drop is measured from the top of the downstream water surface to the top of the structure the water is flowing over.

Water depth:

If a fish barrier is present because the water moving through the structure is too shallow for the fish, first look at the entire structure and determine where the shallowest cross-section is. Measure in inches the water depth at the deepest point in the shallowest cross-section. What you are attempting to do is find the shallowest point that a fish would have to swim through if it was trying to swim up the deepest part of the channel.

Severity

The severity rating for fish barriers will depend on the location of the barrier in the stream network and whether it is a total, partial or temporary barrier to upstream fish migrations. Fish barriers that could potentially interfere with the migration of anadromous fish to their spawning ground are usually given priority in restoration efforts in Maryland. A fish barrier on a large stream or river (e.g., 3rd order or greater) that totally blocks the upstream movement of anadromous fish would usually get a severity rating of 1 or 2, unless a functioning fish passage device is present. If a functioning fish passage device is present, the severity rating may be downgraded to 2 or 3. The structure would usually still be given a fairly significant severity rating because most fish passage devices are designed to pass only certain fish species. Also, many devices are maintained only during the anadromous fish runs in the spring. Total fish blockages on smaller first and second order streams should also receive a severe to moderate severity rating (i.e., less than 3) if fish blockages are isolating a significant portion of a tributary (> 1000 ft.) from contact with the rest of the stream's fish community. Identifying small tributaries where fish populations are isolated from the main fish community is important because the isolated fish populations can become ecologically unbalanced. This can occur when there is a disturbance such as an oil spill or sediment pollution event on an isolated tributary which eliminates some or all fish species from the tributary. A severity rating of 4 or 5 will normally be given to temporary fish blockages, such as beaver dams, or in the case of fish barriers located in areas where there is very little fish habitat above the barrier. Factors that should be taken into consideration in assigning your severity rating are:

- ☐ Is the structure a total, partial or temporary fish barrier?
- ☐ Could the structure effect anadromous fish migrations? Is the structure the most downstream barrier to anadromous fish?
- ☐ Does the structure isolate a tributary's fish community from the rest of the fish in the stream network?
- ☐ How long a stream reach is being isolated and what is the condition of the habitat in the isolated reach?

Examples of the rating system follow:

<u>Severe rating (1):</u> A structure such as a dam or perched road culvert on a large stream or river (e.g., 3rd order or greater) that would totally block the upstream movement of anadromous fish and there is no fish passage device present. An example of a sever fish blockage is shown in Figure 4.6.5-2.

<u>Moderate rating (3):</u> A total fish blockage on a tributary that would isolate a significant reach of stream or a partial blockage that could interfere with the migration of anadromous fish during their spring migrations.

Figure 4.6.5-2. Dam causing a severe fish blockage.

<u>Minor rating (5):</u> A temporary fish barrier such as a beaver dam or a fish blockage at the very head of a stream with very little viable fish habitat above it. Natural fish barriers such as waterfalls are also given a minor severity rating. A minor fish blockage is shown in Figure 4.6.5-3.

Correctability

The correctability rating for fish barriers will depend on how hard it will be to either remove or modify a structure to allow the free upstream migration of both anadromous and resident fish species. Whenever possible the preferred option is usually to remove a fish barrier and return the area to a natural

Figure 4.6.5-3. Small beaver dam creating both a minor and temporary fish blockage.

stream condition. Photographs of a perched road culvert that was replaced by a small bottomless arch to provide natural fish passage is shown in Figure 4.6.5-4. If removal of a fish barrier is not a practical option, the structure can sometimes be modified to allow for the passage of at least some fish species. Removal or modification of a dam or road crossing to allow fish passage will usually involve an engineering review. That is because anything that is done to improve fish passage at a dam or road crossing also has the potential of affecting up and downstream flooding. In addition to engineering review, projects at dams and road crossings usually require permits and substantial funding. For these reasons, most fish blockages at road crossings and dams will have a worst (ie., 4 or 5) correctability rating. The best correctability rating (ie., 1 or 2) will usually be given at temporary fish barriers such as beaver dams or partial fish barriers that do not involve road crossings, or where a small modification to the channel could improve fish passage conditions.

Figure 4.6.5-4. Perched culvert before and after restoration project.

Some fish barriers such as a debris jam at a road crossing are not only an environmental problem, but can also threaten the road itself. Debris clogging of road culverts is one of the main causes of road failure during large rain evens. If the water in the stream cannot pass through the culvert under the road, it will usually begin to flow over the top of the road, possibly causing the road to wash out. If you see a road crossing with a significant blockage in it, please notify your supervisor or the survey manager at the end of the day. They will notify either a county public works department or the State Highway Administration of the flow blockage at the road crossing so that it can be corrected quickly. Factors that should be taken into consideration in assigning your Correctability rating are:

- ☐ Would construction staging or access be a problem?
- ☐ Will heavy equipment be needed?
- ☐ How much earth, stone or other material would need to be moved?
- ☐ How much funding would be needed to do this project?
- ☐ Would permits, detailed survey and detailed construction plans be needed?

Examples of the rating system are as follows:

Best Correctability (1): A temporary fish barrier such as a beaver dam or a debris jam at a road culvert. A team of volunteers in a few hours could remove the blockage if it was determined that removal was warranted.

Moderate Correctability (3): A total or partial fish barrier that could be corrected with a small team in a week or less. Removal of a check dam or a small dam that is already partially breached could be assigned a moderate correctability rating.

Worst Correctability (5): A total fish barrier at a dam or road crossing where no fish passage device is already present. These are usually major engineering undertaking requiring substantial work and funding.

Access

See section 4.5.1.

4.6.6 INADEQUATE BUFFER

Forested stream buffers are very important for maintaining healthy Maryland streams. Forest buffers help shade the stream, preventing excessive solar heating, and the roots stabilize the stream banks. Forest buffers remove nutrients, sediment and other pollutants from runoff, while the leaves of 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 has committed to recreating forest buffers along at least 1,200 miles of stream by the year 2010 (MD-DNR, 1998). DNR is actively looking for good areas for planting forest buffers and will use the SCA survey results to help identify those areas.

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 from the edge of the stream.

DATA SHEET FOR INADEQUATE BUFFER

Map, Team, Site, Date and Photo Numbers:

Fill in the appropriate site identification information on the top of the data sheet and on the field map. Also, record the date and film exposure numbers for the photographs taken at the site.

Inadequate Buffer:

Indicate whether the buffer is inadequate on the left, right or both sides of the stream. Left and right stream banks are always determined facing downstream.

Unshaded Stream:

A natural stream buffer usually will have trees along the edge of the stream's banks that help shade the stream from excessive solar heating. In prioritizing future buffer planting, emphasis is given to stream reaches without trees along the edge of the stream. Indicate on the data sheet if the stream is unshaded and whether it is due to a lack of trees along the left bank, right bank or both stream banks. Left and right stream banks are determined facing downstream. On larger streams and rivers it is common for the trees' canopy to cover only part of the stream channel with the center portion of the stream channel to be unshaded. This is a natural condition and is not considered an environmental problem. If there are large trees on both sides of the stream then the stream is considered shaded even if the tree's branches do not completely shade the entire stream.

Buffer Width:

Determine as accurately as possible, the width of the existing stream buffer on both the left and right sides of the stream. Record your answer in feet. If the existing forest buffer on either side of the stream is greater that 50 ft., then you should simply enter > 50 ft. Left and right stream banks are determined looking downstream.

Length:

Determine as accurately as possible the length of stream along both the left and right stream banks that has an inadequate buffer.

Land Use:

Indicate what the general land use in the stream's corridor is on both the left and right sides of the stream. The left and right sides of a stream are determined by facing downstream. Land use choices on the data sheets include "Crop fields, Pasture, Lawn, Paved, Shrubs & Small Trees, Forest, Multiflora Rose." In making your determination, the area closest to the stream is the area of greatest interest. If more than one land use type is present on a bank, choose the one that best describes the area's land use overall. The database will only accept one land use entry for each side of the stream. If none of the listed categories accurately describes the land use near the stream, circle "**O**ther" and enter an appropriate answer.

Has a buffer recently been established?

If the area has an inadequate buffer but it is obvious that a buffer has been planted or is being allowed to grow, circle **Yes**. Otherwise circle **No**.

Are livestock present?

Indicate if livestock have regular access to the buffer. You do not have to see livestock in the buffer to answer **Yes**, you only need to see evidence that they are using the area. If the area is being used by livestock, indicate the type of livestock operation. Circle Cattle, Horses, Pigs or Other. If you circle Other you should also write in the type of livestock operation.

Severity

The severity rating for inadequate buffers will depend on the condition of the vegetation along the streams banks and the length of stream with an inadequate buffer. Factors that should be taken into consideration in assigning your severity rating are:

- ☐ What are the land use and type of vegetation in the area with an inadequate buffer?

- ☐ Is there evidence that a tree buffer is beginning to form in the inadequate buffer area?
- ☐ Is the inadequate buffer on one or both sides of the stream?
- ☐ Is the stream unshaded?
- ☐ How long is the reach of stream with an inadequate buffer?

Examples of this rating follow:

<u>Severe rating (1):</u> A significant length of stream (> 1000 ft.) that is completely open with no trees on either side of the stream. Both sides of the stream are maintained as either lawn, pasture or some other condition that excludes trees from the stream's banks. An example of a severe inadequate buffer is shown in Figure 4.6.6-1.

<u>Moderate rating (3):</u> A moderate length of stream without trees on one side of the stream, but an adequate forest buffer on the other side.

<u>Minor rating (5):</u> A section of stream with trees on both sides of the stream, but on one side the stream buffer is less than 50 feet wide.

Figure 4.6.6-1. Photograph of an inadequate stream buffer.

Correctability

The correctability of a stream reach with an inadequate buffer will depend primarily on the land use in the area. In most of Maryland, if the land is left alone, trees will quickly begin to grow and a forest will eventually develop. Open areas without trees exist because they are activity maintained that way. Figure 4.6.6-2 shows an inadequate buffer in 1990 and the same area 9 years later. In determining the correctability of an inadequate buffer area, first determine the practicality of establishing a buffer in the area. Do not assume it is impossible to get permission from a private land owner to establish a forest buffer along the stream. You can assume, however, that it is easier to get permission to

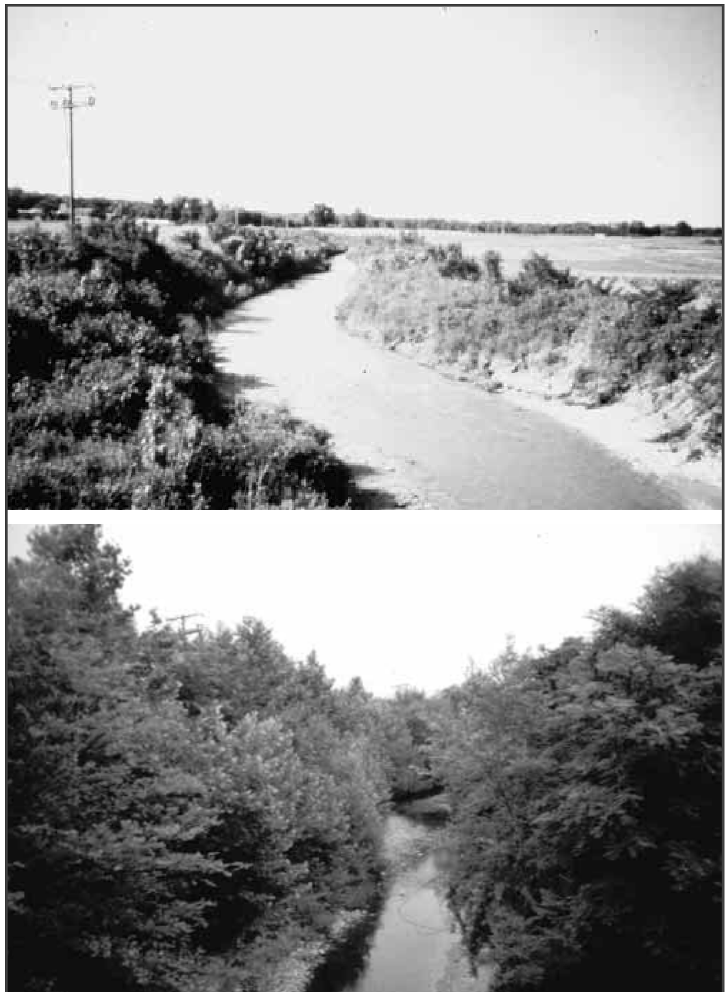

Figure 4.6.6-2. Inadequate buffer before and after stream restoration project.

establish a buffer on public than on private land. Factors that should be taken into consideration in assigning your Correctability rating are:

- ☐ What is the length and width of the inadequate stream buffer?
- ☐ What is the present land use?
- ☐ How much funding would be needed to do this project?

Examples of the rating system follow:

<u>Best Correctability (1):</u> A small stream reach on public land where the land along the stream does not appear to be used for any specific purpose.

<u>Moderate Correctability (3):</u> A significant reach of stream on either public or private land that is presently used for a specific purpose, where it should be possible to accomplish the same thing on an adjacent parcel of land. For example, a large pasture with a stream running through it that is kept open so that livestock can drink water from the stream. With landowner cooperation, it would not be difficult for the NRCS (National Resources Conservation Service) to establish alternative watering areas and fence the livestock out of the stream.

Worst Correctability (5): A significant reach of stream where roads and buildings have been built along the stream banks and there is no place for trees to grow.

Access

See section 4.5.1.

Wetlands Potential

At inadequate buffer sites, a fourth ranking is done to indicate the potential of creating wetlands at these sites. The ranking is done because environmental agencies are often looking for potential areas where wetlands could be built to mitigate for wetland losses in other areas. Open un-forested areas near streams are often considered good possible sites for wetland creation projects. The ranking is based on bank height and the slope of the land. Areas with low banks (< 2 feet) and fairly flat open land adjacent to the stream are given the best ranking of 1. Inadequate buffer sites with high banks (> 5 feet) and narrow steep floodplains are given the worst ranking of 5.

4.6.7 IN/NEAR STREAM CONSTRUCTION

In or near stream construction data sheets are used to document the locations of major disturbances located in or near the stream corridor at the time of the survey. An example of an instream constructing site is shown in Figure 4.6.7-1. If construction is seen in or near the stream, indicate the location on the survey map and look at the general condition of the stream near and downstream of the construction site. Survey teams should be on alert for evidence of inadequate sediment control measures or if sediment pollution from the site has affected the stream. However, survey team members are not sediment inspectors and it is not their job to review sediment control measures at the construction site. Survey crews should avoid walking through the construction site and should never confront anyone at the construction site about problems they observed. Any problems with sediment control measures at the construction site should be noted on the data sheets and the supervisor or the survey manager notified at the end of the day, so appropriate action can be taken.

Figure 4.6.7-1. An instream construction site.

DATA SHEET FOR IN/NEAR STREAM CONSTRUCTION

Map, Team, Site, Date and Photo Numbers:

Fill in the appropriate site identification information on the top of the data sheet and on the field maps. Also, record the date and film exposure numbers for the photographs taken at the site.

Type of Activity:

Indicate the type of construction activity occurring in or near the stream. Choices include: "road construction, installation of a road crossing, utility work, logging, bank stabilization work, residential development and industrial development." If none of the choices accurately describes the activity observed, circle "**O**ther" and describe the construction activity in the space provided.

Sediment Control:

Indicate where sediment control measures at the construction site appear to be adequate. If you observe a problem with the sediment control measures at the construction site, circle "**I**nadequate," and describe the problem in the space provided. You should also take a photograph of any problems you may observe. If you feel that you cannot properly evaluate sediment control measures, circle "**U**nknown."

Stream Bottom with Excess Sediment:

Look at the stream bed just downstream of the construction activity and compare it to conditions upstream of the site. Is there excessive sediment deposition in the stream bed that appears to be related to the construction activity? If yes, indicate the length of stream that is affected by the sediment deposition. If possible, also photograph the sediment problem.

Company Doing Construction:

If you are able to identify who is involved in the construction activity from signs posted at the site or information printed on the vehicles at the site, write it down in the space provided. Do not interview anyone at the site or ask questions to obtain this information. If it is not obvious who is involved in the construction by simply observing the construction site from a distance, leave this section blank.

Location:

Describe the location of the construction activity in relation to the stream.

Severity

The severity rating for In or Near Stream Construction sites is intended to be an overall rating of how significant the survey teams believe the aquatic resource in the area will be affected by the construction activity. Factors that should be taken into consideration in assigning your severity rating are:

- ☐ How large is the construction site?
- ☐ How close to the stream is work being done?
- ☐ Does sediment control appear to be adequate?
- ☐ Is there evidence down stream that sediment from the construction site is getting into the stream?

Examples of this rating system are as follows:

Severe rating (1): A very large construction site with a large amount of disturbance to the stream channel and sediment control measures appear to be absent or very poorly maintained. Investigations downstream indicate that a large amount of sediment is getting into the stream channel and depositing in the stream channel. An example of a severe construction site where sediment control fencing has failed is shown in Figure 4.6.7-2.

Moderate rating (3): The construction site is near the stream but there appears to be very little disturbance to the stream's banks. Construction activities, however, do appear to be inside the streams riparian buffer.

Figure 4.6.7-2. Example of severe construction site where sediment control fencing has failed

Sediment control measures appear to be adequate and investigations downstream indicate that while some sediment may be entering the stream from the construction site, the amount appears to be relatively small.

Minor rating (5): The construction site is away from the stream and well outside the streams riparian buffer. Sediment control measures appear to be adequate, and there is not evidence that sediment from the construction site is entering the stream.

Correctability & Access

Correctability and Access ratings are not needed at in or near-stream construction sites.

4.6.8 TRASH DUMPING

The trash dumping data sheets are used to record the location of places where large amounts of trash have been dumped inside the stream corridor or to note places where trash tends to accumulate. An example of a trash dumping site is shown in Figure 4.6.8-1. The main purposes of identifying where trash is being dumped in or near the stream is so that steps can be taken to limit access to these areas by vehicles if possible. Past work by several community groups have found that if vehicle access is restricted, the trash dumping usually ends. A second reason for noting trash dumping sites is to assist community volunteer groups looking for possible sites to do stream clean-ups. Stream clean-ups are very good community activities which encourage local residents to go out and take a closer look at the condition of their community stream.

Figure 4.6.8-1. Example of a trash dumping site.

DATA SHEET

Map, Team, Site, Date and Photo Numbers:

Fill in the appropriate site identification information on the top of the data sheet and on the field maps. Also, record the date and film exposure numbers for the photographs taken at the site.

Type of Trash:

Indicate the main type of trash present. Possible choices include "Residential, Industrial, Yard Waste, Flotables (Styrofoam peanuts, plastics, and other floating trash), Tires, Construction Waste." If none of the choices provided adequately describes the trash present, circle "**O**ther" and describe it. Please select only one trash category. If more than one type of trash is present chose the one that best describes the trash in general.

Amount of Trash:

Estimate the amount of trash present. If possible the estimate should be based on how many pick-up truck loads would be needed to remove all the trash. If unable to estimate how many pick-up truck loads are present, an estimate of the amount of trash by the size of the pile or the area covered is acceptable.

Trash Confined:

Indicate whether the trash is confined to a single site or if it is spread out over a large area.

Possible cleanup site for volunteers?

Does the site look like a good place to bring community volunteers for a clean-up activity? In making your determination, consider both safety and access issues.

Land Ownership:

Indicate whether the trash dump is located on public or private land. If you know that the land is public land, such as a public park, please indicate if the owner is city, state or county in the space provided. If you know that the land is publicly owned but are not sure who owns it, enter whatever information you may have, such as the name of the park. If you do not know who owns the land, circle "**U**nknown." Do not spend extra time trying to determine whether the land is publicly or privately owned. If the answer to the question is not obvious just circle "**U**nknown," and continue with the survey.

Severity

The severity rating for trash dumping will depend on the amount of trash present, its location and whether cleaning up the trash would present any special problems. Factors that should be taken into consideration in assigning your severity rating are:

- ☐ How much trash is present?
- ☐ What type of trash is present? Are there sharp objects or possible chemicals present?
- ☐ Is it safe for volunteers to enter and pick up trash?

Examples of this rating system are as follows:

Severe rating (1): A large amount of trash scattered over a large area, where access is very difficult. If there are any large chemical drums present or indications of other hazardous materials, the site is given a Severity Rating of 1, no matter how much material is present. An example of a severe trash dumping site is shown in Figure 4.6.8-2.

Moderate rating (3): A fairly large amount of trash that is in a small area with easy access. The trash may have been dumped over a long period of time but it could be cleaned up in a few days, possibly with the assistance of a small backhoe.

Minor rating (5): A small amount of trash (i.e., less than two pickup truck loads) located inside a park with easy access.

Figure 4.6.8-2. Example of a severe trash dumping site.

Correctability

The correctability rating for trash dumping areas will depend on how much trash is present and how easy it would be to clean up the problem. The correctability rating does not include long term solutions such as putting up fencing to prevent vehicles from entering an area to dump trash. However, if the survey team believes there is a simple long term solution to the trash dumping problem at a site, they should use an Unusual Problem/Comment Sheet to make their suggestions. Factors that should be taken into consideration in assigning a Correctability rating are:

- ☐ How much trash is present?
- ☐ What type of trash is present? Are there sharp object or possible chemicals present?
- ☐ Is it safe for volunteers to enter and pick up trash?

Best Correctability (1): A small amount of trash (i.e., less than two pickup truck loads) located inside a park with easy access. This site would make a good site for a community stream cleanup.

Moderate Correctability (3): An area with a large amount of trash in a fairly contained area that is not difficult to access. This would be a problem that may be too big for volunteers to clean up in a single day. The trash, however, is in large piles, and a crew working for several days with the assistance of a small backhoe could clean up the site.

Worst Correctability (5): A large amount of garbage spread over a large area with restricted or poor access. This is either the type of site where you could have a stream clean up every weekend and it would still have a trash problem, or a site where hazardous chemical may be present and the site needs to be evaluated by professionals.

Access

See section 4.5.1.

4.6.9 UNUSUAL CONDITION OR COMMENT

The unusual condition or comment data sheets are used by survey teams to record the location of anything out of the ordinary or to provide some additional written comments on a specific problem. Figure 4.6.9-1 shows a site where there was an unusually large amount of algae in a stream.

Figure 4.6.9-1. Excessive algae growth in stream.

DATA SHEET

Map, Team, Site, Date and Photo Numbers:

Fill in the appropriate site identification information on the top of the data sheet and on the field maps. Also, record the date and film exposure numbers for the photographs taken at the site.

Type:

Indicate if the data sheet is being filled out to document an **Unusual Condition** or to provide **Comments** on a situation that has been encountered while surveying the stream. **Unusual conditions** may include: unusual odor, scum, excessive algae, water color/clarity, red flock, oil on surface, etc. If you encounter an unusual condition that you believe is an environmental problem and the other data sheets do not apply, than circle **Unusual Condition** and fill out the rest of the data sheet including the severity, correctability and access ratings.

In cases where you encounter something that is of environmental interest but not necessarily a problem, or in cases where you have already filled out a problem data sheet and want to add some additional observations on the problem, the word **Comment** should be circled. You should than complete the **Describe section** of the sheet. Since this is only a comment, you should not fill in severity, correctability or access rating. It is important to note that comment sheets cannot only be used to make observations about problems, but can also be used to bring attention to possible positive things that you may encounter. For example, if you come upon a completed instream restoration project or see an area where a farmer is doing a good job at keeping the cattle out of the stream, you may want to fill out a comment sheet to document it.

Describe:

Describe the problem or situation in the space provided. Please try to make your description as concise as possible. If you require additional space, use the back of the data sheet.

Potential Cause:

Use the space provided to comment on either the cause of the problem or to make a comment about a specific observation. If you have a suggestion on a possible correction for the problem, make that suggestion in this space. Please try to make your statements as concise as possible. If you require additional space, use the back of the data sheet.

Severity

The severity rating for Unusual Conditions will generally follow the general guidelines for the problem severity rating system presented in Section 4.5.1. Factors that should be taken into consideration in assigning your severity rating are:

- ☐ What is the length of stream impacted and how severe is the impact on the stream biota?
- ☐ Is the problem a human health risk as well as an environmental problem?

Examples of the rating system follow:

Severe rating (1): Problems that appear to have a direct and wide reaching impact on the stream's aquatic resources. Within a specific problem category, a 1 rating indicates that the problem is among the worst that the field teams have seen or would expect to see in Maryland.

Moderate rating (3): Problems that appear to be having some adverse impacts at a site. While a rating of 3 would indicate that survey crews believed it was a significant problem, but they have either seen or would expect to see much worse problems in that specific category.

Minor rating (5): Problems that do not appear to be directly affecting the stream. A rating of 5 indicates that a problem was present and should be addressed, but compared to other problems it would be considered minor.

Correctability

The correctability rating for Unusual Condition will generally follow the general guidelines for the problem severity rating system presented in Section 4.5.1. Factors that should be taken into consideration in assigning your Correctability rating are:

- ☐ How much time and effort would be needed to correct the problem?
- ☐ Would the project need Federal, State and/or local permits?
- ☐ How much funding would be needed?

Examples of the rating system are as follows:

Best Correctability (1): 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 a small group of volunteers (10 people or less) could fix in less than a day without using heavy equipment.

Moderate Correctability (3): Problems that may require a small piece of equipment, such as a backhoe, and require some planning to correct. This is not the type of project that volunteers could 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.

Worst Correctability (5): Problems which would require a large expensive effort to correct. These projects would usually require heavy equipment, significant amount of funding ($100,000.00 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.

Access

See section 4.5.1.

4.6.10 REPRESENTATIVE SITE

Representative site data sheets are used to document the general condition of both in-stream habitat and the condition of the adjacent stream corridor. The representative site evaluation 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). For each of the 10 habitat parameters a rating of optimal, suboptimal, marginal or poor is assigned based on the grading criteria that is presented at the end of Appendix C. The 10 habitat parameters evaluated are:

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

In addition to the habitat ratings, data is collected on the stream's wetted width and pool depths at both runs and riffles at each representative site. Depth measurements are taken along the stream thalweg (e.g., main flow path). At these sites, field crews also indicate whether the bottom sediments in the area were primarily silts, sands, gravel, cobble, boulders or bedrock.

Representative site evaluations are usually done at set intervals both along the stream's mainstem and on major tributaries. The frequence that representative site data sheets are filled out will depend on the stream system, main purpose of the survey and the needs of the survey's sponsor. In past surveys, the data sheets have been filled out at either 1/4 or 1/2 mile intervals depending on the survey. In general, for an urban stream 1/4 mile spacing of representative sites has been used, and for more rural areas 1/2 mile intervals. Representative sites are determined at the beginning of the survey by the survey manager, and indicated with a red dot on the survey maps. The survey manager may vary the spacing of representative sites to collect information at critical survey points such as upstream and downstream of the confluence of major stream segments. When a survey team comes to a predesignated representative site, they should complete a Representative Data Sheet.

DATA SHEET FOR REPRESENTATIVE SITES

Map, Team, Site, Date and Photo Numbers:

Fill in the appropriate site identification information on the top of the data sheet and on the field maps. Also, record the date and film exposure numbers for the photographs taken at the site.

Habitat Assessment:

Using the habitat assessment guidelines on pages 66-68, indicate whether each of the 10 habitat parameters listed on the data sheet should be rated Optimal, Suboptimal, Marginal or Poor. You need only to check the appropriate box on the data sheet. Do not attempt to assign numerical scores to each parameter.

Wetted Width:

Wetted width is the width of the stream that is covered with water. At the pool, riffle and run sections near the predesignated representative site, identify representative cross sections and measure the wetted width of each in inches.

Thalweg Depth:

The thalweg is the main flow channel in a stream cross section. This is usually the area where water depth and water velocities are the highest. At the pool, riffle and run sections near the predesignated representative site, identify representative cross sections and measure the thalweg depth in inches.

Bottom Type:

Looking at primarily the riffle and run sections of the stream, determine if the bottom sediments in the stream are primarily silts, sands, gravel, cobble, boulders or bedrock. Most stream bottoms are made up of a variety of different size sediments, but your answer should indicate the dominant size.

5.0 DATA MANAGEMENT

5.1 DATA SHEETS

Data sheets used in the SCA survey can be found in Appendix C. During the survey, each team will carry enough data sheets for that day's work. At the end of the day, all used data sheets should be removed from the storage compartment on the clip board and checked by the team leader for completeness. Any data sheets that are incomplete or require special attention, such as a leaking sewage line or near stream construction sites that is causing a sediment pollution problem, should be set aside and discussed with either the survey crew chief or survey manager as soon as possible. Data sheets not requiring immediate attention should be placed in sequential order. These data sheets are clipped together and placed in a storage box until the information on the data sheets can be entered into the survey's database. Do not bring completed data sheets from the previous day into the field where they can be damaged or lost.

5.1.1 DATA ENTRY

Data entry should be done within one or two weeks of when the data is collected. If possible, the team that collected the data should enter the information from the data sheets into the project database. It is also helpful to have the photograph available during data entry to help answer any questions that may arise. At present, the data collected during SCA surveys are stored in separate project databases. As the number of streams that have undergone an SCA survey increase, the data from these separate project databases will be combined and incorporated into DNR's Geographical Information System (GIS).

Information collected during the SCA survey is entered into a separate Microsoft Access Database developed for each project. A data entry program has been developed to aid in data entry and is available from the Watershed Restoration Division of DNR. After the data entry program has been loaded and a project data base established, the survey crew can begin data entry. Data entry is usually done when the crew has some free time usually due to poor weather conditions. It is important, however, that the data be entered into the project database periodically during the survey, and that there is no more than a 2-week time lag between data collection and data entry. After each data entry cycle, the data that has been entered into the project database should be printed out and a backup copy of the database made. Backup copies of the database should be stored in a safe place.

5.1.2 DATA VERIFICATION

All data entered into the project database must be verified by the survey crew to insure that the information has been accurately entered into the database. Data entry verification is a simple process where the data in the database is checked against the original data sheets. This is usually done by one person reading aloud the information from a printout of the database and a second individual checking the original data sheet to make sure it is correct. When discrepancies occur they should be noted on the database printout and the database corrected. Once the data in the database has been verified, the original data sheets should be stored in a safe place.

5.2 CATALOGING PHOTOGRAPHS

Photographs taken during the SCA survey have proven to be a very important tool in analyzing problem sites and in prioritizing future restoration work. The information collected by the field teams during an SCA survey is limited, and the photographs can often help provide insight about problems identified in the survey.

The survey crew should develop a regular routine to collect exposed film and bring it in for developing. Film should be dropped off and picked up from a film processor at least once a week. When the photograph prints and negatives are returned to the field teams, the team should first make sure the photographs are in proper sequential order. If there are any questions about the sequential order of the photographs the team should refer back to the negatives. The field team should then determine the field identification number for each photograph, and write the field identification number on the back of each photograph using a soft felt tip pen. Do not use a ball point pen or pencil because they can cause creases in the photographs. Once all the photographs have been processed, they should be placed in 3-ring binder plastic sleeves and stored in a safe place. The plastic sleeves holding the negatives should be labeled with the survey name, team number and dates the photographs were taken. After the negatives have been labeled, they should also be stored in a safe place away from the photographs.

After the field surveys have been completed, all photographs should be digitized using a scanner. In past studies two survey crew members have been able to scan two to three hundred photographs in a single day. The scanned photographs are usually stored in a temporary directory and eventually copied onto a compact disk (CD). The production of a CD containing digitized copies of all the photographs, as well as a copy of the survey's database and final report, has proven to be a very effective way of sharing the survey's information with other watershed stakeholders. The size of the files needed to store each digitized photograph depends on the scanning resolution. In order to store more than five hundred photographs on a single CD, photographs are usually scanned at 100 to 200 dpi. Photographs scanned at 100 to 200 dpi will provide a fairly clear image on a computer monitor and can also be used to produce small prints using a color printer. To produce larger blowups of the images, it will usually be necessary to rescan the original photographs at a higher resolution. In the past, the TIF file format has been used because it can be read by a variety of software packages.

After all the photographs have been scanned, they should be placed in sequential order and placed back into a 3-ring binder. The 3-ring binders should be safely stored until they are turned over to the project manager for analysis and production of a final report. After a final report has been completed, the original photographs will be either given to the survey sponsor or kept on file with DNR's Watershed Restoration Division.

5.3 MAP INFORMATION

The location of environmental problems and representative sites are first recorded on field survey maps. At the end of each day field team leaders should quickly review the maps to make sure they are filled in properly. When all the streams present on a map have been surveyed, the completed field maps should be stored in a safe place. If possible the completed maps should be photocopied and stored at a separate location from the original maps. Periodically during the survey, the completed field survey maps will be brought to either the sponsor's or DNR's GIS centers and entered into a GIS database.

5.3.1 GIS DATA ENTRY

Data entry of site locations into a GIS database will depend on the GIS system being used. When county governments have been the survey's sponsor, the counties have provided training to the survey crew members on how to enter site location information directly into the sponsor's GIS system. Once data entry is completed, the data will eventually be transferred to DNR for use in the GIS system. When the survey sponsor does not have an adequate GIS system, the data has been entered directly into DNR's GIS system.

5.3.1 GIS DATA VERIFICATION

Just as field data entered into a project database must be verified (Section 5.1.2), it is important that site location data also undergoes the same process. Once the site location data has been entered into a GIS system and the location of the survey sites is ready to be displayed by the system, survey crew members should compare all site locations in the GIS system with the original field survey maps. When discrepancies are identified, they should be noted and arrangements made with the GIS system manager to correct them.

5.4 DATA REVIEW AND MODIFICATION

Once the survey teams have completed data entry and have verified that the data has been entered correctly, the entire survey crew should be brought together to review the data. This data review by the survey teams is primarily designed to assure that the severity and correctability ratings are consistent. While survey members all receive the same training and follow the same protocols during the survey, it is not unusual, especially for surveys that have been done over several months, to find at the end of the survey some small inconsistencies in the ratings of different problems. These inconsistencies are often due to increases in the ability of survey teams to properly evaluate problems as they gain more experience. By reviewing all of the data at the end of the survey, the survey crew has an opportunity to compare ratings they have given different problems at different times, and determine if the ratings are consistent within each problem category and with the survey protocols.

The review is done by first sorting the data in each problem category by the severity rating in descending order. The crew should then compare the information they have about each problem to determine if all of the problems that received a specify severity or correctability ratings are similiar or if the ratings of some of the problems should be adjusted. If the ratings, or any other information is changed during the data review, it is important that changes be made to both the computer database and on the original data sheets. Changes made on the original data sheets should be done in colored pencil to indicate that it was changed during the survey crew's data review.

The SCA survey is designed to provide a quick systematic survey of the streams in a watershed to assess habitat conditions and identify environmental problems for future restoration work. The main products of the survey are: lists of environmental problems in nine separate categories, a general rating of in-stream and riparian habitat in different stream segments, and a series of maps showing the location of problem and representative sites in the watershed.

Data collected as part of the SCA survey is first entered into both a project database and a GIS system (See Section 5.0). Once the data has been entered into a GIS system, a series of maps showing the locations of the problems identified in the survey should be produced. Depending on the size of the watershed surveyed and the capabilities of the GIS system, one or more maps are usually produced for each of the nine problem categories, as well as maps showing the location of representative sites. An additional map showing the location of all problem and representative sites on a single map should also be produced. The maps should be detailed enough so that the location of a site can be easily identified, but not cluttered with so much information that it is difficult to either see all the sites on the map or read the field identification number for each site. An example is shown in Figure 6.0-1.

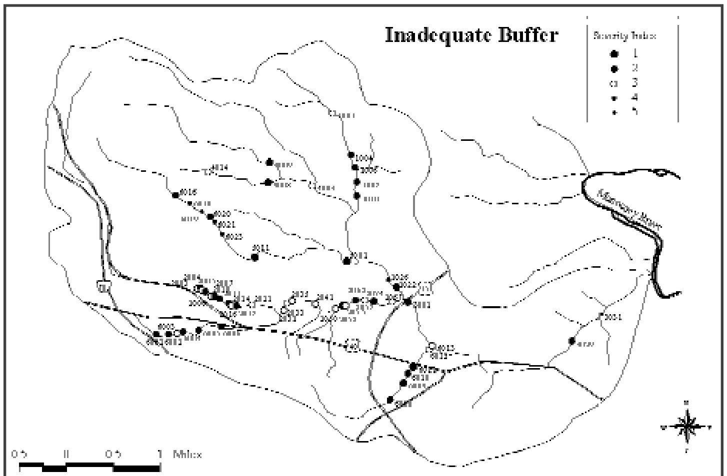

Figure 6.0-1. Map of Carroll & Rock Creeks Inadequate Buffer Sites

Information collected and entered into the project database should be arranged and displayed in three separate sets of tables. The first table is the Site Identification Table which is developed by combining all the data from the problem and representative sites. Tables produced from this new data set will show the following information: field identification number, problem type, severity rating, correctability rating, accessability rating, map coordinates (state plane or latitude and logitude) and stream segment name. The data sorted and displayed by sequential field identification number is useful in working with the maps to determine what problems are present on what stream segment. An example of this table is shown in Figure 6.0-2 and was produced as part of the SCA survey of Carroll and Rock Creeks.

SN*	Problem	S*	C*	A*	Northing	Easting	Stream Segment
RC1001	REPRESENTATIVE SITE				198307.59	361804 28	UPPER CARROLL
RC1001	INADEQUATE BUFFER	3	4	3	198307.59	361804 28	UPPER CARROLL
RC1002	REPRESENTATIVE SITE				197929.91	361990 09	UPPER CARROLL
RC1003	REPRESENTATIVE SITE				197668.91	362042 57	UPPER CARROLL
RC1004	INADEQUATE BUFFER	2	3	3	197570 9	362106 47	UPPER CARROLL
RC1005	REPRESENTATIVE SITE				197453 72	362132 69	UPPER CARROLL
RC1006	PIPE OUTFALL	2	3	2	197363 25	362160 99	UPPER CARROLL
RC1006	INADEQUATE BUFFER	2	3	4	197363 25	362160 99	UPPER CARROLL
RC1007	PIPE OUTFALL	4	4	3	197107 05	362216 24	UPPER CARROLL
RC1007	INADEQUATE BUFFER	2	3	2	197107 05	362216 24	UPPER CARROLL
RC1008	REPRESENTATIVE SITE				197038 9	362191 5	UPPER CARROLL
RC1009	PIPE OUTFALL	5	1	3	196879 12	362207 73	UPPER CARROLL
RC1010	INADEQUATE BUFFER	2	3	4	196876 04	362211 6	UPPER CARROLL
RC1010	LIVESTOCK	1	3	3	196876 04	362211 6	UPPER CARROLL
RC1011	REPRESENTATIVE SITE				196555 72	362157 53	UPPER CARROLL
RC1012	REPRESENTATIVE SITE				196249 67	362039 46	UPPER CARROLL
RC1020	CHANNEL ALTERATION	3	3	3	195229 74	362993 3	UPPER CARROLL
RC1020	REPRESENTATIVE SITE				195229.74	362993 3	UPPER CARROLL
RC1021	PIPE OUTFALL	1	4	3	195254.66	362977 85	UPPER CARROLL
RC1022	INADEQUATE BUFFER	2	4	3	195317.7	362874 84	UPPER CARROLL
RC1023	REPRESENTATIVE SITE				195329.1	362844 85	UPPER CARROLL
RC1024	EXPOSED PIPE	1	4	3	195339.8	362832 38	UPPER CARROLL
RC1024	UNUSUAL CONDITION	1	4	3	195339.8	362832 38	UPPER CARROLL
RC1025	PIPE OUTFALL	2	3	2	195381.28	362795 01	UPPER CARROLL
RC1026	INADEQUATE BUFFER	4	2	2	195452.22	362748 38	UPPER CARROLL
RC1026	EROSION	2	3	2	195452 22	362748 38	UPPER CARROLL
RC1028	REPRESENTATIVE SITE				195634 68	362675 45	UPPER CARROLL
RC1029	PIPE OUTFALL	3	2	2	195666 56	362687 48	UPPER CARROLL
RC1030	FISH BARRIER	2	3	4	195718 18	362622 49	UPPER CARROLL
RC1031	REPRESENTATIVE SITE				195775 2	362468 61	UPPER CARROLL
RC1031	PIPE OUTFALL	3	2	1	195775 2	362468 61	UPPER CARROLL
RC2001	CHANNEL ALTERATION	4	5	3	195273 97	359434 41	ROCK CREEK
RC2002	REPRESENTATIVE SITE				195282 44	359447 87	ROCK CREEK
RC2003	INADEQUATE BUFFER	3	5	2	195310 27	359491 9	ROCK CREEK
RC2004	INADEQUATE BUFFER	2	5	2	195307 64	359528 47	ROCK CREEK
RC2005	INADEQUATE BUFFER	3	1	2	195285 51	359563 71	ROCK CREEK
RC2005	EROSION	2	1	2	195285 51	359563 71	ROCK CREEK
RC2006	PIPE OUTFALL	4	3	2	195258 63	359575 76	ROCK CREEK
RC2006	EROSION	3	2	2	195258.63	359575 76	ROCK CREEK

SN=Site Number P=Problem S=Severity C=Correctability A=Access

Figure 6.0-2. Example of a Site Identification Table produced as part of the Rock & Carroll Creek SCA survey.

Most of the data presented in the Site Identification Table is the data that is common to all the problem categories. One exception is representative sites, which are not given severity, correctability and access ratings. In addition, information on stream segment names is not part of the original database and must be determined separately and added to the site identification data set. The purpose of breaking the stream up into a series of stream segments is twofold. First, it provides some local, easily recognizable, geographical references to the site

Problem	Site Number	Sides	Width Left	Length Left	Land Use Left	Width Right (ft)	Length Right (ft)	Land Use Right (ft)	Ownership	S*	C*	A*
Inadequate Buffer	RC4009	Both	0	1500	Livestock	20	1500	Livestock	Private	1	2	1
Inadequate Buffer	RC5001	Both	0	1000	Lawn	10	1000	Lawn	Unknown	1	4	4
Inadequate Buffer	RC5011	Both	0	600	Park	0	600	Park	Private	1	4	2
Inadequate Buffer	RC4008	Both	0	500	Pasture	0	500	Pasture	Private	1	1	2
Inadequate Buffer	RC6009	Both	5	400	Lawn	0	400	Lawn	Private	1	3	3
Inadequate Buffer	RC2074	Both	0	500	Lawn	0	500	Lawn	Unknown	1	4	1
Inadequate Buffer	RC6011	Both	0	650	Lawn	0	650	Other	Public	1	3	1
Inadequate Buffer	RC3001	Both	0	1000	Park	10	1000	Park	Public	1	3	1
Inadequate Buffer	RC2007	Left	0	150	Lawn			Shrubs	Public	2	2	2
Inadequate Buffer	RC2004	Right			Shrubs	10	75	Paved	Private	2	5	2
Inadequate Buffer	RC2011	Both	0	250	Lawn	0	300	Lawn	Unknown	2	2	2
Inadequate Buffer	RC2052	Both	0	50	Lawn	0	50	Lawn	Public	2	2	2
Inadequate Buffer	RC3029	Both	0	500	Park	0	500	Park	Private	2	4	2
Inadequate Buffer	RC1004	Both	30	100	Park	30	100	Park	Private	2	3	3
Inadequate Buffer	RC6006	Both	5	1420	Other	5	1420	Other	Private	2	1	1
Inadequate Buffer	RC6008	Left	5	1400	Lawn			Shrubs	Private	2	4	3
Inadequate Buffer	RC6001	Left	5	300	Park			Shrubs	Private	2	1	2
Inadequate Buffer	RC6002	Left	5	300	Park			Shrubs	Private	2	1	2
Inadequate Buffer	RC6005	Both	5	1420	Crop Field	5	1420	Crop Field	Private	2	1	1
Inadequate Buffer	RC2017	Right			Shrubs	0	200	Lawn	Unknown	2	2	2
Inadequate Buffer	RC1007	Both	30	500	Crop Field	30	500	Lawn	Unknown	2	3	2
Inadequate Buffer	RC6004	Both	0	250	Park	0	250	Park	Private	2	1	1
Inadequate Buffer	RC2014	Left	12	300	Lawn			Shrubs	Private	2	2	3
Inadequate Buffer	RC2057	Both	0	200	Shrubs	0	200	Shrubs	Public	2	2	2
Inadequate Buffer	RC2010	Both	0	120	Lawn	0	120	Shrubs	Unknown	2	2	2

**NOTE: S= Severity C= Correctability A= Access*

Figure 6.0-3. Example of a Problem Identification Table produced as part of the Rock & Carroll Creeks SCA survey.

numbers. When working with a large number of sites that are identified by only field identification numbers, it is often helpful to quickly determine if a site is in the upper, middle or lower mainstem or in one of the tributaries. The second reason is to group sites when reviewing information on general stream conditions. Data collected at both problem and representative sites can be grouped by stream segment to aid in later data analysis.

Stream segments are determined by first reviewing the maps of the watershed. The overall goal is to divide the stream network into a series of ecologically related stream segments. The stream segments can vary in length and should be determined based on the local geology and land use. Initially, the stream will be segmented into the stream's mainstem and major tributaries. Depending on the size of the stream system, these initial segments may be further divided into upper, middle, lower segments or major and minor tributaries. The number and size of the stream segments will be dictated by the pattern of the stream network and land use in the watershed. The beginning and end of a stream segment should be based on identifying logical break points in the stream network. These would include the stream confluences or even a road crossing where land use is very different up and downstream of the road. Each stream segment should be given a name and all problem and representative sites in the segment identified using the GIS maps. As site identification numbers are matched to stream segments, the information should be recorded and entered into the Site Identification Data set.

The second set of tables that are usually produced for the SCA survey are the Problem Information Tables. These tables are grouped by problem type and include all of the information collected on the survey data sheets. An example of a Problem Information Table produced as part of the Rock and Carroll Creek SCA survey is shown in Figure 6.0-3. While the information in these tables can be organized in a number of different ways, usually the data is sorted in descending order by the severity, correctability and accessability ratings. This produces a set of tables with the sites that are considered the worst in each category at the top of the table.

The final table produced in the analysis of the SCA data is the Representative Site Table. The Representative Site Table displays the data collected concerning general habitat conditions during the SCA

Site Number	Problem	Macro-Invertebrate Substrate	Embeddedness	Shelter For Fish	Channel Alteration	Sediment Deposition	Velocity & Depth	Channel Flow	Bank Vegetation	Bank Condition	Riparian Vegetation
LOWER CARROLL CREEK											
RC3004	Representative Site	Suboptimal	Suboptimal	Marginal	Optimal	Marginal	Optimal	Marginal	Poor	Poor	Poor
RC3010	Representative Site	Suboptimal	Marginal	Optimal	Suboptimal	Optimal	Optimal	Suboptimal	Suboptimal	Suboptimal	Poor
RC3019	Representative Site	Optimal	Optimal	Optimal	Suboptimal	Optimal	Suboptimal	Optimal	Suboptimal	Suboptimal	Poor
RC3027	Representative Site	Marginal	Optimal	Poor	Poor	Optimal	Poor	Optimal	Poor	Optimal	Poor
RC6011	Representative Site	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor
	Average	Suboptimal	Suboptimal	Marginal	Marginal	Suboptimal	Suboptimal	Suboptimal	Marginal	Marginal	Poor
ROCK CREEK											
RC2002	Representative Site	Optimal	Suboptimal	Optimal	Suboptimal	Marginal	Optimal	Suboptimal	Optimal	Optimal	Marginal
RC2009	Representative Site	Suboptimal	Optimal	Suboptimal	Optimal	Marginal	Suboptimal	Suboptimal	Marginal	Suboptimal	Marginal
RC2016	Representative Site	Suboptimal	Suboptimal	Optimal	Optimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal	Marginal	Suboptimal
RC2024	Representative Site	Marginal	Marginal	Suboptimal	Marginal	Marginal	Marginal	Suboptimal	Marginal	Poor	Poor
RC2029	Representative Site	Suboptimal	Marginal	Marginal	Suboptimal	Marginal	Poor	Optimal	Optimal	Suboptimal	Poor
RC2036	Representative Site	Suboptimal	Marginal	Suboptimal	Suboptimal	Marginal	Marginal	Marginal	Marginal	Poor	Marginal
RC2042	Representative Site	Suboptimal	Optimal	Marginal	Optimal	Poor	Suboptimal	Marginal	Marginal	Marginal	Poor
RC2050	Representative Site	Marginal	Marginal	Suboptimal	Optimal	Marginal	Suboptimal	Suboptimal	Suboptimal	Marginal	Poor
RC2056	Representative Site	Suboptimal	Suboptimal	Suboptimal	Optimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal	Marginal	Poor
RC2067	Representative Site	Marginal	Suboptimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal
RC2073	Representative Site	Marginal	Suboptimal	Marginal	Suboptimal	Marginal	Suboptimal	Suboptimal	Optimal	Suboptimal	Poor
RC6002	Representative Site	Suboptimal	Suboptimal	Marginal	Optimal	Marginal	Marginal	Suboptimal	Optimal	Suboptimal	Suboptimal
	Average	Suboptimal	Suboptimal	Suboptimal	Suboptimal	Marginal	Suboptimal	Suboptimal	Suboptimal	Marginal	Marginal

Figure 6.0-4a. Example of the first part of the Representative Site Table produced as part of the Rock & Carroll Creeks survey

Site Number	Problem	Riffles wetted width(in)	Run wetted width(in)	Pool wetted width(in)	Riffle thalweg depth(in)	Run thalweg depth(in)	Pool thalweg depth(in)	Bottom Type
LOWER CARROLL CREEK								
RC3004	Representative Site	10	19	16	4	7	15	GRAVEL
RC3010	Representative Site	264	324	312	4	10	16	BOULDER
RC3019	Representative Site	27	26	25	4	8	18	GRAVEL
RC3027	Representative Site	31	33	20	5	24	25	GRAVEL
RC6011	Representative Site	11	4	13	1	1	9	CONCRETE
ROCK CREEK								
RC2002	Representative Site	32	30	50	5	6	8	UNKNOWN
RC2009	Representative Site	36	24	28	3	4	4	COBBLE
RC2016	Representative Site	36	24	48	2	4	12	COBBLE
RC2024	Representative Site	8	24	12	1	2	11	GRAVEL
RC2029	Representative Site	40	35	108	3	8	14	SAND
RC2036	Representative Site	72	48	86	2	2	6	UNKNOWN
RC2042	Representative Site	348	216	276	3	4	8	GRAVEL
RC2050	Representative Site	45	50	180	1	1	24	SAND
RC2056	Representative Site	13	12	20	2	5	8	GRAVEL
RC2067	Representative Site	252	132	13	2	5	6	GRAVEL
RC2073	Representative Site	8	5	20	2	2	4	COBBLE
RC6002	Representative Site	60	84	8.5	18	2	4	GRAVEL

Figure 6.0-4b. Example of the second part of the Representative Site Table that was produced as part of the Rock & Carroll Creek survey.

SCA DATA CHANGE LOG

Survey ___________________ Project manager: ___________________

Initial and enter date when change made.

Site Number (map, team, site)	Date Change Proposed	Change (description)	Master Database	GIS Map Data	Original Data Sheets

Figure 6.0-5. SCA data change log sheet that is used by the project manager to keep track of changes made to the original survey data.

survey. The information is grouped by stream segments and the habitat ratings in each category are combined to provide an overall rating for each habitat category in each stream segment. An example of a portion of the Representative Site Tables from the Rock and Carroll Creek SCA survey are shown in Figure 6.0-4 a & b.

Once a working set of maps and tables have been developed, it is the responsibility of the project manager to do a complete review of the information. During the review the photographs, data and GIS maps are examined for all problem sites. The review is usually done with the survey team leaders and the project manager will look for possible discrepancies in the data, as well as possible trends and restoration opportunities. It is not unusual for the project manager to make a number of changes to the original survey data during the review. This is especially true in reviewing the severity and correctability rating of the survey teams. It is not unusual when viewing a number of different problems in the same category to adjust the rating to reflect the relative importance of specific problems. In making these changes it is important that the data base, GIS maps and original data sheets all reflect any changes that are made. The SCA Data Change Log shown in Figure 6.0-5 can be used by the project manager to keep track of changes.

Once the project manager's review is performed, it is recommended that a panel of experts be brought together to review the data in specific problem categories. It is helpful if the panel is made up of not only individuals who are familiar with correcting specific types of problems, but also some of the watershed stakeholders who will be asked to help fix the problems. During the panel review, survey data and photographs will be discussed and follow-up surveys may be scheduled. The objective of the panel review is to identify any trends in the data and to begin to develop a consensus among the watershed stakeholders on what future restoration work may be needed.

Once the data has been reviewed, a final report summarizing the results of the SCA survey is written. The final report should summarize the findings of the survey and discuss any trends seen. The report should also point out possible restoration opportunities and/or follow-up work that may be needed. This report is not intended to provide an overall management strategy or plan for a watershed. Management plans are consensus documents that are written in collaboration with the stakeholders in the watershed. The SCA survey report instead provides a list of environmental problems and recommendations on possible steps that could be taken to improve environmental conditions. The SCA survey should be seen as a resource that watershed stakeholders can use in developing future watershed restoration strategies. For copies of past SCA reports check out DNR's website at www.dnr.state.md.us or contact:

Kenneth Yetman
Watershed Restoration Division
Maryland Department of Natural Resources
Tawes State Office Building
Annapolis, MD 21401
e-mail: kyetman@dnr.state.md.us

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APPENDIX A

EXAMPLES OF FOLLOW-UP CONTACT LETTERS

Warren County

November 1, 2001

Dear Watershed Resident:

Warren County is conducting a stream survey of the Bear Creek watershed where your property is located. This survey is being performed as part of the County's cooperative efforts to protect the natural resources within the Rocky Gorge Reservoir watershed.

The Maryland Conservation Corps, whose staff presented you this letter, has been contracted by Warren County to perform the fieldwork for this study. Teams of two to three corps members are walking the streams in the watershed and making field observations and taking photographs of various stream characteristics such as streambank erosion, trash, exposed or undermined pipes, unshaded stream sections and other related environmental concerns. Corps members have been trained in stream survey techniques by the Maryland Department of Natural Resources. The information collected from this study will be used to help direct future stream restoration and protection efforts.

Please understand, that the Corps' field staff have been directed only to record the condition of the streams in the watershed. They are not here to remedy or address any potential problems at this time. If you have any specific concerns regarding the streams on your property, please fell free to direct them to John Smith of the Department of Public Works at 410-999-9999.

Sincerely,

John Smith

John Smith
Storm Water Management Division
Department of Public Works

APPENDIX B

EXAMPLES OF PROPERTY OWNER NOTIFICATION LETTERS

Warren County

November 1, 2001

Dear Bear Creek Watershed Resident:

Your help is needed for an important environmental study of Bear Creek and its tributaries.

In November 2001, Warren County Government along with the Maryland Conservation Corps began a base study of the Bear Creek watershed for developing a baseline assessment of the streams condition.

Your permission is requested to allow a field team to visit the property shown under your ownership by the latest digital version of the Maryland tax records at 00399 Singer Road referenced by tax identification number 01201123. Each member of the team will be appropriately identified and will observe proper protocols. It is anticipated that the crews will be in your area in February 2001.

The first step in the program is to walk the stream and to do field observations of various stream characteristics such as areas of erosion, stream degradation, unshaded stream banks, and other related environmental concerns.

Upon completion of the field study, the information will be collated into a draft document and presented at a Public meeting. Public comment will be welcome at the meeting.

Bear Creek will be the third watershed study in Warren County, preceded by studies in Swan Creek in 1994 and Bynum Run in 1996. The information for Winters Run as with the other studies will be used to identify and set priorities in areas where restoration could be implemented. The types of projects that my potentially be investigated and implemented will range from recommendations to property owners about modifying lawn maintenance practices, tree and shrub plantings to stabilize stream banks, and larger capitally funded projects to manage runoff and restore stream habitat.

Your permission to walk your property will allow this important project to move forward. Should you object to our field crews entering your property, please contact John Smith at (410) 999-9999 by February 13, 2001. Otherwise, we will assume that we have permission to walk the stream on your property.

Thank you for your support.

Very truly yours,

John Jones
Warren County Executive

APPENDIX C

DATA SHEETS

CHANNEL ALTERATION CA

Map: _______________ Team: _______ Site: _________

Date: ____/____/____ Photo: _______ Survey: _______
MM DD YY

Type: **Co**ncrete, **Ga**bion, **R**ip-**r**ap, **E**arth **C**hannel, **O**ther: ________________

Bottom Width: _______________ in **Length:** _______________ ft.

Does channel have perennial flow? **Y**es **N**o

Is sediment deposition occurring in the channel? **Y**es **N**o

Is vegetation growing in the channel? **Y**es **N**o

Is it part of a road crossing? **No** **Ab**ove **Be**low **Bo**th

Channelized length above road crossing _______________ ft.

Channelized length below road crossing _______________ ft.

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**–1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)

CHANNEL ALTERATION CA

Map: _______________ Team: _______ Site: _________

Date: ____/____/____ Photo: _______ Survey: _______
MM DD YY

Type: **Co**ncrete, **Ga**bion, **R**ip-**r**ap, **E**arth **C**hannel, **O**ther: ________________

Bottom Width: _______________ in **Length:** _______________ ft.

Does channel have perennial flow? **Y**es **N**o

Is sediment deposition occurring in the channel? **Y**es **N**o

Is vegetation growing in the channel? **Y**es **N**o

Is it part of a road crossing? **No** **Ab**ove **Be**low **Bo**th

Channelized length above road crossing _______________ ft.

Channelized length below road crossing _______________ ft.

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**–1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)

EROSION SITE ES

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______
MM DD YY

Type: **D**owncutting **W**idening **H**eadcutting **U**nknown

Cause: **Be**nd at steep slope, **P**ipe **O**utfall, Below **Ch**annelization, Below **R**oad **C**rossing, **Li**vestock, **L**and **U**se **C**hange Upstream, **O**ther: ___________________________

Length: _____________________ ft. **Average exposed bank height:** _______________________ ft.

Present Land Use Left Side (looking downstream): **Cr**op field, **Pa**sture, **La**wn, **Pav**ed, **Sh**rubs & Small Trees, **Fo**rest, **M**ultiflora **R**ose, **O**ther __________________________

Present Land Use Right Side (looking downstream): **Cr**op field, **Pa**sture, **La**wn, **Pav**ed, **Sh**rubs & Small Trees, **Fo**rest, **M**ultiflora **R**ose, **O**ther __________________________

Threat to Infrastructure?: **Y**es **N**o **Describe**: _______________________________________

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**–1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)

EROSION SITE ES

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______
MM DD YY

Type: **D**owncutting **W**idening **H**eadcutting **U**nknown

Cause: **Be**nd at steep slope, **P**ipe **O**utfall, Below **Ch**annelization, Below **R**oad **C**rossing, **Li**vestock, **L**and **U**se **C**hange Upstream, **O**ther: ___________________________

Length: _____________________ ft. **Average exposed bank height:** _______________________ ft.

Present Land Use Left Side (looking downstream): **Cr**op field, **Pa**sture, **La**wn, **Pav**ed, **Sh**rubs & Small Trees, **Fo**rest, **M**ultiflora **R**ose, **O**ther __________________________

Present Land Use Right Side (looking downstream): **Cr**op field, **Pa**sture, **La**wn, **Pav**ed, **Sh**rubs & Small Trees, **Fo**rest, **M**ultiflora **R**ose, **O**ther __________________________

Threat to Infrastructure?: **Y**es **N**o **Describe**: _______________________________________

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**–1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)

EXPOSED PIPE EP

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______
MM DD YY

Pipe is: Exposed across bottom of stream, Exposed along stream bank, Exposed manhole, Above stream, Other: ________________________________

Type of Pipe: Concrete, Smooth Metal, Corrugated Metal, Plastic, Terra Cotta, Other: _____________________

Pipe Diameter: ______________ in. **Length exposed:** _______________ ft.

Purpose of Pipe: Sewage, Water Supply, Stormwater, Unknown, Other: __________________________

Evidence of Discharge?: **Y**es **N**o

Color: Clear, medium brown, dark brown, green brown, yellow brown, green, other: _________________

Odor: Sewage, oily, musky, fishy, rotten eggs, chlorine, none, other: _________________

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**–1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)

EXPOSED PIPE EP

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______
MM DD YY

Pipe is: Exposed across bottom of stream, Exposed along stream bank, Exposed manhole, Above stream, Other: ________________________________

Type of Pipe: Concrete, Smooth Metal, Corrugated Metal, Plastic, Terra Cotta, Other: _____________________

Pipe Diameter: ______________ in. **Length exposed:** _______________ ft.

Purpose of Pipe: Sewage, Water Supply, Stormwater, Unknown, Other: __________________________

Evidence of Discharge?: **Y**es **N**o

Color: Clear, medium brown, dark brown, green brown, yellow brown, green, other: _________________

Odor: Sewage, oily, musky, fishy, rotten eggs, chlorine, none, other: _________________

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**–1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)

PIPE OUTFALL PO

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______
MM DD YY

Type of Outfall: Stormwater, Sewage Overflow, Industrial, Pumping Station, Agricultural, Other: ___________________________

Type of Pipe: Earth Channel, Concrete Channel, Concrete Pipe, Smooth Metal Pipe, Corrugated Metal, Plastic, Other: ___________________________

Location (facing downstream): left bank, right bank, head of stream, Other ___________________

Pipe Diameter: ______________ in. **Channel width:** ______________ ft.

Evidence of Discharge?: **Y**es **N**o

Color: Clear, medium brown, dark brown, green brown, yellow brown, green, other: ______________

Odor: Sewage, oily, musky, fishy, rotten eggs, chlorine, none, other: ______________

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**–1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)

PIPE OUTFALL PO

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______
MM DD YY

Type of Outfall: Stormwater, Sewage Overflow, Industrial, Pumping Station, Agricultural, Other: ___________________________

Type of Pipe: Earth Channel, Concrete Channel, Concrete Pipe, Smooth Metal Pipe, Corrugated Metal, Plastic, Other: ___________________________

Location (facing downstream): left bank, right bank, head of stream, Other ___________________

Pipe Diameter: ______________ in. **Channel width:** ______________ ft.

Evidence of Discharge?: **Y**es **N**o

Color: Clear, medium brown, dark brown, green brown, yellow brown, green, other: ______________

Odor: Sewage, oily, musky, fishy, rotten eggs, chlorine, none, other: ______________

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**–1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)

FISH BARRIER FB

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______
MM DD YY

Fish Blockage: **To**tal, **Pa**rtial, **Te**mporary, **Un**known

Type of Barrier: **Da**m, **R**oad **C**rossing, **P**ipe **C**rossing, **N**atural **F**alls, **B**eaver **D**am, **Ch**annelized, Instream **Po**nd, **D**ebris **D**am, **Ot**her: __________________________

Blockage because: Too **hi**gh Too **sh**allow Too **fa**st

Water drop: __________________ inches (if too high)

Water depth: ___________________ inches (if too shallow)

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**–1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)

FISH BARRIER FB

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______
MM DD YY

Fish Blockage: **To**tal, **Pa**rtial, **Te**mporary, **Un**known

Type of Barrier: **Da**m, **R**oad **C**rossing, **P**ipe **C**rossing, **N**atural **F**alls, **B**eaver **D**am, **Ch**annelized, Instream **Po**nd, **D**ebris **D**am, **Ot**her: __________________________

Blockage because: Too **hi**gh Too **sh**allow Too **fa**st

Water drop: __________________ inches (if too high)

Water depth: ___________________ inches (if too shallow)

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**–1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)

INADEQUATE BUFFER IB

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______
MM DD YY

Buffer inadequate on: **L**eft **R**ight **B**oth (looking downstream)

Is stream unshaded? **L**eft **R**ight **B**oth (looking downstream) **N**either

Buffer width left: _______ ft. **Buffer width right:** _______ ft.

Length left: ____________ ft. **Length right:** ____________ ft.

Present land use left side: **Cr**op field, **Pa**sture, **La**wn, **Pav**ed, **Sh**rubs & Small Trees, **Fo**rest, **M**ultiflora **R**ose, **O**ther _____________________

Present land use right side: **Cr**op field, **Pa**sture, **La**wn, **Pav**ed, **Sh**rubs & Small Trees, **Fo**rest, **M**ultiflora **R**ose, **O**ther _____________________

Has a buffer recently been established: **Y**es **N**o

Are Livestock present: **Y**es **N**o **Type:** **C**attle, **H**orses, **P**igs, **O**ther: _____________________

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**–1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Wetland Potential	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)

(Good wetland potential = low slope, low bank height)

INADEQUATE BUFFER IB

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______
MM DD YY

Buffer inadequate on: **L**eft **R**ight **B**oth (looking downstream)

Is stream unshaded? **L**eft **R**ight **B**oth (looking downstream) **N**either

Buffer width left: _______ ft. **Buffer width right:** _______ ft.

Length left: ____________ ft. **Length right:** ____________ ft.

Present land use left side: **Cr**op field, **Pa**sture, **La**wn, **Pav**ed, **Sh**rubs & Small Trees, **Fo**rest, **M**ultiflora **R**ose, **O**ther _____________________

Present land use right side: **Cr**op field, **Pa**sture, **La**wn, **Pav**ed, **Sh**rubs & Small Trees, **Fo**rest, **M**ultiflora **R**ose, **O**ther _____________________

Has a buffer recently been established: **Y**es **N**o

Are Livestock present: **Y**es **N**o **Type:** **C**attle, **H**orses, **P**igs, **O**ther: _____________________

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**–1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Wetland Potential	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)

(Good wetland potential = low slope, low bank height)

IN OR NEAR STREAM CONSTRUCTION IC

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______
MM DD YY

Type of activity: **Ro**ad, **R**oad **C**rossing, **U**tility, **Lo**gging, **B**ank **S**tabilization, **Re**sidential Development, **In**dustrial Development, **O**ther: _______________________

Sediment Control: **A**dequate **I**nadequate **U**nknown

If inadequate, why? ____

Is stream bottom below site laden with excess sediment? **Y**es **N**o

Length of stream affected: _________________________ ft.

Company doing construction: _____________________________________

Location: ____

Severity Severe **1** **2** **3** **4** **5** Minor Unknown (**–1**)

Contact office as soon as possible: (   )

IN OR NEAR STREAM CONSTRUCTION IC

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______
MM DD YY

Type of activity: **Ro**ad, **R**oad **C**rossing, **U**tility, **Lo**gging, **B**ank **S**tabilization, **Re**sidential Development, **In**dustrial Development, **O**ther: _______________________

Sediment Control: **A**dequate **I**nadequate **U**nknown

If inadequate, why? ____

Is stream bottom below site laden with excess sediment? **Y**es **N**o

Length of stream affected: _________________________ ft.

Company doing construction: _____________________________________

Location: ____

Severity Severe **1** **2** **3** **4** **5** Minor Unknown (**–1**)

Contact office as soon as possible: (   )

TRASH DUMPING TD

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ (MM DD YY) **Photo:** _______ **Survey:** _______

Type of trash: **Re**sidential, **In**dustrial, **Y**ard **W**aste, Flotables, **Ti**res, **Co**nstruction,
Other: ______________________________

Amount of trash: _______________________ pick-up truck loads

Other measure: _______________________

Is trash confined to? **S**ingle site, **L**arge Area

Possible cleanup site for volunteers? **Y**es **N**o

Land Ownership: **Pu**blic **Pr**ivate **Un**known

If public, name: __________________________________

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**-1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**-1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**-1**)

TRASH DUMPING TD

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ (MM DD YY) **Photo:** _______ **Survey:** _______

Type of trash: **Re**sidential, **In**dustrial, **Y**ard **W**aste, Flotables, **Ti**res, **Co**nstruction,
Other: ______________________________

Amount of trash: _______________________ pick-up truck loads

Other measure: _______________________

Is trash confined to? **S**ingle site, **L**arge Area

Possible cleanup site for volunteers? **Y**es **N**o

Land Ownership: **Pu**blic **Pr**ivate **Un**known

If public, name: __________________________________

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**-1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**-1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**-1**)

UNUSUAL CONDITION OR COMMENT UC

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______
MM DD YY

Type: (circle one) **Unusual Condition** **Comment**

Describe: **Od**or, **Sc**um, Excessive **Al**gae, **W**ater **C**olor/Clarity, **R**ed **F**lock, **S**ewage **D**ischarge, **Oi**l

____

____

____

Potential Cause: ____

____

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**–1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)

UNUSUAL CONDITION OR COMMENT UC

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______
MM DD YY

Type: (circle one) **Unusual Condition** **Comment**

Describe: **Od**or, **Sc**um, Excessive **Al**gae, **W**ater **C**olor/Clarity, **R**ed **F**lock, **S**ewage **D**ischarge, **Oi**l

____

____

____

Potential Cause: ____

____

Severity	Severe	**1**	**2**	**3**	**4**	**5**	Minor	Unknown (**–1**)
Correctability	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)
Access	Best	**1**	**2**	**3**	**4**	**5**	Worst	Unknown (**–1**)

REPRESENTATIVE SITE RE

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______

MM DD YY

	Optimal	Suboptimal	Marginal	Poor
Macroinvertebrate Substrata				
Embeddedness				
Shelter for fish				
Channel Alteration				
Sediment Deposition				
Velocity and Depth				
Channel Flow				
Bank Vegetation				
Bank Condition				
Riparian Vegetation				

Wetted width: Riffles: _________ in. **Runs:** _________ in. **Pools:** _________ in.

Thalweg depth: Riffles: _________ in. **Runs:** _________ in. **Pools:** _________ in.

Bottom type: Silts, Sands, Gravel, Cobble, Boulder, Bedrock

REPRESENTATIVE SITE RE

Map: _______________ **Team:** _______ **Site:** _________

Date: ____/____/____ **Photo:** _______ **Survey:** _______

MM DD YY

	Optimal	Suboptimal	Marginal	Poor
Macroinvertebrate Substrata				
Embeddedness				
Shelter for fish				
Channel Alteration				
Sediment Deposition				
Velocity and Depth				
Channel Flow				
Bank Vegetation				
Bank Condition				
Riparian Vegetation				

Wetted width: Riffles: _________ in. **Runs:** _________ in. **Pools:** _________ in.

Thalweg depth: Riffles: _________ in. **Runs:** _________ in. **Pools:** _________ in.

Bottom type: Silts, Sands, Gravel, Cobble, Boulder, Bedrock

HABITAT ASSESSMENT
Rocky Bottom Streams

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
1. Attachment Sites for Macroinvertebrates (see page 67)	Well-developed riffle and run; riffle is as wide as stream and length extends two times the width of stream; cobble predominates; boulders and gravel common.	Riffle is as wide as stream but length is less than two times width; cobble less abundant; boulders and gravel common.	Run area may be lacking; riffle not as wide as stream and its length is less than 2 times the stream width; gravel or large boulders and bedrock prevalent; some cobble present.	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking.
2. Embeddedness (see page 67)	Fine sediment surrounds and fills in 0-25% of the living spaces around and in between the gravel, cobble, and boulders.	Fine sediment surrounds and fills in 25-50% of the living spaces around and in between the gravel, cobble, and boulders.	Fine sediment surrounds and fills in 50-75% of the living spaces around and in between the gravel, cobble, and boulders.	Fine sediment surrounds and fills in more than 75% of the living spaces around and in between the gravel, cobble, and boulders.
3. Shelter for Fish (see page 67)	Snags, submerged logs, undercut banks, or other stable habitat are found in over 50% of the site.	Snags, submerged logs, undercut banks, or other stable habitat are found in over 30-50% of the site.	Snags, submerged logs, undercut banks, or other stable habitat are found in over 10-30% of the site.	Snags, submerged logs, undercut banks, or other stable habitat are found in less than 10% of the site.
4. Channel Alteration (see page 67)	Stream straightening, dredging, artificial embankments, dams or bridge abutments absent or minimal; stream with meandering pattern.	Some stream straightening, dredging, artificial embankments or dams present, usually in area of bridge abutments; no evidence of recent channel alteration activity.	Artificial embankments present to some extent on both banks; and 40 to 80% of stream site straightened, dredged, or otherwise altered.	Banks shored with gabion or cement; over 80% of the stream site straightened and disrupted.
5. Sediment Deposition (see page 67)	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at stream obstructions and bends; moderate deposition in pools.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom affected; pools almost absent due to substantial sediment deposition.
6. Stream velocity and depth combinations (see page 67)	Slow (< 1 ft/sec)/shallow (< 1 ft); slow/deep, fast/deep; fast/shallow; all four combinations present	3 of the 4 velocity/depth combinations present; fast current areas generally predominate.	Only 2 of the 4 velocity/depth combinations are present. Score lower if last current areas are missing.	Dominated by 1 velocity/depth category (usually slow/shallow areas)
7. Channel Flow Status (see page 68)	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; <25% of channel substrate is exposed.	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
8. Bank Vegetative Protection (see page 68)	More than 90% of the streambank surfaces covered by natural vegetation, including trees, shrubs, or other plants, vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by natural vegetation, but one class of plants is not well-represented; some vegetative disruption evident; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; patches of bare soil or closely cropped vegetation common; less than one half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation, disruption of streambank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
9. Condition of Banks (see page 68)	Banks stable, no evidence of erosion or bank failure; little potential for future problems.	Moderately stable; infrequent, small areas of erosion mostly healed over.	Moderately unstable; up to 60% of banks in site have areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank collapse or failure; 60-100% of bank has erosional scars.
10. Riparian Vegetative Zone Width (see page 68)	Width of riparian zone >50 feet; no evidence of human activities (i.e., parking lots, roadbeds, clear-cuts, mowed areas, or crops) within the riparian zone.	Width of riparian zone 35-40 feet.	Width of riparian zone 20-35 feet.	Width of riparian zone <20 feet.

HABITAT CHARACTERISTICS DEFINITIONS

Use the habitat characteristic (parameter) definitions and guidance that follows when completing the habitat assessment field data form. Rocky-bottom streams (Piedmont Streams) are generally fast moving streams with beds that are made up to gravel/cobbles/boulders in any combination and that have definite riffle areas.

1. ***Attachment Sites for Macroinvertebrates*** are essentially the amount of living space or hard substrates (rocks, snags) available for aquatic insects and snails. Many insects begin their life underwater in streams and need to attach themselves to rocks, logs, branches, or other submerged substrates. The greater the variety and number of available living spaces or attachment sites, the greater the variety of insects in the stream. Optimally, there should be a predominance of cobble, and boulders and gravel should be common. The availability of suitable living spaces for macroinvertebrates decreases as cobble becomes less abundant and boulders, gravel, or bedrock become more prevalent.

2. ***Embeddedness*** refers to the extent to which rocks (gravel, cobble, and boulders) are surrounded by, covered, or sunken into the silt, sand, or mud of the stream bottom. Generally, as rocks become embedded, the living spaces available to macroinvertebrates and fish for shelter, spawning, and egg incubation are decreased.

   To estimate the percent of embeddedness, observe the amount of silt or finer sediments overlying and surrounding the rocks. If kicking does not dislodge the rocks or cobbles, they may be greatly embedded. It may be useful to lift a few rocks and observe how much of the rock (e.g., 1/2, 1/3) is darker due to algal growth.

3. ***Shelter for Fish*** includes the relative quantity and variety of natural structures in the stream, such as fallen trees, logs, and branches, large rocks, and undercut banks that are available to fish for hiding, sleeping, or laying eggs. A wide variety of submerged structures in the stream provide fish with many living spaces; the more living spaces in a stream, the more types of fish the stream can support.

4. ***Channel Alteration*** is basically a measure of large-scale changes in the shape of the stream channel. Many streams in urban and agricultural areas have been straightened, deepened (e.g. dredged), or diverted into concrete channels, often for flood control purposes. Such streams have far fewer natural habitats for fish, macroinvertebrates, and plants than do naturally meandering streams. Channel alteration is present when the stream runs through a concrete channel; when artificial embankments, riprap, and other forms of artificial bank stabilization or structures are present; when the stream is very straight for significant distances; when dams, bridges, and flow altering structures such as combined sewer overflow pipes are present; when the stream is of uniform depth due to dredging, and when other such changes have occurred.

   Signs that indicate the occurrence of dredging include straightened, deepened, and otherwise uniform stream channels, and the removal of streamside vegetation to provide access to the stream for dredging equipment.

5. ***Sediment Deposition*** is a measure of the amount of sediment that has been deposited in the stream channel and the changes to the stream bottom that have occurred as a result of the deposition. High levels of sediment deposition create an unstable and continually changing environment that is unsuitable for many aquatic organisms.

   Sediments are naturally deposited in areas where the stream flow is reduced, such as pools and bends, or where flow is obstructed. These deposits can lead to the formation of islands, shoals, or point bars (sediments that build up in the stream, usually at the beginning of a meander) or can result in the complete filling of pools. To determine whether or not these sediment deposits are new, look for vegetation growing on them; new sediments will not yet have been colonized by vegetation.

6. ***Stream Velocity and Depth Combinations*** are important to the maintenance of aquatic communities. Restrictions to normal velocity and/or the filling of pools will affect the organisms living in the stream by reducing the dissolved oxygen that is available and by slowing down the movement of food items. Streams function best when the movement of water continually replenishes the supply of oxygen and food, and does not become stagnant.

Slow velocity is generally described as water moving **less than (<) 1 foot/second**

Fast velocity is generally described as water moving **greater than (>) 1 foot/second**

Shallow water is generally described as **less than (<) 1.5 feet**

Deep water is generally described as **greater than (>) 1.5 feet**

Four general categories of velocity and depth are optimal for benthic macroinvertebrate and fish communities. The best streams will have all four velocity/depth combinations and can maintain a wide variety of aquatic life:

(1) slow, shallow
(2) slow, deep
(3) fast, deep
(4) fast, shallow

Depth can be estimated by standing in the stream at various points. If the water level comes to below the bottom of your knee cap, it can be considered shallow. If it reaches above the bottom of your knee cap, consider it deep. Also, you can use the measuring rope to measure the length of your leg to the knee cap to judge depth.

To estimate velocity, use the measuring rope to mark off 10-foot areas of stream in the same general areas where you measured depth. Drop a twig in the stream and count the number of seconds it takes for the stick to travel the 10 feet. Generally it is best to do this in run and pool areas since velocity is difficult to measure in riffles as the twig may get caught up by rocks. Divide 10 by the number of seconds to determine velocity in "feet per second." For example:

If the twig took 6 seconds to travel the 10 foot distance, then divide 6 seconds into 10 feet, which is equal to 1.4 ft/sec. In this case, the velocity would be considered fast, as it is greater than 1 ft/sec.

Since water in riffle areas tends to have the greatest velocity, you can assume that riffle velocity is faster than velocity in either the run or pool areas you measure.

7. ***Channel Flow Status*** is the percent of the existing channel that is filled with water. The flow status will change as the channel enlarges or as flow decreases as a result of dams and other obstructions, diversions for irrigation, or drought. When water does not cover much of the streambed, the amount of living area for aquatic organisms is limited.

8. ***Bank Vegetative Protection*** measures the amount of the stream bank that is covered by natural (i.e. growing wild and not obviously planted) vegetation. The root systems of plants growing on stream banks help hold soil in place, reducing erosion. Vegetation on banks provides shade for fish and macroinvertebrates, and serves as a food source by dropping leaves and other organic matter into the stream. Ideally, a variety of vegetation should be present, including trees, shrubs, and grasses. Vegetative disruption may occur when the grasses and plants on the stream banks are mowed or grazed upon, or the trees and shrubs are cut back or cleared.

9. ***Condition of Banks*** measures erosion potential and whether the stream banks are eroded. Steep banks are more likely to collapse and suffer from erosion than are gently sloping banks and are therefore considered to have a high erosion potential. Signs of erosion include crumbling, unvegetated banks, exposed tree roots, and exposed soil. Bank failure and the subsequent collapse of portions of the stream bank is referred to as bank sloughing.

10. ***The Riparian Vegetative Zone Width*** is defined here as the width of natural vegetation from the edge of the stream bank. The riparian vegetative zone is a buffer zone to pollutants entering a stream from runoff; it also controls erosion and provides stream habitat and nutrient input into the stream. A wide, relatively undisturbed riparian vegetative zone reflects a healthy stream system; narrow, far less useful riparian zones occur when roads, parking lots, fields, lawns and other artificially cultivated areas, bare soil, rocks, or buildings are near the stream bank. The presence of "old fields" (i.e., previously developed agricultural fields allowed to convert to natural conditions) should rate higher than fields in continuous or periodic use. In arid areas, the riparian vegetative zone can be measured by observing the width of the area dominated by riparian or water-loving plants, such as willows, marsh grasses, and cottonwood trees.