Bioretention and Rain Garden
Functional Assessment Form Instructions

A. OVERVIEW

1. Assessment GOALS: This assessment protocol has been designed to assess the following aspects of bioretention and rain garden facilities:

- Does the rain garden infiltrate stormwater during storm events?
- Is the facility supporting plant growth?
- How well do soils reflect infiltration conditions?
- Do site design, construction and maintenance activities correlate with other signs of rain garden success?
- Does the rain garden offer community value to neighbors and passersby?
- Does the rain garden age correlate with other signs of functional success and community acceptance?

(Note that some of these aspects can only be determined during the proper field conditions.)

2. GEAR:

Team Equipment:

Safety vests
Clipboard(s)
Functional assessment **data form**
Either a hand bucket auger or soil-core probe
Narrow spade or trowel
Instructions and color guides (Plant/weed guides, simplified soil texture flowchart, etc.)
Pencils and pencil sharpeners
Screwdriver
Flashlight
Small tarp or plastic sheet
12" Ruler
100 ft. tape measure
Permanent markers
Site and /or planting plans (if available)
Spray bottle of water (for soil texturing)
Site location flags

Personal Gear: Recommended

Weather-appropriate clothing/supplies (hats, raingear, sunscreen/sunglasses)
Water & refreshments for 3 hours

3. RAIN GARDEN TERMINOLOGY:

Zones: There are three zones in a rain garden:

- Zone 1: The flat bottom part of the rain garden.
- Zone 2: The area from the bottom of the overflow extending down to Zone 1. This is the area where water will infiltrate.
- Zone 3: The area from the bottom of the overflow extending up to the defined edge of the rain garden. If there is no defined edge, then the rain garden will end one meter beyond the highest points.

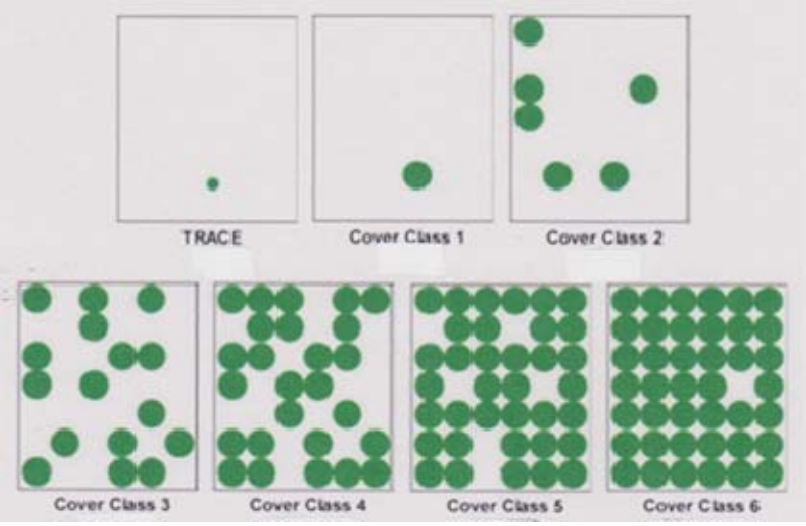
Source: *Rain Garden Handbook for Western Washington*, Hinman, et al., 2013.

Terms: There are six important terms used when discussing rain gardens or bioretention:

- Inflow(s): Intended source of stormwater into the rain garden, which could be a pipe, rain chain, open-channel swale, curb-cuts in paved area, or overland flow from landscaped areas.
- *Overflow(s):* A defined exit area for stormwater used in cases of heavy storm events to ensure water flows to an appropriate discharge location.
- Contributing Area: Sometimes referred to as "drainage area," this is the area that will drain into the rain garden. It can include sections of roof, roads, parking lots, driveways, landscape areas and other surfaces.
- Sheet Flow: This will be evident when no clear inflow is visible and generally refers to an overland flow or downslope movement of stormwater as a continuous film over relatively smooth sidewalk, street, driveway, lawn/landscaped area, bare soil or rock surfaces and not concentrated into channels larger than rills. The rain garden or bioretention facility will be graded to permit the sheet flow to enter, and it may be armored along the edge with drain rock to prevent erosion.
- Bioretention: Bioretention facilities are defined in regulation and refer to swales, planting cells, or planters that are engineered to treat and infiltrate a specific amount of stormwater. They have exact design criteria to ensure they function according to their permitted design intent. They require a soil mix specified by the regulators. They may contain control structures such as under-drains, elevated overflow structures in Zone 1, catch basins to filter sediment, or check dams or weirs to slow the flow of water moving through the facility. Bioretention facilities are commonly found on commercial properties, in public rights-of-way, and recent construction.
- Rain Gardens: Rain gardens do not fall under regulations and are not usually built in response to mandatory stormwater permits. They include compost-amended native soils or non-engineered

designed soil mixes. Typically, they have simple inflow(s) and an overflow near their surface rather than in Zone 1 (but not always). Rain gardens do not require complex modeling.

4. Understanding "Cover-class" method: Review the online training slides for more details on understanding the cover-class method for designating land-use cover. Throughout the assessment, you will be defining coverage areas for several rain garden features based on evaluating a range of percentages.



Modified from: Daubenmire, R. 1959. A canopy-cover method of vegetation analysis. *Northwest Sci*. 33:43-65.

B. USING THE ASSESSMENT FORM

NOTE*: View the self-paced online training slides to assist you in preparing for monitoring and provide background information. The sections outlined below are explained in more detail in this helpful resource.*

Functional Assessment – The Functional Assessment allows the group to survey as-built conditions, maintenance practices and concerns, vegetation coverage, hydrology and community values.

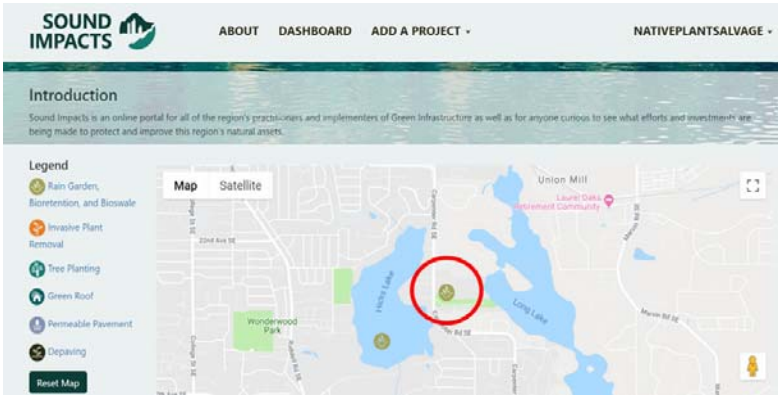
Team Names: Please record all team names and contact information here.

Page Recorder Name: Please note the recorder on each page, as it is encouraged to share the data recording responsibility.

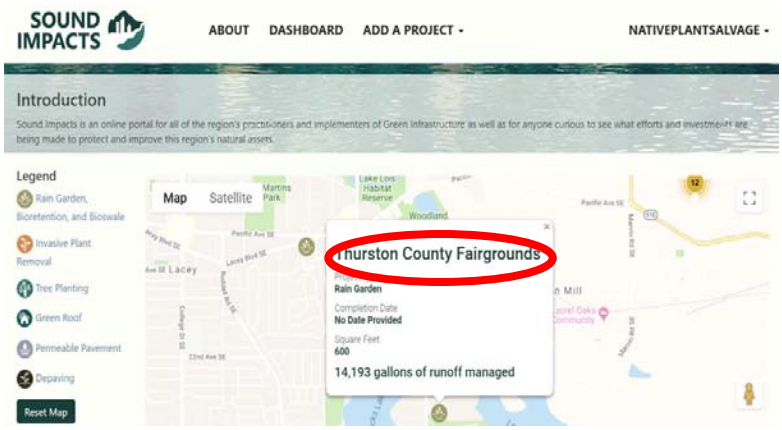
Section I: BACKGROUND INFORMATION

- Provide a site name, which will be the agreed-upon name by which your coordinator has referred to the site.
- Note the date and starting time of the survey.
- Provide the closest street address.
- Using the map application on Google maps, provide the latitude and longitude of your site.
    - Open the map application on your phone or computer and enter site address or intersection location.
    - Satellite view allows you to identify *actual site* of rain garden or bioretention facility.
    - Drop a pin on the facility.
    - Pin drop will trigger new box appearing, containing latitude / longitude numbers.
    - The first number shown will be *latitude*, and the second number shown will be *longitude*.

- Instructions to find the site's "Sound Impacts ID":
    - Visit www.SoundImpacts.org
    - On the legend select the "rain garden, bioretention, and bioswale" **icon** (to remove the other kinds of sites on the map).
    - Zoom in on map to the location of the site you are assessing (*see image 1)*.
    - Click on the rain garden icon at the location you are assessing
    - **Note:** if there is **not** an icon in the correct location, follow the instructions on how to add the site to Sound Impacts by clicking "Add a project" at the top of the page. A username and password will need to be created if you don't already have one.
    - Click on the **name of the site** in the box that pops up *(see image 2).*

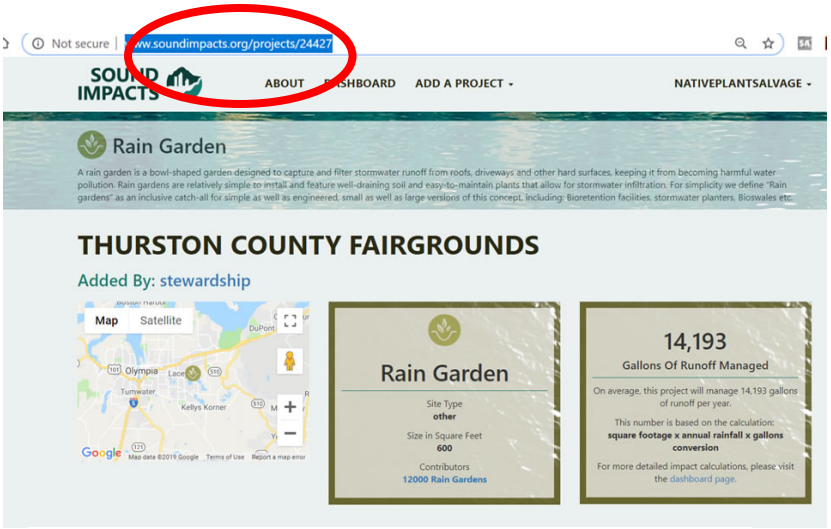


Sound Impacts: *Image 1*.



Sound Impacts: *Image 2*.

    - This triggers a new page appearing. Look at the address bar: **note the 5- or 6-digit number at the end of the URL** (24427 in the example shown in *image 3*). That number is the unique "Sound Impacts ID."



Sound Impacts: *Image 3*.

- In advance of your survey, or when you are finished, use the **wunderground.com** web site to note the actual precipitation to this area as noted: today (but not after you were there), yesterday, and two days ago. Log in and enter zip

code or nearest town into search bar in top left corner. There are usually multiple sites in each area to look at, select the closest location to the facility you are assessing by scrolling down. Once found, click on the site and then choose the "history" tab. Enter the date you want and click "View." Then, scroll down to precipitation and record precipitation (in inches) for the day of the survey and the prior two days. If no precipitation, record "0."

Section II: SITE OVERVIEW

- Type of Site: Determine if the facility is a "rain garden," "bioretention," or "unknown." Please explain how you determined the information under "Source of 'Type'." **Note:** Bioretention sites' plans will often have a Professional Engineer's Stamp, and sites are typically located on commercial or public property, in the right-of-way, or in recent construction.
- Record the rain garden age by assessing the site plan or other background information provided, such as from the owner ("Verifiable Source"). If you have no verifiable source but you are confident using factors such as plant vigor, personal knowledge of the area surveyed, or other clues, you may check one of the age boxes, but must provide a description of how you came to your estimate. State "unknown" if not sure of age.

Section III: CONTRIBUTING AREA/HYDROLOGY

***Getting Ready**:* Before doing this survey, the team will need to define the zones and outer limits of the rain garden. See "Terms" on page 2 for guidance.

Section III-1: Land Uses of Water Source: Select the one land use type that represents where the rain garden or bioretention facility water is running off from (contributing area). This may not be the most dominant land use in the area.

Section III-2: Overflow: Find each overflow and determine if it is graded to direct water away from the facility. Circle Yes, No or Unknown.

Section III-3. Blockages: Evaluate the inflow(s), overflow(s), and any sheet flow area to determine if flow of water is obstructed by sediment buildup, leaves, sticks, trash, weeds, and other possible blocks. To determine how blocked a structure/pipe is, remove any rock that is covering the structure and look (use flashlight if necessary) or poke around inside any existing inflow or overflow pipes with the screwdriver in your kit – not all sites will have pipes or structures. The goal is to discover if the pipe or channel has blocked water flow, not if there is rock covering the structures, as that may be for aesthetic reasons and should still allow for water flow.

Record the percentage of blockage (if any) and type of blockage. Please use the following cover-class codes, *as shown on the form*: **N = None; T = <0.5%; A = 0.5-5%; B = 6-25%; C = 26-50%; D = 51-75%; E = 76-95%; F = >96%.**

Section III-4. Erosion: Assess the severity of erosion in each zone, based on evidence of channelization, scouring or sloughing in the rain garden.

"Minor" erosion would be evident if:

- sloughing of soils within the ***total facility*** is under 20%;
- erosion is **not** occurring on side slopes (e.g., zone 2);
- site is not in need of prompt repair; and
- an easy remedy option is available to address erosion problem (e.g., replacing mulch, increasing rock armoring).

"Moderate" erosion would be evident if:

- sloughing of soils within the ***total facility*** is occurring under 60%;
- **or it may** involve side slopes at **any** level of erosion;
- level of erosion requires remedy soon but not *urgently*; and
- addressing erosion **might** require more complicated repair option than suggested in "minor" (e.g., substantial plants added or replanting, possible change of elevations in order to deepen or enlarge size of rock armoring).

"Extensive" erosion would be evident if:

- sloughing of the soils is *over 90% in* ***<u>any particular zone</u>*** *(note difference from other two categories);*
- complications of remedies potentially needed to repair erosion would be ***irrelevant*****;** and
- addressing erosion requires ***urgent action***.

Section III-5: Other Hydrology Concerns: Provide any descriptive information that you believe will help data reviewers understand how stormwater is moving in the facility. This is a place to note any information that has not yet been recorded in prior parts of Section III, or to clarify your findings, particularly in non-typical situations.

<u>Section IV: ZONE 1 CONDITIONS</u>

Section IV-1. Zone 1 Length: Determine the extent of Zone 1 (the flat bottom). Use a tape measure to record the length of Zone 1. Divide that length into thirds and record the length of each third. Use pin flags or leave the tape measure stretched out to visually demarcate Zone 1 into Sections 1A, 1B and 1C. When looking at the rain garden, Section 1A will be to the left and Section 1C to the right. The direction a team uses to view a rain garden is up that team, but please be consistent in the use of the Sections throughout your site visit.

Section IV-2. Standing Water, Siltation, and Liners: Record the depth and condition of any standing water in Sections 1A, 1B and 1C on the form. If there is no standing water, record "none" in that row. Note the level of siltation found in each section using the code provided. Silt will be very fine material that has dropped out of the water column.

Record if a liner or filter fabric is present. A liner would be noted on the site plan, and **should** be well below the depth you'll be investigating. Filter fabric may be encountered as you proceed with the next

step, IV-3, where you will carefully clear small areas to prepare to investigate the underlying soils. Either way, if you encounter any liners or fabrics, record the depth of placement and do not puncture them!

Section IV-3. Soil Texture: Take three soil core samples: one each in Sections 1A, 1B, and 1C. Take the readings at least two feet away from the **origin point** for inflow and the **exit point** for overflows or in-ground overflow structures. Complete each column completely before moving to the next sample. Note in section IV-4 under "other substrate observations" if you cannot take a sample for any reason (such as fabric present throughout).

1. To classify soil texture, first carefully move aside any rocks, mulch or vegetation from the area that you will be sampling, being careful not to mix these materials with each other.
2. Determine if the soil is compacted. If the soil meets both of the following conditions, then record it as compacted. Signs of compacted soil are:
    a. It is very hard to drive soil-core probe or shovel into the soil;
    b. There are clods or crusting at surface indicating that there is often standing water, and thus, less porous soils.
3. Use the appropriate tools — either a hand bucket auger or soil-core probe — to determine the depth to native soils first. As you probe the soils, you'll first encounter the special rain garden soil mix. Below that you will find the original, native soils. Since the native soils' composition is generally more mineral and with much less organic matter, you will be able to see the change in color that indicates you've reached native soils (usually lighter in color).
4. As you probe the soils, you'll take samples until you reach the native soils (or you can go no further, which *could* occur prior to reaching native soils). As you bring up soil from your sample hole, place excavated soil on a plastic tarp to prevent soil from contaminating adjacent armoring, mulched areas, landscaping, etc.
5. **Method: Hand bucket auger**: You will almost always need to take multiple samples from the same hole to reach the full depth of the bioretention/rain garden soils, which will likely be in the range of 12"-24" deep. When you see the soil surface at the top of the bucket, remove the auger. Turn the auger slightly to keep the soils from falling out, and place your sample(s) on the tarp. Stop taking bucket augers/soil cores when you can go no further or have reached the native soils.
    a. **Important:** Once you see native soils in your bucket sample, carefully remove the soil plug and measure the **exact number of inches of soil plug that is composed of the native soil depth.** If your sample isn't cohesive, don't empty it on your tarp until you've measured inches of native soils contained in the auger bucket.
    b. Depth to native soils can be measured by placing a tape measure into the auger hole, reading measurement, and **subtracting** the length of native-soil plug that was previously measured in the last auger sample. This calculation—*depth of hole minus the inches of native soils in your final excavated plug*—will equal "depth to native soils" on the form.
    c. In larger holes, where you can actually see the clear line in the hole showing the two different soils, you can just measure the depth of the hole *just to the line where native soils start*; you many need to use a flashlight to ensure you can accurately place the bottom of your tape measure where the native soils begin.

6. **Method**: Soil-core Probe: This probe is longer and narrower than the hand bucket auger. Therefore, it may be easier to push into the soils, and it may require fewer samples brought up until you reach the native soils. (Sometimes, you'll reach the native soils on the first probe.) As with the hand bucket auger method, take as many samples as required until you see the native soils appear in your soil plug.
    a. As before, carefully move aside mulch, rocks etc. to reveal bare ground. With some pressure, push the core into the ground. If you encounter early resistance, it could be a rock below the surface. You may need to move your probe a few times to find a location with less resistance.
    b. As you bring up each soil core, give a gentle half-twist to ensure soils don't fall out of probe.
    c. As before, empty the soil core plugs onto the tarp, being careful not to spill into the rocks or mulch. Sometimes the plug is hard to remove. Carefully extricate the plug from the probe onto your tarp using a screwdriver in your equipment kit.
    d. As with the method above, measure the exact number of inches of the portion of the plug that contains the native soils.
    e. **Always keep the rain garden soils separate from the native soils** on your tarp. (You'll soon be doing an additional analysis of these two types of soil.)
    f. Once you've reached the native soils and measured the number of inches of native soil plug in your final sample, return your empty probe to the hole and **mark the ground-level location on your soil probe. Measure this length** (i.e., you're measuring how deep the hole is).
    g. **Subtract** the length of *native soils* in the final soil plug from this measurement of the length of the soil probe from hole bottom to ground level. This calculation is your "depth to native soils."

7. Continue this process for each column so you record data for each third of Zone 1 as requested on the form.
8. If you were unable to reach the native soils, record "didn't reach" rather than noting number of inches to native soils. If you were unable to reach native soils, but you were able to take **some** measurements, include that information on the form under section IV-4, "other substrate observations." For instance, if you were able to probe up to 15" but no further due to compacted soils below that point, that information would be useful for the data reviewers.
9. **Soil texture characterization.** Now turn your attention to the soils on your tarp from your probing activities. First, characterize the texture of the rain garden/bioretention soils for each of the three sections of Zone 1, then characterize the underlying native soils (if you have been able to obtain a sample) for each section. Even if you were unable to penetrate your tool very deeply, you should be able to gather enough soil to do a texture assessment of the top of the rain garden soils at a minimum. Use the trowel or spade provided to obtain rain garden soil from each section if you were unable to use a probe tool.

10. Use the *simplified "texture by feel"* method **outlined in the flow-chart in your supplies**.
    a. Take a heaping tablespoon/peach-pit sized soil sample in your palm. Make sure that the soil is *damp*, but not wet (a light very spray of water might be necessary, but start with un-sprayed soil first).
    b. Try to make a ball with the soil sample. If the ball falls apart, the soil should be described as sandy. If a ball forms, make a ribbon by slowly rubbing/pushing the soil with your thumb across your fingers, from your pinky to your index finger. Measure the "ribbon" of soil that extends over your index finger. Using the definitions below, select the soil type for each sample.

- **Sandy**: Mostly gritty; may not form a ball; forms no ribbon or a very short ribbon.
- **Silty**: Feels mostly smooth (like wet flour) but could have some grit. Forms short ribbons (less than 1").
- **Clayey**: Feels mostly slippery/smooth (but could have some grit). Forms longer ribbons (1" or more).

Replace materials: When you have finished all soil observations, return as much soil as you can to the holes and replace any moved mulches and/or rock armoring. Remember to be careful not to spill soils in rock armoring or mulched areas.

Section IV-4. Other Substrate Observations:
Provide any descriptive information that you believe will help data reviewers understand substrate characteristics. This is a place to note any information that has not yet been recorded in prior parts of Section IV or to clarify your findings, particularly in non-typical situations. An example might be soils not compacted above, but compacted below, limiting amount of soil characterization ultimately possible.

Section V: OVERALL SUBSTRATES, VEGETATION, CONDITIONS

Section V-1. Substrate: In each Section of Zone 1, and overall for Zones 2 and 3, record predominant type of mulch and its depth in the first box, using the codes provided at the end of the section.

In the second box, record the overall percent coverage of the **mulch**, **bare ground** and types of **rock** armoring or **large stones/logs** using the cover classes provided, for all of Zones 1 (not individual sections), 2 and 3. Please record the cover class abbreviation and not a specific percentage. If none of the items in the first column is found in a zone, then record "N" for None, as noted on the form.

Section V-2. Vegetation: Assess vegetation communities' coverage and vigor in each of the three zones, using the percent cover class abbreviations and vigor definitions provided on the form
Note: Review the online training slides for more information about determining plant "vigor" designation.

The definitions below retain consistency in the monitoring:

All Vegetation: This is an assessment of all vegetative coverage, *without* a vigor assessment.

Target Problem Plants ("TPP"): You will need to refer to your ***handout*** and note just those specific plants that are called out under this definition. Note that some of these include *whole groups* of plants, such as spreading grasses, all clovers/vetches, etc.

Non-Target Weeds: This includes all weeds **not** on the TPP, noted above. Examples include: lawn dandelions, plantain, shot weed and other weedy mustard-family plants.

Deciduous Shrubs/Trees: All woody plants that lose their leaves in the winter. Typically, these are broad-leaved plants but can include some needle-leaved plants. When in doubt, rub the leaves between your thumb and forefinger: Are they tender? Do they fall apart quickly when pressure is applied? If so, they are most likely deciduous.

Evergreen Shrubs/Trees: All woody plants that have leaf coverage in the winter. These leaves will be leathery or tough and will not wither easily when pressure is applied. This group includes sub-shrubs such as low-growing sunroses (*Helianthemum*), wallflowers (*Erysimum*), Heathers (*Erica* or *Calluna*), candytuft (*Iberis*), kinnikinnik (*Arctostaphylos uva-ursi*), and other shrub-like evergreens that grow over one-foot high.

Herbaceous: This broad category includes all the **intentional** rain garden plants that are either non-woody perennials, self-seeding annuals, bulbs, ferns, desirable grasses (such as various bunching grasses), and the "emergents"—rushes, sedges, and bulrushes. Some of these will be ephemeral and only visible at certain times of the year (though evidence of them may persist, such as a daylily flower stalk or dried grass foliage from the previous growing season). Some of the emergents grow in bunches from a primary base and some spread by rhizomes underground but can be identified by their distinctive leaves and flowers. When in doubt, consult the plant photos/descriptions in your *Rain Garden Handbook for Western Washington*.

Ground Cover: This category includes those plants that spread out quickly, completely cover all the ground as they spread, and provide all-season coverage. Plants may provide coverage through spread by runners or vegetative sprigs, or by fast-growing, prostrate, dense woody growth. Common examples include: coastal strawberry (*Fragaria chiloensis*), creeping raspberry (*Rubus calycinoides*) ground-hugging *Ceanothus* varieties or ground-hugging cotoneasters such as *Cotoneaster dammeri*, some evergreen stonecrops (*Sedum* species), creeping herbs such as the various creeping thymes, carpet-bugles (*Ajuga*), and periwinkles (*Vinca*).

Section V-3. Other Vegetation Observations:
Provide any descriptive information that you believe will help data reviewers understand vegetation characteristics. This is a place to note any information that has not yet been recorded in prior parts of Section V or to clarify your findings, particularly in non-typical situations.

Note: If vegetation from *outside of the rain garden is overhanging the facility*, it should **not be counted** in the coverage described above. However, it may be **noted in this section**, especially if it has implications for maintenance, such as potential to introduce invasive species/weeds, potential to drop branches that need to be attended to after storms, or potential to create heavy leaf/needle drop that will require regular maintenance so as not to smother rain garden plants.

Section V-4. Public Amenities: Within your team, discuss these *qualitative* questions and come to *consensus*. Record the *team answers* to the first three questions in this section. The final question is a simple "yes" or "no" based on presence/absence of educational signage. You may need to look around for a sign if you are monitoring one rain garden in a cluster; to record "yes," you should be able to see the sign from the rain garden being monitored.

Section V-5: Other Observations
Provide any final descriptive information that will help data reviewers understand how the rain garden is functioning, is being maintained or other needed insights.

C. WRAPPING UP

- Record your End Time on the Functional Assessment Form.
- Note any areas of the form that did not work to represent the rain garden accurately or thoroughly. Please describe how.
- Gather and clean/dry all equipment, tools, and laminated sheets. Stow in kit.
- Review data form for completeness and confirm who is submitting the form.
- Confirm who is returning the kit.
- Let the program contact know if any equipment is missing or needs repair or if the team had any questions or concerns.

D. PHOTO DOCUMENTATION (Optional): Maintaining *regular photo points* adds to the database for any given rain garden. Collaborate with your data collectors/reviewers or program coordinator to determine how to *maintain* and *share* photo records.

If photo documentation is requested by the program coordinator, consider these tips:

- If monitoring multiple sites, make the **first photo** for each site a photo of some form of documentation noting: site name, date, and monitoring team members.
- Take the overview photographs **before starting to make observations.**
- If monitoring is being done in conjunction with regular maintenance visit, take "before" and "after" photos to document maintenance efforts from that visit.
- Photograph problems, innovative solutions employed, or *anything noteworthy.*
- **Identify and record consistent locations to be photographed at each monitoring visit.** Consider these ideas:
    - ✓ Photos from opposite sides of the rain garden, looking inward;
    - ✓ Photos of the inflow and overflow structures/systems;
    - ✓ Photos of the predominant form of organic mulch and rock armor (if any) in the rain garden (use pencil for scale);
    - ✓ Photo from best public viewpoint, if it exists.

E. PROGRAM CONTACTS

If you have any questions on methods or instructions, problems with equipment or challenges with scheduling, please contact the following people / person:

Name:_____ Telephone:_____
Email:_____