

### **Appendix 3 – Guide to Restoration Activities.**

The following is designed to provide a general guide for conducting activities that promote healthy watersheds and clean water in rivers and streams for our community's enjoyment. The guide includes the following sections:

I. General guidelines for conducting all outdoor restoration events and activities;

II. General guidelines for conducting specific events/activities including:

- 1) Stream Cleanups;
- 2) Debris Dam Removal;
- 3) Reforestation Projects;
- 4) Bank Stabilization Projects;
- 5) Rain Barrel installation;
- 6) Rain Garden construction;
- 7) Proper Use or Elimination of Lawn Chemicals and Tips For Reducing Lawn Chemicals
- 8) Household Automotive Fluids, Chemicals and Pet Waste

Each of the practice sections below are organized into three categories including tools and materials, general methods and additional resources. Because of the nature of some of the activities, you are encouraged to include many partners in implementing the actions. However, do not let yourself or your organization be overly influenced by government or other officials who don't think you or your organization can accomplish the actions you deem necessary based on the data you have collected and verified. You may not know it, but you have experts on your team and in your community who are willing to help you succeed!

## **I. General guidelines for conducting outdoor restoration events and activities**

- 1) Get permission from landowners, local leaders and regulatory agencies if necessary.
- 2) Conduct a field reconnaissance trip to determine logistics, such as how you will access the site and how you will get trees, tools and other materials necessary for the project to the site.
- 3) Set the date and time.
- 4) Recruit Volunteers:
  - a. Make a list of and contact potential volunteers;
  - b. Make sure the volunteers are capable of the project work requirements
    - i. Small kids with adult supervision and the elderly can help with tree planting, but not with projects involving heavy lifting
    - ii. Small kids and others with physical limitations can, however, make sure volunteers have food and plenty of water.
  - c. If your project is big, like trying to plant 1000 trees, you will want to try to work with a larger group, such as a school.
- 5) Make a list of materials needed.
- 6) Publicize your event.
- 7) Implement you project.
- 8) Report, publicize and celebrate your success and struggle!

Modified from “How to plan and implement a riparian reforestation project” (Green Hands USA, America Volunteers: <http://www.greenhandsusa.com/eventguide/page:267>).

## II. Guidelines for conducting specific events

### 1) Stream Cleanups

- a. Tools and Materials – gloves, trash bags, shovels to remove buried items, weather appropriate clothing, waders, boots.
- b. General Methods:
  - i. Scout your river to identify the location of the worst spots..
  - ii. Spread your volunteers out to cover as much ground as possible, but make sure they work in teams of at least two.
  - iii. Have a central collection point for all the waste.
  - iv. Once you have all the waste, make sure you sort, weight and/or determine volumes and origins of the different types of waste. This information can and should be used to educate the public through the media and report to your members. You may also be able to use the information to help prevent the litter.
  - v. Be sure to recycle any of the material that can be recycled.
- c. Resources
  - i. Organizing a River Clean up: American Rivers:  
<http://www.americanrivers.org/assets/pdfs/national-river-cleanup/diy-nrc-toolkit.pdf>.
  - ii. How to Conduct a Litter Cleanup – Keep Pennsylvania Beautiful, Getting Started: <http://gacofpa.org/ConductaCleanup/Guidelines.aspx>.  
Organizing a Litter Cleanup in Your Community: Blount County Tennessee, Stormwater: <https://www.blounttn.org/Stormwater/Adopt-A-Stream%20Program.pdf>
  - iii. Biodegradable gloves, recyclable garbage bags:
    1. Eco Products: [www.ecoproducts.com](http://www.ecoproducts.com).
    2. Seventh Generation: <http://www.seventhgeneration.com/Recycled-Garbage-Bags>.
  - iv. Your local hardware store.

## 2) Debris dam removal

- a. Tools and Materials:
  - i. Saw, axe, pruning tools, rope or tow strap.
  - ii. Waders, knee boots.
- b. General Methods – a general set of steps for the removal process:
  - i. Always work from the upstream side in removing debris, particularly the smaller materials – branches, leaves, etc.
  - ii. Remove the small stuff first by pulling branches out. With a small debris dam with a small number of large trees that form the backbone of the debris dam, it should be possible to remove all the small material before attacking the large pieces (tree trunks and logs). With a large debris dam, you will start at the top of the debris dam and work your way down. You can saw large trees as you come to them. DO NOT cut trees that are holding back water. This is the most hazardous situation. If a large debris dam is attacked at low water levels, it should be possible to pull apart the small material, saw the large material, and clear the flow as you work your way down into the dam.
  - iii. When using a chain saw on a debris dam, replace normal bar oil with vegetable oil (any kind is acceptable) to reduce impact on aquatic life. Vegetable oil is far less toxic.
  - iv. Careful analysis is necessary when cutting large material with a chain saw, in order to make cuts that won't pinch and trap the saw. It requires some experience using a chain saw to cut trees, in order to be able to anticipate how the log will move when cut. Whenever possible, cut one end and continue to make cuts. The possibility of pinching a saw is greatest when cutting the middle of a log. Pieces should be cut so that they can be handled safely, generally not exceeding 50 pounds. For large logs, the pieces may be as little as four to six inches long.
  - v. Avoid, whenever possible, cutting logs underwater. It is much harder on the saw. Use a log hook or pry bar to raise logs out of the water for cutting.

- vi. When logs are connected to the bank, either through a root wad or where the ends of the log(s) have been buried in the bank, do not remove these ends from the bank. These root wads or embedded logs will help protect the bank from further erosion.
  - vii. Material that is removed from a debris dam should be removed from the site altogether or placed well above the normal flood line, so that high water doesn't return the material to the stream.
- c. Resources: Stream Obstruction Removal Guidelines, C. McConnell et al., editors. American Fisheries Society, 1983. Available on the American Fisheries Society webpage at <http://fisheries.org/shop/x55010xm>.

### 3) How to plan and implement a riparian reforestation project

#### a. Tools and Materials

- i. Shovels, pics and other appropriate digging tools.
  1. If planting large (1” caliper) trees you may want to rent a skid loader with a 24” auger.
- ii. Native Trees.
- iii. Trash bags.

#### b. Methods

- i. Plant native trees that are tough! Natives use less water and are used to the area’s environmental conditions;
- ii. Plant bare root seedlings January through the first week in April;
- iii. Plant larger, but no larger than 1” caliper trees November – March;
- iv. Work with your area forester to select those that are best for your project.
- v. Make sure you know how to plant and that you can instruct others to use the same method. Getting the trees into the ground properly is the most important task your volunteers will do to ensure survival (TreeCare.com, Tree care made easy, How to plant a tree: <http://www.treehelp.com/how-to-plant-a-tree/>).

#### c. Resources

- i. See Table 1 - Native Tennessee Trees and Plants for Water’s Edge and Moist Upland Sites, compiled by Harpeth River Watershed Association.
- ii. Tennessee Areas foresters can be found at: Tennessee Division of Forestry: <http://www.state.tn.us/agriculture/forestry/directory.shtml>.
- iii. Arbor Day foundation for tree types for your area: <http://www.arborday.org/treeinfo/zonelookup.cfm>.
- iv. Center for Watershed Protection’s “Urban Watershed Forestry Manual” and other tree planting resources: <http://www.forestsforwatersheds.org/>.
- v. Tennessee Department of Agriculture resources for reforestation projects: <http://www.tn.gov/agriculture/publications/forestry/RBP-links.pdf>.

#### **4) Bank stabilization projects (see also Appendix 3.1 Tennessee Cedar Revetments)**

- a. Tools and materials
  - i. Two and one half to five pound sledge hammer, gripple tool, driving rods, shovels;
  - ii. Duck bill anchors or other suitable anchors, surveyors tape, 3/32 wire, gripples, revetments, coir logs, rock, and other materials as called for in the design.
- b. Methods – cedar revetment/coir log placement
  - i. Always start at the lower end of the section to be stabilized and make sure you have enough time, materials and manpower to complete the section to the next stable point. This is generally done to make sure the upstream revetments overlap and are on top of the downstream revetments. This can be accomplished starting at the upstream end, but care needs to be taken not to tighten the wires (see below) until the second downstream revetment is placed against the bank and under the upstream revetment;
  - ii. Start by driving anchors at the tow of the bank along the section as low as possible;
  - iii. Attach wire (10'-12') or flag with orange surveyors tape so you can find the anchor loops later;
  - iv. Once the lower anchors are in, drive one anchor about 18" directly above the first and last anchor. These will be used to secure the upper and lower end of the revetments;
  - v. Drive anchors 18' above and ½ way between the lower anchors. This will allow you to grid (See cable pattern 1 in Appendix3.1) the cable across the revetments;
  - vi. Once you have the anchors in and wire tied on the bottom, you can place your initial revetment and begin to lace the wire through the anchors. In some cases you may have to install additional anchors and/or revetments;
  - vii. As you are lacing the wire around the revetments, it is important to isolate wires into 3-5 anchors only. This way, if one anchor comes out, your

entire length of revetment or coir log stabilization won't come out, only the section attached to the 3-5 anchors;

- viii. As you place revetments, make sure to overlap them like fish scales;
- ix. Use gripples to connect wires, form loops, etc. as needed. Make sure to leave at least 6" of wire extending from each side of the gripple so you can use the gripple tool to tighten;
- x. Use the gripple tool to tighten the revetments in place. It is critical to pull the revetment against the bank to prevent additional bank erosion;
- xi. Make sure to follow up with vegetation plantings in the fall and early winter (live stakes) and check and tighten your wires and gripples following any major storm event;
- xii. Rivers and streams are dynamic systems and high flows may damage your work. In fact, this is likely. Make sure to follow up and make minor repairs and adjustments before they become major repairs!

c. Resources

- i. Natural Resources Conservation Service Guidance and drawings.
  - 1. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/ndcsmc/?cid=nrcs143\\_009158](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/ndcsmc/?cid=nrcs143_009158).
  - 2. <http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/quality/tr/?cid=stelprdb1045856>.
- ii. Schueler, T., Brown, K. 2004. Manual 4: Urban Stream Repair Practices. Urban Subwatershed Restoration Manual Series. Center for Watershed Protection, Ellicott City, MD: [http://www.cwp.org/online-watershed-library/cat\\_view/64-manuals-and-plans/80-urban-subwatershed-restoration-manual-series](http://www.cwp.org/online-watershed-library/cat_view/64-manuals-and-plans/80-urban-subwatershed-restoration-manual-series)
- iii. In Stream Conservation website - Diagrams and Conceptual Drawings for River Restoration practices:  
[http://www.instreamconservation.org/?attachment\\_id=245](http://www.instreamconservation.org/?attachment_id=245).
- iv. U.S. Tennessee Valley Authority:  
<http://www.tva.gov/river/landandshore/stabilization/pdf/stabilization.pdf>.



## 5) Rain Barrels

### a. Tools and Materials

- i. Materials - 55 gallon food grade drum or other suitable container, fittings to allow for hose attachment and down spout connection, concrete blocks/plywood to build a base.
- ii. You can purchase a rain barrel kit and barrel from the Council (TECTN.org) or you can get your own. The parts necessary to construct a rain barrel (less the barrel) are also available at hardware stores.
- iii. Tools - drill with whole saw, sized based on your specific fittings, tin snips or hack saw to cut downspout.

### b. Methods

- i. Determine the location for your rain barrel. Generally you want the barrel to be in a high point around your house so you can use gravity to move the water. But if you have some areas that stay wet around your house and there is a downspout creating this problem, this may be a good location.
- ii. Place your blocks or platform as level as possible. This may mean excavating in some areas and filling in others. The more level the rain barrel is the less likely it could topple when full.
- iii. Once the platform is in place, set the barrel on the platform.
- iv. Measure the distance from the gutter to the rain barrel. You ideally want this as close as possible, while allowing yourself some room to work in between the barrel and the gutter.
- v. Some rain barrel kits have attachments that plug into the gutter and thus no overflow is necessary for the barrel itself.
- vi. Once you have determined where your connection to the gutter should be, mark it with a wax pencil. Locate the area that you want the discharge across from the gutter connection. This hole should be about 4-6" off the bottom of the barrel. Mark this spot with the wax pencil.
- vii. Check and double check that you have everything marked as it should be.
- viii. Once you are confident your marks are correct on the barrel, drill out the holes.

- ix. Attach your fittings to the barrel first and then attach the barrel to the gutter. It's not a bad idea to cut the gutter last.
  - x. For more detail see Section c below.
- c. Resources and other information:
- i. How to build and install a rain barrel –[U.S. EPA: How can I make a Rain Barrel?: http://www.epa.gov/reg3esd1/garden/pdf/make-rainbarrel.pdf](http://www.epa.gov/reg3esd1/garden/pdf/make-rainbarrel.pdf).

## 6) Rain Gardens<sup>1</sup>

### a. Tools and materials

- i. shovels
- ii. sand, compost and native soil
- iii. rain garden plants

### b. Methods

#### i. Things to keep in mind:

1. Try to place the garden near a runoff source like a downspout, driveway, or sump pump to capture rainwater.<sup>2</sup>
2. Locate about ten feet from your home or other structure to ensure no effect on the foundation.
3. Never build a rain garden over a septic system or shallow underground utilities.
4. Contact your local government and call 811 (TN One Call) before you dig your rain garden to ensure no utility lines are present.<sup>3</sup>
5. Be sure to avoid a big tree's "drip line," the area around the tree where the edge of the tree canopy ends, as tree roots are under the canopy.<sup>4</sup>
6. Think about your view! Rain gardens are beautiful and planting your garden in an area where you can enjoy the flowers is always a great idea!
7. Make sure to invite neighbors and friends to help you construct it! Have a party after! And then go to their homes to help them, it is a great way to get to know your neighbors and build community!

#### ii. Find your spot and check soil infiltration.

1. To determine how fast the water drains:
  - a. Dig a twelve-inch-deep hole and fill it with water;

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<sup>1</sup> U.S. EPA: <http://www.epa.gov/oaintrnt/glossary.htm#raingarden>.

<sup>2</sup> Rain Garden Network: <http://www.raingardennetwork.com/>.

<sup>3</sup> Tennessee One Call: <http://www.tnonecall.com/>.

<sup>4</sup> Fine Gardening: <http://www.finegardening.com/how-to/articles/planting-under-a-tree.aspx>.

- b. Once the water has soaked into the ground, fill the hole with water again and time how long it takes the water to soak into the ground. If it takes less than 24 hours, it is a great spot for your rain garden, if it takes more than 24 hours you may want to choose another spot.<sup>5</sup>
2. If you choose a slope, make sure to build a berm on the downhill side to keep the water from flowing out (this is a good use of some of the excavated soil).
3. Determine size:
  - a. To determine the size of your rain garden in square feet, multiply rain depth (1 inch) by the square footage of the area creating the runoff (e.g., your roof top or driveway);
  - b. Divide square footage by depth of the rain garden (6 inches);<sup>6</sup>
  - c. The product equals the size in square feet of your rain garden;
  - d. You may not be able to build a rain garden as big as necessary to capture all the runoff from an area, but that does not mean you should not build it. Just use the area you have and make sure to have an overflow point that drains away from any structures.
4. Building Your Rain Garden
  - a. Line the boundary of the rain garden with a hose, rope or other flexible line. This allows you to adjust the borders until you get it the shape you like.
  - b. It's time to dig. Small rain gardens can easily be excavated by hand, while larger ones may need an excavator and skilled operator. Make sure the bottom of the rain garden is flat, to help ensure maximum water absorption.
  - c. Make sure to keep about 1/3 – 1/2 of your native soil to include in your rain garden soil mix. And make sure to

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<sup>5</sup> Rain Gardens for Nashville: <http://www.raingardensfornashville.com/>

<sup>6</sup> Rain Gardens for Nashville: <http://www.raingardensfornashville.com/>.

properly dispose of the remaining soil. You can place the soil to be used on a tarp of plastic to make clean up easier.

- d. Depending on your site conditions the mix may vary, but a general rule would be to mix 1/3 sand, 1/3 compost and 1/3 native soil.
- e. Mixing the soil can be done as you are refilling the hole. It also helps to use a small tiller to go over the area as it is being filled.
- f. Plants need to be able to stand “wet feet,” as the rain garden will be taking in runoff and holding water as it infiltrates into the ground. It is best to work with a local nursery to identify the best plants for your area.
- g. Finally, mulch the area with 3-4 inches of mulch.
- h. Enjoy!

c. Resources and other information

- i. Additional detail on how to build a rain garden can be found: Rain Gardens for Nashville:

<http://www.raingardensfornashville.com/>

- ii. Rain Garden Network: <http://www.raingardennetwork.com/build.htm>

The Garden of Oz: <http://thegardenofoz.org/rain-gardens.asp>

- iii. Additional detail on plants can be found at:

- 1. Rain Scaping:

<http://www.rainscaping.org/index.cfm/fuseaction/plants.main/typeID/37/index.htm>.

- 2. Check with your local nursery, keeping in mind rain garden plants must be able to tolerate periods of being wet, and then extended periods of dry soil.

- iv. Additional resources:

- 1. Tennessee Department of Agriculture:

<http://www.tn.gov/agriculture/water/rainwater.shtml>.

## 7) Proper Use or Elimination of Lawn Chemicals and Tips For Reducing Lawn Chemicals

- a. Tools and materials
  - i. Soil test kit
- b. Methods
  - i. Landscape with native plants whenever possible. Using plants that are naturally found in your region greatly reduces the need for fertilizer, pesticides, and watering.
  - ii. Test your soil for nutrient deficiencies before applying fertilizer. Your lawn may not need fertilizer, or may only need certain nutrients Always follow the directions on package labels.
  - iii. Use organic, all-natural fertilizers.
  - iv. Be careful when applying lawn chemicals to the edge of garden beds or areas of your yard that slope, as there is potential for increased runoff in these areas.
  - v. Be sure to allow for the specified drying time after applying lawn chemicals, and do not water too soon. Also, check the weather before applying lawn chemicals, and do not apply if it is going to rain close to the time of application.
- c. Resources and other information
  - i. Tennessee Home and Farm, soil testing, <http://tnhomeandfarm.com/soil-testing-offered-by-ut-extension>
  - ii. Home Depot Organic lawn Fertilizer, <http://www.homedepot.com/b/Outdoors-Garden-Center-Lawn-Care-Organic-Lawn-Care-Organic-Lawn-Fertilizer/N-5yc1vZc5uk>

## 8) Household Automotive Fluids, Chemicals and Pet Waste: Additional Resources

- a. Tools - reserved
- b. Methods - reserved
- c. Resources and other information
  - i. Chemicals - Advanced Purification Engineering Corp, Free Drinking Water, Why Should I Not Pour Solvents Down the Drain? Does This Cause Pollution?. [http://www.freedrinkingwater.com/water\\_quality/quality2/j12-08-pour-solvents-chemicals-down-the-drain-pollution.htm](http://www.freedrinkingwater.com/water_quality/quality2/j12-08-pour-solvents-chemicals-down-the-drain-pollution.htm).
  - ii. Automotive Fluids
    - Santa Barbara County, Automotive Fluids. <http://www.lessismore.org/materials/87-automotive-fluids>.
    - Rethink Recycling, Automotive Fluids. <http://www.rethinkrecycling.com/residents/materials-name/automotive-fluids>.
    - Greenville County Used Automotive Fluids: Frequently Asked Questions. [http://www.greenvillecounty.org/soil\\_and\\_water/pdf/faq\\_usedautomotivefluid.pdf](http://www.greenvillecounty.org/soil_and_water/pdf/faq_usedautomotivefluid.pdf)
    - Tennessee Department of Environment and Conservation, Used Oil Program. [http://www.tn.gov/environment/solid-waste/solid-waste\\_used-oil.shtml](http://www.tn.gov/environment/solid-waste/solid-waste_used-oil.shtml).
  - iii. Pet Waste
    - Wisconsin Department of Natural Resources, Pet Waste and Water Quality, 1999. <http://clean-water.uwex.edu/pubs/pdf/pet.pdf>.

**Table 4 - Native Tennessee Trees and Plants for Water's Edge and Moist Upland Sites\***

<b>Tree Size</b>	<b>Species</b>	<b>Light</b>	<b>Wildlife/Comments</b>
Trees > 50'	Black Oak (water oak)	Full/partial sun	Birds, small & large mammals. Often planted as an ornamental; small acorn eaten by many wildlife species including wood ducks & wild turkeys. Spring bloom.
	Pin Oak	Full/partial sun	Birds, small & large mammals. <b>Fast-growing</b> bottomland oak; leaves turn scarlet red in fall and usually persist into the winter; acorns eaten by many game species including wood duck and wild turkeys; often planted on food plots.
	Willow Oak	Full/partial sun	Birds, small & large mammals. Russet-red fall color; small leaves; small acorn eaten by many wildlife species including wood ducks and wild turkeys; grows in bottomland and near streams. Can be cut into stakes and planted directly in eroding vertical banks.
	Sycamore	Full/partial sun	Birds, small mammals. Outer layer of bark flakes off revealing lighter colors beneath; large leaves; excellent cavity tree for mammals and wood ducks; <b>fast grower</b> . Spring bloom. Can be cut into stakes and planted directly in eroding vertical banks.
	Sweetgum	Full sun	Birds, small mammals. Reddish and purple fall color; produces gum balls; seeds eaten by finches and small mammals. Spring bloom.
	Green Ash	Full/partial sun	Birds, small mammals. <b>Fast growth rate</b> ; yellow fall color; distinctive fruits eaten by a variety of wildlife.
Trees 20'-50'	River Birch	Full sun	Birds, small & large mammals. Widely planted as an ornamental; distinctive bronze-colored exfoliating bark; high tolerance for highly acidic soils; bloom in spring.
	Black Willow	Full sun	Birds, small & large mammals. Often used in bioengineering projects; <b>fast-growing</b> but short-lived shrubby-look tree; import food source for waterfowl; host plant for several butterfly species. Bloom in spring. Can be cut into stakes and planted directly in eroding vertical banks.
	Sweetbay	Full/partial sun	Birds, small mammals. Widely planted as an ornamental; semi-evergreen; leaves dark green on top, silvery on bottom; creamy white, lemon scented flowers 2-3" in diameter; larval plant food for butterflies. Bloom in spring.
Bushes 8'-20'	Hazel Alder (Alnus serrulata)	Full sun	Birds. Also known as smooth alder or tag alder; commonly used for shoreline or streambank restoration projects; poor rooting ability from cuttings; roots have



Tree Size	Species	Light	Wildlife/Comments
			nitrogen fixing capability; good cover plant for wood ducks; used by birds in next construction; can develop colonies. Bloom in spring.
	Spicebush	Partial sun Full shade	Birds. Yellow fall color; yellow flowers; foliage spicy fragrant when crushed; bright red fruit eaten by birds in winter; host plant for spicebush swallowtail butterfly; fragrant twigs make good toothpicks. Bloom in spring.
Bushes 3'-8'	Winterberry	Partial sun Full shade	Birds, small mammals. A Deciduous holly; the attractive bright red fruits of winterberry are poisonous to humans but eaten by small mammals and more than 48 species of birds, including bluebirds, American robin and northern mockingbird; male and female plants needed to produce fruits; red berries persist into January making this a very popular shrub for landscaping. Bloom in spring. Water's edge.
	Wild Hydrangea	Partial sun Full shade	Birds, small mammals. Light yellow fall color, large clusters of white flowers in summer, eaten by white-tailed deer. Bloom in summer. Moist upland, water's edge.
	Silky Dogwood	Full sun Partial shade	Birds, small mammals. Attractive white flowers in early summer; blue fruits in late summer; reddish stems in winter; fair rooting ability from cuttings; frequently used in shoreline and streambank restoration projects and can be established from fascines, stakes, brush mats, or rooted plants. Bloom in spring. Water's edge. Can be cut into stakes and planted directly in eroding vertical banks.
	Buttonbush	Full sun Partial shade	Birds, large mammals. One of the most flood-tolerant shrubs; white flowers are clustered in a ball; flowers excellent nectar source for butterflies and other insects; seeds eaten by wood ducks and mallards; excellent protective cover for young wood ducks. Bloom in summer. Water's edge, wetlands & standing water. Can be cut into stakes and planted directly in eroding vertical banks.
	American Beautyberry	Full sun Partial sun	Birds, small & large mammals. Beautiful magenta berry-like fruit persists through winter; heavily used by white-tailed deer and more than 40 species of songbirds; prefers loamy to rocky soil. Bloom in summer. Dry/moist upland, water's edge.