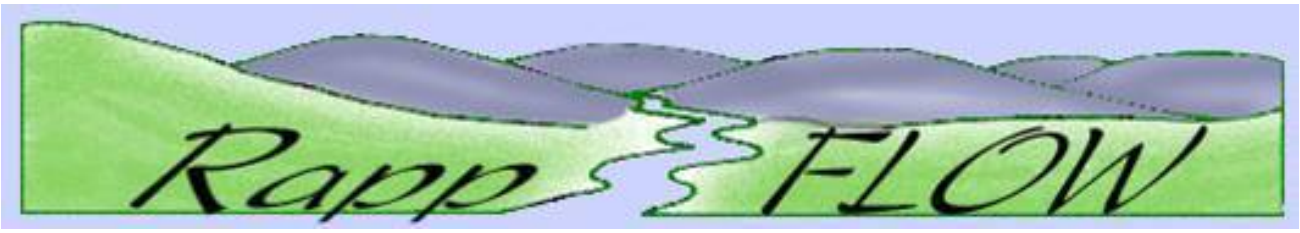

Riparian Buffer Evaluation Program

Volunteer Handbook

Written by Meghan Gloyd, Virginia Tech STEP Intern to RappFLOW in Summer 2006, with technical assistance from the VA Department of Forestry and the Culpeper Soil and Water Conservation District.

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1.0 General Information

1.1 Introduction

The first step in protecting the quality of water in our streams and ponds is to observe and evaluate the effectiveness of the vegetation alongside the waterway. This handbook has been designed to accompany the RappFLOW Riparian Buffer Evaluation Data Sheet. It contains background information on riparian buffers, their effect on the environment, and the effort in Rappahannock County to restore effective buffer zones around rivers and streams. The manual contains several important safety tips, a checklist to ensure volunteers are equipped before entering the field, and an in-depth explanation of each item on the data sheet. Contact information for RappFLOW volunteers is also included, in case questions arise that are not addressed in the handbook.

1.2 What is a Forested Riparian Buffer?

A buffer is simply a strip of land that separates two different ecosystems. In the case of riparian buffers, the buffer separates the stream or pond from the farmland, backyard, or road surrounding it. The word riparian refers to the area adjacent to a body of water, in this case a stream or pond, which provides a transition between the aquatic and upland environments. This area many times is not clearly defined and can vary in size. A forested riparian buffer is a type of buffer along a stream or river that is made up of trees, shrubs, and other forest-like vegetation.[1]

The riparian area can be divided into three zones, as shown below in Figure 1
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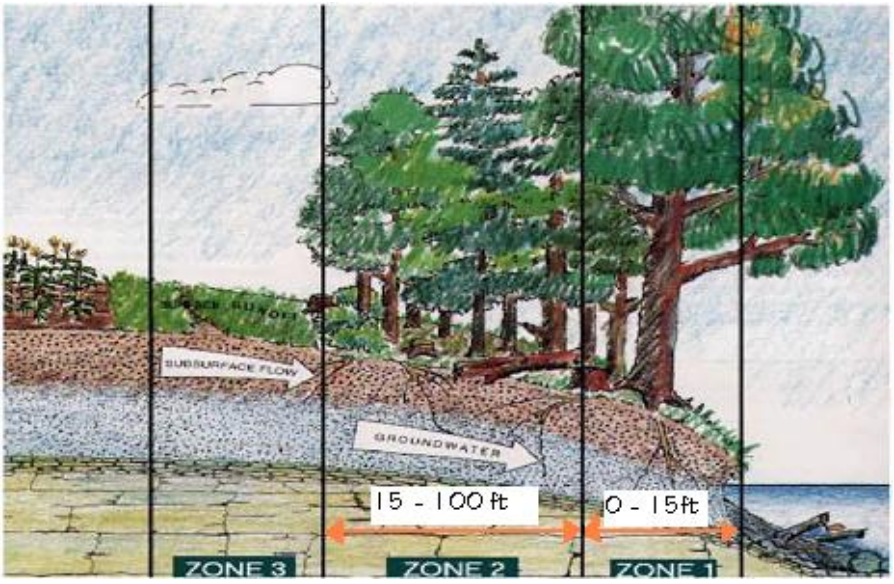

Figure 1: Riparian Buffer Zones[1]

Zone 1 occupies the first 15 feet from the stream bank and ideally should be made up of undisturbed mature forest. The primary purpose of this region of the buffer is to stabilize the stream bank and provide shade to the stream.

Zone 2 is the land from 15 to 100 feet from the bank, and is ideally a managed forest; meaning that the forest is being maintained to ensure that it is able to effectively filter the water. The primary purpose of this zone is to remove, transform, or store nutrients, sediments and other pollutants flowing over the surface and through the groundwater before they can reach the stream or aquifers.

Zone 3 is an optional zone that will not be evaluated in this handbook, but is used primary for run off control in areas where a higher flow is expected. It typically consists of a grass filter strip that slows the run off and allows more the water to enter the ground.[1]

1.3 Why create and manage Forested Riparian Buffers?

Forested riparian buffers are designed to meet the following four main objectives:

1. They help prevent upland sources of pollution from reaching the stream by trapping, filtering, and converting sediments, nutrients, and chemicals.
2. They are able to supply food, cover, and thermal protection to fish and wildlife.
3. They serve as a means of preserving the integrity of the stream in terms of aquatic organisms, depth, flow, and width by slowing the water and stabilizing the bank.
4. They refresh ground water by slowing the water down and allowing it to penetrate the soil, watering plants and refilling aquifers which wells draw water from.

For these reasons they are considered the most beneficial type of riparian buffers.[1]

Many of the pollutants in a stream come from non-point sources. A non-point source is defined as pollution that originates from many diffuse sources, such as runoff from roads, fields, or other surfaces. Fertilizers and organic matter cause heightened levels of phosphorous and nitrogen in the water which harm the aquatic environment. These nutrients can be stopped from flowing into the stream by a buffer. Rain and sediment that runs off the land can be slowed and filtered in the buffer, settling out sediment, nutrients, and pesticides before they reach streams. Tree roots are able to absorb the excess nutrients and store them in their leaves, branches, and roots. The forest floor is also capable of transforming nitrate found in fertilizers, (which is bad for the environment) into nitrogen gas through a process called denitrification.[1] According to the U.S. Forest Service, riparian forests can reduce nutrient and sediment inputs to a

water body by 30 to 90 percent. The capacity of forests to absorb and store runoff can be 10 to 15 times higher than grass and four times higher than a plowed field.[2]

Riparian buffers also perform several other services to the stream habitat. The leaf canopy provides shade that keeps the water cool. Cool water retains dissolved oxygen, and encourages the growth of diatoms, beneficial algae, and aquatic insects. As leaves fall into a stream and are trapped on fallen limbs and rocks in the stream, they provide food and habitat for small bottom dwelling creatures which are critical to the aquatic food chain. Wooded stream corridors provide the most diverse habitats for fish and other wildlife. Woody debris provides cover for fish while preserving stream habitat over time.[1]

Not only do riparian buffers improve and maintain the quality of the stream but also of the surrounding ecosystem. Many different types of animals consider riparian buffers as the perfect habitat, providing biodiversity for the area. Some mammals that call riparian buffers home are beavers, big brown bats, black bears, eastern Pipistrelles, northern short-tailed shrew, raccoons, river otters, silver-haired bats, and Virginia opossum. Several species of birds are also attracted to this habitat including American goldfinches, bald eagles, red-bellied woodpecker, owls, red herons, red-shouldered hawks, song sparrows, tufted titmice, wood ducks, and yellow warblers. Frogs, several types of salamanders, and snakes also make their home in this sort of environment. Riparian buffers not only provide habitats for many animals but also provide travel corridors for animals as they migrate to different regions of the forest or world.[1]

Riparian buffers also help to control erosion because the roots of the trees and plants hold the soil in place increasing bank stability. Plants also slow water down during downpours. When water is slowed down more of it is able to sink into the ground, leaving less water entering the stream from the surface at a slower more natural rate, reducing the chances of flooding and refreshing groundwater. Groundwater not only feeds the creek, but the aquifers from which wells draw water.

Riparian buffers offer an aesthetically pleasing landscape to those around it and a quiet retreat to enjoy while fishing, hiking, or simply relaxing. They provide a great place to put a bench to sit and read, bird watch, photograph, paint, and even think.

1.4 Riparian Buffers and Rappahannock County

Since riparian buffers have been proven to preserve, protect, and improve the quality of the water in streams and rivers, RappFLOW is working on a three part plan to improve Rappahannock County's buffer system.

1. The first step is to inventory the existing buffers with the help of volunteers and riparian landowners. This involves evaluating the buffers along the rivers both on public and private land, using RappFLOW's evaluation data sheets.
2. The next step is to identify areas where buffers are in need of repair or are nonexistent and to work with landowners to improve the existing buffers.
3. The third step involves maintaining the buffers and monitoring the progress.

RappFLOW's long term goals are to create a system of healthy buffers along the stream corridors in Rappahannock County, and to promote an increased understanding of the benefits of riparian buffers within the Rappahannock County community.

2.0 Safety Precautions

Please make safety your top priority!

- Always perform evaluation with at least one partner. Do not go alone.
- Check the weather before you leave. Do not evaluate a buffer during a thunderstorm!
- Before you leave, please let someone know where you are going and when you expect to be back.
- Park in a safe location away from traffic
- Be aware of the presence of others nearby – do not go to a remote section of the area alone.
- Listen to weather reports and check river conditions.
- Be aware of your own limitations
- If you need to go into the water, please do not wade into the water above the knee, even in waders.
- Carefully make your way through the riparian buffer. Watch for steep banks and poison ivy!
- Carry a first aid kit with you and let your partners know of any allergies or medical conditions you may have.
- Do not trespass on private property without the consent of the landowner.
- Be aware of any wildlife that may live in the area you are monitoring.
- Wear bug repellant and sunscreen as necessary.

Please do not evaluate any buffers if you feel the least bit of risk of any kind!

3.0 Checklist of Equipment and Supplies

RappFLOW will provide a kit* with:

- Field Data Sheets (enough for the number of reaches and banks)
- Handbook
- GPS Unit
- Tape Measure

* The kit may be picked up from the RappFLOW Office. Please make arrangements with Jean Pfefferkorn ahead of time. Her contact information can be found in section 5.

You should bring:

- Bug Repellant
- Sunscreen
- 2 Pencils
- Clipboard
- Clothes and shoes you can get wet and dirty
- Digital Camera (if you have one)
- GPS unit (if you have one)

4.0 Completing the Riparian Buffer Evaluating Sheet

4.1 Completing Section 1: Background Information

This section will aid you in completing the top half of the first page of the data evaluation sheet.

I: Determining Stream Bank

While facing downstream, the direction in which the water is flowing, determine whether you are on the right or left bank. Figure 2, shows this in greater detail. Record the bank you are evaluating on the top right hand corner of your field data sheet. Please complete a separate evaluation for each bank.

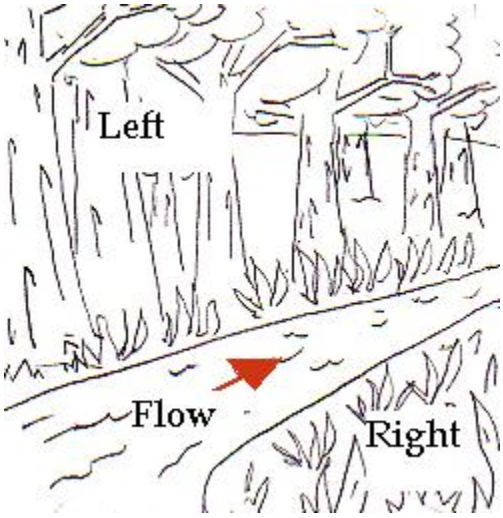

Figure 2: Determining Stream Bank

Q.1: Date

Please record the date for which you are completing the evaluation.

Q.2: Name

Please include both the first and last names of everyone performing the assessment.

Q.3: GPS Unit Number

Identify the GPS Unit you are using. On the RappFLOW unit, look for a handwritten number on the side of the unit. This will help when downloading the waypoint data.

Q.4: Location Description

Describe the area you are evaluating in a way that others will know where it is. Identify all of the following that apply:

- River or stream name
- Closest street or intersection
- Address of property
- Owners of property

Q.5: Length of the Reach

A reach is the length of the stream and buffer which you are evaluating. An ideal length of reach is 100 ft, however if the stream, buffer, or bank characteristics change drastically within the 100 ft range it may be useful to break the region into two or more reaches.

Q.6: Recording Up and Downstream GPS Waypoints

Take a GPS waypoint at each end of the reach you are evaluating. How to take a GPS point may vary based on the GPS Unit which you are using. Please check the instructions included with the unit. Be sure that the points are recorded in the unit. If you can not figure out how to mark points, simply write the latitude and longitude coordinates.

Q.7: Unusual or Interesting Features within the Reach

For each unusual feature within the reach, photograph, describe, or sketch the feature on the data sheet and include the GPS point of the feature. Unusual features include but are not limited to:

- Concrete slabs
- Manholes
- Pipes entering the stream
- Trash in the stream
- Dams
- High Erosion
- Animals (dead or alive)
- Poor Water Aesthetics

Q.8: Additional Comments about the Reach

The types of thing you may include in this section are notes about cattle in the creek, any sort of swale (typically a grass or gravel covered ditch that channels water

towards to the stream), roads that run through the reach, bridges, manmade embankments, and any sort of distinguishing feature that impacts the body of water.

Q.9: Photo or Sketch of Reach

Please take a picture of the reach which you are evaluating, facing downstream. If you do not have a camera please make a rough sketch. You should include the relative locations of the various features described above.

4.2 Completing Section 2: Stream Characteristics

This section will assist you in filling out Section 2: Stream Characteristics.

Q.1: Determining Average Stream Width

While looking at the entire reach, determine what the average stream width for the reach would be if the water was at bankfull. Bankfull is the location of the water if the stream were full, but not flooded. Bankfull height can be identified by:

- Where vegetation starts (Figure 3)
- Change in bank slope
- Change in bank materials
- Undercutting
- Stain lines on rocks or tree roots (Figure 4)

The width is found by measuring from the bankfull height on one bank to the bankfull height on the opposite bank. If the stream level is low enough (below the knee) you can measure the width at various locations and take the average; otherwise estimate the distance.

Figure 3: Change in Vegetation

Figure 4: Stain Lines

Q.2: Determining Average Bank Height

While standing at the edge of the bank, measure the distance from the top of the bank (where it levels out) to the stream bottom. Use a stick or tape measure if possible; otherwise a rough estimate is fine. Keep in mind that this is for the bank which you are evaluating. If the bank is steep or conditions do not allow for you to get close to the edge, it may be easier to evaluate from the other side.

Q.3: Determining Bank Slope

Looking at the bank which you are evaluating determine whether the bank's average slope is undercut (see Figure 5), vertical (straight down), greater than 45°, or less than 45°.

Figure 5: An Example of an Undercut Bank[3]

Q.4: Determining the Predominant Bank Cover

Looking at the bank for which you are filling out the data sheet and taking into consideration the entire reach, determine what percent of the bank has some sort of vegetation. This vegetation could be trees, grass, shrubs, or any other type of naturally occurring ground cover. Again, this may be easier to evaluate from the opposite side. Figures 6-9 show examples of each of the percentage choices.

Figure 6: Greater than 90% Vegetated

Figure 7: 70-89% Vegetated

Figure 8: 50-69% Vegetated

Figure 9: 0-49% Vegetated

Q.5: Stabilizing Structures

On the bank which you are evaluating, look for manmade stabilizing structures. These include but are not limited to:

- Rip-rap - large rocks intentionally placed on the bank, typically used to help prevent erosion. A good indicator of rip rap is that all the rocks are the same type and color (Figure 10)
- Concrete
- Metal

Figure 10: Rip-Rap

Q.6: Bank Erosion

Along the stream bank is there any evidence of erosion? In cases of no erosion, the bank is intact.

- Undercutting is when the water has eroded away the bank in such away that an overhang is created, see Figures 5, 11 and 12.

Figure 11: An Undercut Bank

Figure 12: Major Undercutting

- Bank Slumping is when the water is beginning to chip away at the bank and sections of it are disturbed and in the stream. This is shown in Figure 13, note how the slumped bank has began to re-vegetate.

Figure 13: Bank Slumping

- Manmade or livestock disturbances include vehicle or cattle paths through the streams, construction work, or any activity that leaves the bank susceptible to erosion. (Figures 14 and 15)

Figure 14: Erosion due to Animal Crossing

Figure 15: Erosion due to Vehicle Crossing

Q.7: Deposition and Sandbars

Looking at the stream over the duration of the reach, note if there are any sections where sediment or sand has built up (Figure 16). In cases where the water level is high, the sandbar or deposition may be just below the surface. If you suspect the source (such as vehicle crossing upstream) please indicate.

Figure 16: Sandbar

Q.8: Determining the Number of Overhanging Trees

Scan the bank over the entire reach and count the number of trees that are overhanging the water and providing shade. Shade helps keep the water temperature cool and allows fish to thrive.

Q.9: Determining the Number of Trees or Branches in the Stream

Again looking at the entire reach, count the number of large branches or trees that have fallen into the stream. When a branch or tree falls into the stream and does not act as a debris plug (catching all the smaller sticks and sediment causing it to build

up in the stream and stop flow) it can provide habitats for many aquatic organisms. However, too many branches and trees in the stream can cause a log jam and can lead to scour and erosion.

Q.10: Ditches, Tributaries, Pipes, and Swales

Over the entire reach, are there any areas where water flows directly into the stream by way of a ditch, tributary, swale, or pipe? Water entering this way flows directly into the stream and is not filtered by the buffer. Ditches and swales carry surface water runoff from parking lots, roads, and buildings. Pipes can indicate discharge from agriculture, roadways, sewer treatment plants, or industrial plants. A tributary that is not buffered may carry pollution from other parts of the watershed.

Figure 17: Pipe Entering Stream

Figure 18: Ditch

Q.11: Determining Overall Bank Stability

While standing near the bank, rate its stability. Be careful in areas where the bank is undercut or slumping; do not stand on an unstable bank. It may be useful to check this at several areas in the reach.

4.3 Completing Section 3: Evaluating Zone 1 of the Riparian Buffer

Zone 1 occupies the first 15 feet from the stream bank and ideally should be made up of undisturbed forest, meaning that not only is the forest established but that trees are not being removed. The maturing trees in an undisturbed forest provide shade for the stream. Shade helps insulate the stream and allows for fish to flourish. This region of the buffer also stabilizes the stream bank. It is useful to use a tape measure to mark off 15 feet at the beginning and end of the reach, as shown in Figure 19.

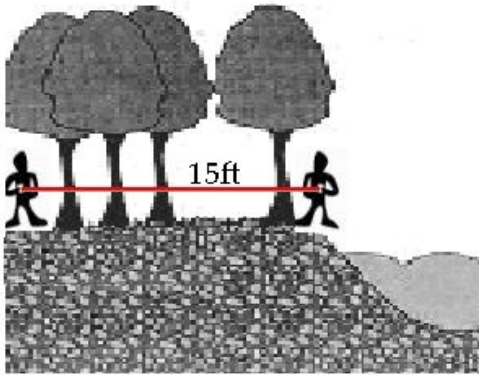

Figure 19: Determining Zone 1

Q.1: Most Common Land Cover in Zone 1

By surveying the entire area, determine what makes up the majority of landscape in Zone 1.

- Ideally, trees would make up the majority of the landscape.
- In new developing buffers, small trees and shrubs will most likely be the most numerous land cover.
- A wild open meadow is characterized by tall grass and some shrubby vegetation that have not been mowed in a while. This type of cover provides some protection for the stream by slowing down the water and catching sediment, but is not able to filter the ground water because the plants roots are typically not deep enough.
- Thick grass or hay land is very similar to a meadow but it includes no shrubs and is mowed once or twice each year. (Figure 20)

Figure 20: Cut Hayfield

- If the land is actively being farmed then a majority of the cover will be considered agricultural crops or pasture. Unless no-till agriculture is practiced, the soil will be exposed on cropland at certain times of the year. Pasture land is not exposed, but without a buffer, the manure is washed off into the creek.
- If nothing is planted or there is very little ground cover, then mark exposed soil.

- Impervious surfaces include houses, roads, and parking lots.
- Gravel roads or parking lots are slightly more pervious than asphalt.
- In more developed regions, people's lawns may make up a majority of the land cover and are considered impervious.

Q.2: Determining Tree Density in Zone 1

In the spring and summer when the trees are full, the easiest way to determine tree density is to look at the canopies. You can then gauge the density by how much of the sky you can see through the leaves. If you see little or no sky, then the tree cover is densely vegetated (Figure 21). If you about half sky and half canopy then the tree cover is moderately vegetated (Figure 22). If you see almost all sky and very little canopy, then the tree cover is sparsely vegetated (Figure 23). In the winter or late fall when the leaves have fallen, just imagine that there are leaves by looking at the spread of the branches.

Figure 21: Densely Vegetated

Figure 22: Moderately Vegetated

Figure 23: Sparsely Vegetated

Q.3: Determining Tree Height in Zone 1

Looking again at the trees growing in zone 1, determine the average height relative to the width of the stream. If an average size tree were to fall across the stream would it transverse the entire stream or only go part way? The taller the trees the more protection it is able to provide for the stream both in terms of shading and nutrient management. This is because the larger the tree, the greater depths which their roots penetrate the soil aiding bank stability and groundwater purification. Also, the height of the trees may give insight into the age of the buffer.

Q.4a and b: Determining Riparian Buffer Direction

Using a map, determine whether the buffer you are evaluating is on the east or south side or the west or north side of the stream. If you do not have a map, determine this based on the sun, which rises in the east and sets in the west. While it is important to have a buffer on both sides of the stream for the purpose of filtering the ground water and slowing the run off, trees on the south or east side aid create shade cover during most of the day.

Q.5: Determining Shrubbery in Zone 1

Considering all of zone 1, look primarily at the vegetation in the mid-height range (small trees and shrubs about 2 to 5 feet tall and wide). An area densely vegetated with shrubs will be hard to walk through (Figure 24), while a sparsely vegetated area is quite easy to walk through. Moderate is in the middle.

Figure 24: Dense Shrub Cover

Q.6: Determining Small Plant and Grass Cover in Zone 1

While looking at the ground in zone 1, note how much is covered with grass or small plants. If there is very little exposed soil, then full cover exists (Figure 25). If there are patches of exposed soil and patches of covered soil, then this is considered spotty cover (Figure 26). If part of the area contains a solid ground cover, but another section has no ground cover, this is partial cover (Figures 27 and 28). Any type of small ground cover helps, not only to stop erosion, but slow the flow of water into the stream, allowing sediment and nutrients to settle out.

Figure 25: Full Cover

Figure 26: Spotty Cover

Figure 27: Partial Cover

Figure 28: Partial Cover

Q.7: Determining if Stream Bank Tree Throw has occurred

Stream bank tree throw is when the bank has collapsed or is undercut under where a tree is located causing the tree to fall or be thrown into the stream (Figure 29). If this is in danger of happening in more than one place, this indicates an erosion problem.

Figure 29: Stream Bank Tree Throw

Q.8: Impervious Surfaces in Zone 1

An impervious surface is a surface that if rain hit the surface, it will not be absorbed. Determine what percentage of the entire area encompassed by zone 1 these impervious surfaces make up. Some typical examples of these are:

- Roads
- Houses and other buildings
- Parking lots
- Manholes

Q.9: Recent Timber Harvest in Zone 1

Timber harvest refers to the intentional cutting down of trees in the buffer to be used for other purposes. Selective harvest (leaving over more than 20% of the trees) means that someone cut only certain trees within the zone (see Figure 30). High grading means that someone has cut down all the large or valuable trees (see Figure 31). Clear cut means that all the trees in the region have been cut down and taken away (see Figure 32). Within Zone 1, all of these practices are detrimental to the buffer and the stream.

Figure 30: Selective Harvest[4]

Figure 31: High Grading[5]

Figure 32: Clear Cut[6]

Q.10: Active Land Conversion

Often times the land right along the bank will be purchased and used for something other than a buffer. Some evidence of active land conversion away from a forested buffer is:

- Construction
- Logging
- Grading/Removal of topsoil
- Excavating

Please note that the area must be actively undergoing this change or if it is obvious that the change is imminent.

4.4 Completing Section 4: Evaluating Zone 2 of a Riparian Buffer

Zone 2 is the land from 15 to 100 feet from the bank, and is ideally a managed forest; meaning that the forest is being maintained to ensure that it is able to effectively filter the water. The primary purpose of this zone is to remove, transform, or store nutrients, sediments and other pollutants flowing over the surface and through the groundwater. Again, use a tape measure to determine where this zone ends.

Q.1 and 2: Determining the Most Common Land Covers in Zone 2

By surveying the entire area determine what makes up the majority of the land cover in Zone 2. If two of the types of land cover each make up 50% of zone 2, please mark the one closest to the stream as the most common. For example, if you are in forested area for the first 42 feet into zone 2 from the stream and then you have a lawn for the second half, you would mark trees as the most common since they are closer to the stream and the lawn would be the second most common. If any particular land cover makes up the entire area, then mark it twice. For a description of the land covers please refer to Section 3, Question 1.

Q.3: Determining the Predominant Slope

Considering the entire region of zone 2, determine the predominant slope of the region. A flat grade may have some ups and downs but is generally horizontal. Water will move slowly across the surface. A medium grade has a gentle slope. This slope would most likely not be considered ideal for sledding, but in a rainstorm water would not pool. A very steep slope is characterized by a good sledding hill. Water would run quickly towards the creek.

Q.4: Impervious Surfaces in Zone 2

Please refer to Section 3, Question 8 for a list of possible impervious surfaces. Determine the percentage of the area that these surfaces make up.

Q.5: Recent Timber Harvest in Zone 2

Please refer to Section 3, Question 9 as needed. When done under the guidance of a best management practice plan, a small amount of selective harvesting in zone 2 can allow increased vegetative diversity and increased nutrient uptake, especially when the forest has matured.

Q.6: Active Land Conversion

For a list of possibilities and information please refer to Section 3, Question 10.

4.5 Completing Section 5: Additional Points

Q.1: Identifying Restoration Efforts

In recent years, there has been a push to restore forest, wetlands, and streams in the area. These projects could include things like erosion management, tree and shrub planting, and the creation of rain gardens. Fencing cattle and other livestock out of the stream is another type of restoration effort. New trees can often be identified by the

tubes placed around them for protection. The also re-vegetate on their own if livestock are fenced out and mowing stops.

Figure 32: Restoration Efforts

Q.2: Continuous Buffer Calculation

If the total of zone 1 is 85 points or higher and the total of zone 2 is 41 points or higher and the buffer is continuous over two or more stream segments upstream, then add 10 points to the total. A stream segment length is measured as 12 times the average stream bed width.

5.0 RappFLOW Contact Info

www.rappflow.org

Office Mailing Address:
130 Mossie Lane
Amissville VA 20106

Office Street Address: (downstairs of Antique Tables Made Daily)
12018B Lee Highway
Sperryville, VA 22740

Office Phone: (540) 937-4038

Any questions or comments can be directed to the following RappFLOW Staff:

Tim Bondelid, Project Director
Email: timothy@trbondelid.com

Bev Hunter
Email: bev_hunter@earthlink.net

Please contact Tim to coordinate picking up and dropping off field data sheets and the buffer evaluation kit.

6.0 References

[1] Palone, Roxanne and Albert Todd. Chesapeake Bay Riparian Handbook: A Guide for Establishing and Maintaining Riparian Forest Buffers. Revised June 1998.
[2] Riparian Forest Buffers: Linking Land and Water. "Functions and Benefits of Riparian Forest Buffers". Published by the Chesapeake Bay Program, Forest Workgroup, and U.S. Forest Service. Pages 2 – 5.
[3] Volunteer Stream Monitoring: A Methods Manual. Published by EPA in 2002. Accessed on June 8, 2006 (http://www.epa.gov/volunteer/stream/vms41.html)
[4] Picture Adapted from the Canadian Fire Service. Accessed on June 9, 2006. (http://fire.feric.ca)
[5] Picture Adapted from Forestmeister. Accessed on June 9, 2006. (http://www.forestmeister.com)
[6] Picture Adapted from Canadian Nature Service. Accessed on June 9, 2006. (http://www.nature.ca)