Appendix 5-D

Stormwater Pollution Benchmarking Tool for Existing Industrial, Federal and Municipal Facilities in Virginia

Adapted from Chesapeake Stormwater Network Technical Bulletin No. 7:

Stormwater Pollution Benchmarking Tool for Existing Industrial, Federal and Municipal Facilities in the Chesapeake Bay Watershed Version 3.0, June 2011

Table of Contents

CHAPTER SECTION HEADINGS

5-D.1.0 INTRODUCTION 5-D-4

5-D.2.0 THE EVOLUTION OF THE STORMWATER BENCHMARKING TOOL 5-D-4

5-D.3.0 OBJECTIVES AND OUTCOMES FOR STORMWATER BENCHMARKING 5-D-5

5-D.5.0 GETTING STARTED 5-D-6

5-D.5.0 DESCRIPTION OF THE STORMWATER BENCHMARKS 5-D-7

5-D.5.1 Benchmark 1: Define Your Watershed Address 5-D-8

5-D.5.2 Benchmark 2: Develop a Stormwater Profile for Your Facility 5-D-9

5-D.5.3 Benchmark 3: Improve Your On-Site Employee Training Efforts 5-D-10

5-D.5.4 Benchmark 4: Update Your Stormwater Pollution Prevention

	Plan	5-D-11
5-D.5.5	Benchmark 5: Understand the Stormwater Plumbing at Your Site	5-D-12
5-D.5.6	Benchmark 6: Look for Opportunities to Reduce Rooftop Runoff	5-D-13
5-D.5.7	Benchmark 7: Investigate Loading and Unloading Areas	5-D-14
5-D.5.8	Benchmark 8: Prevent Pollution from Parking Lots	5-D-15
5-D.5.9	Benchmark 9: Prevent Spills and Runoff from Fueling Areas	5-D-16
5-D.5.10	Benchmark 10: Deal with Outdoor Wash-Water and Winter Deicing Operations	5-D-17
5-D.5.11	Benchmark 11: Keep Rain and Runoff Away from Vehicle Repairs	5-D-18
5-D.5.12	Benchmark 12: Evaluate Spill Control and Response Procedures	5-D-19
5-D.5.13	Benchmark 13: Prevent Runoff from Materials Stored Outside	5-D-20
5-D.5.14	Benchmark 14: Prevent Dumpster and Compactor "Juice"	5-D-21
5-D.5.15	Benchmark 15: Improved Turf Management and Conversion	5-D-22
5-D.5.16	Benchmark 16: Investigate Feasibility of Parking Lot BMP Retrofits	5-D-23
5-D.5.17	Benchmark 17: Adopt Green Landscaping Practices	5-D-24
5-D.5.18	Benchmark 18: Check for Illicit Dry Weather Flows at Storm Drain Outlets	5-D-25
5-D.5.19	Benchmark 19: Regularly Maintain Your Stormwater Infrastructure	5-D-26
5-D.5.20	Benchmark 20: Natural Area Conservation and Restoration	5-D-27
5-D.5.21	Benchmark 21: Become a Local Watershed Partner	5-D-28
5-D.5.22	Benchmark 22: Support a Local Stream Cleanup	5-D-29
5-D.6.0	**THE STORMWATER BENCHMARKING TOOL SCORE SHEET**	5-D-30
5-D.7.0	**HANDY INTERNET LINKS TO FIND YOUR WATERSHED ADDRESS AND LEARN MORE ABOUT WATERSHEDS AND STORMWATER POLLUTION PREVENTION**	5-D-34
5-D.7.1	Find Your Watershed Address	5-D-34
5-D.7.2	Learn More About Watersheds	5-D-34
5-D.7.3	Pollution Prevention Resources	5-D-34
5-D.8.0	**ESTIMATING THE ANNUAL POLLUTANT LOAD FOR A FACILITY USING THE SIMPLE METHOD**	5-D-36
5-D- **5-D.9.0**	**ESTIMATING THE ANNUAL RUNOFF VOLUME FOR A FACILITY USING THE SIMPLE METHOD**	5-D-38
5-D.10.0	**REFERENCES**	5-D-39

FIGURES

Figure 5-D.1	A Watershed Map Image Showing a Specific Facility Location	5-D-8
Figure 5-D.2	A Municipal Equipment Martialing Yard	5-D-9
Figure 5-D.3	Employee Training	5-D-10
Figure 5-D.4	Example Site Photo	5-D-11

Figure 5-D.5	Surveying a Site's Stormwater "Plumbing"	5-D-12
Figure 5-D.6	Reducing Rooftop Runoff	5-D-13
Figure 5-D.7	Investigate Loading and Unloading Areas	5-D-14
Figure 5-D.8	Parking Lot Pollution	5-D-15
Figure 5-D.9	Covered vs. Uncovered Fueling Areas	5-D-16
Figure 5-D.10	Outdoor Garden Center Wash-Water Directed to Storm Drain	5-D-17
Figure 5-D.11	Uncovered Pile of Road Salt	5-D-17
Figure 5-D.12	Indoor Truck Maintenance Area	5-D-18
Figure 5-D.13	A Spill That Got Away	5-D-19
Figure 5-D.14	Exposed Pile of Mulch	5-D-20
Figure 5-D.15	Leaking Drums of Restaurant Cooking Grease	5-D-20
Figure 5-D.16	Dumpster Waste and Trash Compactor "Juice"	5-D-21
Figure 5-D.17	Turf Can Generate High Runoff Rates of Nutrients and Pesticides to Streams	5-D-22
Figure 5-D.18	Turf Areas Can Be Converted to Native Forest, Meadow, or Filter Infiltration Type Stormwater BMPs	5-D-22
Figure 5-D.19	Different BMP Retrofit Options Available to Treat Parking Lot Runoff	5-D-23
Figure 5-D.20	The Clean Fence Line and Dead Vegetation Are Signs that Herbicides Have Been Applied	5-D-24
Figure 5-D.21	Lawn Clippings Left Along the Curb Can Be Washed Into the Storm Drain	5-D-24
Figure 5-D.22	Suspicious Flow from Storm Drain Pipe Outlet	5-D-25
Figure 5-D.23	Sample of Illicit Discharge From a Storm Drainage Pipe Outlet	5-D-25
Figure 5-D.24	Catch Basin Cleanout	5-D-26
Figure 5-D.25	Storm Drain Inlet Inspection	5-D-26
Figure 5-D.26	A Typical Small Natural Area Remnant at An Industrial Site	5-D-27
Figure 5-D.27	Partnering Watershed Organizations with Facilities Needing Help	5-D-28
Figure 5-D.28	A Stream Cleanup Martialing Area	5-D-29

TABLES

Table 5-D.1	Interpreting the Initial Benchmark Score	5-D-6
Table 5-D.2	National Averages of Pollutant Event Mean Concentrations for Industrial Land Uses	5-D-38

5-D.1.0. INTRODUCTION

This Appendix presents a visual method to assess the need for stormwater pollution practices, retrofits and stewardship at existing industrial, institutional, federal, state and municipal facilities. Thousands of these facilities exist across Virginia, each of which has the potential to be severe stormwater hotspots, which are defined as a site that generates higher loads of pollutants and toxics, and/or has a higher risk of leaks, spills or illicit discharges. Despite the impact of stormwater hotspots on the local receiving waters and the Chesapeake Bay, they have not been effectively regulated or managed for several reasons.

While as many as 30,000 facilities across the Bay watershed are technically regulated under EPA's industrial or municipal stormwater permit programs, most individual permits do not contain specific monitoring requirements or numeric limits on effluent quality. Thus, at many sites, all that is needed to comply with the permit is to make sure you have a paper document known as a stormwater pollution prevention plan present on your site. The chances that a local or state regulator will inspect your site are increasingly small (National Research Council, 2008). Even if sites are inspected, the permits do not require any site-specific or quantitative measurements to determine whether runoff is dirty or reasonably clean, which makes it difficult to trigger enforcement actions.

A second key issue is that many property managers and environmental compliance officers simply don't understand much about stormwater, in contrast to their knowledge about the more traditional environmental health and workplace safety issues they must deal with every day (e.g., hazardous waste storage and disposal and spill response). Few good training materials have been developed regarding site-based stormwater pollution prevention techniques, and even fewer tools exist to diagnose the actual stormwater pollution problems present at a site. Consequently, there is a strong need for a quantitative diagnostic tool to assess stormwater pollution problems and identify site-specific and cost-effective solutions.

There has been growing recognition about the need to expand pollution prevention activities, particularly at federal facilities (DOD, 2009 and EPA, 2009). These new stormwater initiatives seek to respond to the President's 2009 Executive Order 13805 on Enhancing Restoration of the Chesapeake Bay. For example, DOD (2009) conservatively estimated that existing federal facilities comprised nearly 85,000 acres of developed land in the Bay watershed, and there was a need for a comprehensive tool to evaluate pollution prevention, retrofitting and stewardship opportunities at individual facilities. In addition, the first guidance and assessment tools for managing runoff from municipal stormwater hotspots has just been released (CWP, 2009).

5-D.2.0. THE EVOLUTION OF THE STORMWATER BENCHMARKING TOOL

The current version of the stormwater benchmarking tool presented here has rapidly evolved in the last six years. It began with the release of the Hotspot Site Investigation or H.S.I. (CWP, 2005) which was a simple checklist to confirm whether a site could be classified as potential, moderate or severe stormwater hotspot, based on visual analysis of site conditions. The H.S.I. has been extensively tested over the last six years at hundreds of different sites around the country, and has been found to be a robust tool. Its main weakness, however, is that while it could discriminate between dirty and clean sites, it could not measure how green a facility is

(i.e.,, has it gone beyond the minimum to build on-site stormwater retrofits, enhanced land management or foster greater watershed stewardship.

To bridge this gap, the Chesapeake Stormwater Network (CSN) developed a more comprehensive stormwater benchmarking tool, in cooperation with Coca-Cola North America and the World Wildlife Fund. The H.S.I was extensively modified to provide a benchmarking score for individual Coca Cola bottling facilities. The new tool was tested from 2007 to 2009 and refined based on comments from plant managers and environmental compliance officers at five different bottling facilities in the Southeastern U.S. Simultaneously, the CSN developed a similar benchmarking tool for three large port facilities in the Port of Houston, though a cooperative agreement between the Conservation Law Foundation and the Port Authority.

Based on this experience, the CSN concluded that it was possible to produce a generic stormwater benchmarking tool that could be applied to existing individual industrial, municipal, federal, corporate or institutional facilities of less than 50 acres in size within the Chesapeake Bay watershed. The new tool (CSN Technical Bulletin No. 7, 2010) provides a quantitative score to measure whether a facility is dirty, clean or green. It also helps users develop an action list of pollution prevention, stormwater retrofit, land management and watershed stewardship practices to implement at the site.

5-D.3.0. OBJECTIVES AND OUTCOMES FOR STROWMATER BENCHMARKING

Stormwater benchmarking involves a rapid office and field survey to identify correctable stormwater pollution problems at individual industrial or municipal facilities. The benchmarking tool is a comprehensive assessment that rates each facility against 22 performance benchmarks and identifies simple low cost pollution prevention actions that can be undertaken at each facility to improve its stormwater runoff quality. Each benchmark is associated with the completion of one to five individual tasks or practices that can improve stormwater quality.

The recommended goal for stormwater benchmarking is to attain a minimum total facility score of 95 or greater (out of a total of 100 points). Once the on-site team has completed its work, they tabulate the total score, and interpret it using the guidance provided in **Table 5-D.1** below. The assessment team should document their work with digital photos to show both good practices and existing stormwater problems, and incorporate these directly into employee training programs.

Based on the benchmarking exercise, the user can rank each facility among its peers, and provide detailed information to update stormwater pollution prevention plans that are legally required at many facilities. In addition, benchmarking can improve employee understanding about stormwater runoff, watersheds and community stewardship. In most cases, the initial scores will be rather low, but the tool helps identify a series of immediate, short-term and mid-term action items to complete at the facility in ensuing years.

The benchmarking tool has been designed to apply to a wide range of facility types. If it turns out that you do not engage in the indicated activity or practice for a specific benchmark, you can award yourself full points (e.g., no refueling occurs at your facility so this benchmark does not apply to you). If it turns out that more than a third of the benchmarks do not apply to your

facility, you probably have a unique facility category, and may want to customize the tool by adding/subtracting benchmarks or changing the weight of points awarded among the benchmarks. The basic idea is to go beyond the minimum at every facility so that it is not only clean but green, such that a wide range of low cost practices are used or installed to ensure it has the least possible impact to local waters and the larger river basin.

Table 5-D.1. Interpreting the Initial Benchmark Score

Score	Rating	Comments
95 - 100	**Excellent**	**Congratulations:** Your activities and practices make you an industry leader in stormwater compliance. You go way beyond the minimum and deserve recognition in your community.
85 - 94	**Good**	**Great Start:** You run a clean, effective operation and only have a handful of areas for improvement to meet the goal.
75 - 84	**Fair**	**Needs Work:** Although you are doing a lot of things right, there are many areas where you can do more.
65 - 74	**Poor**	**Not so Good:** Your site is probably a hotspot for stormwater pollution, and your team needs to become more effective toward meeting the standard.
35 – 64	**Very Poor**	**Lots of Work to Do:** Your site is probably a severe hotspot, and your facility is probably noncompliant with your stormwater permit. The team and facility manager need an aggressive, effective action plan.
Less than 35	**Unacceptable**	**Shred the Evidence (just kidding):** Your site is almost certainly noncompliant with your stormwater permit, and you are exposing your company to regulatory risks, fines and citizen lawsuits! Improving your score should be an immediate facility-wide priority.

5-D.4.0. GETTING STARTED

The stormwater benchmarking exercise is designed to be completed in four hours or less, although some implementation activities may take longer. To get started, the environmental compliance officer should familiarize themselves with the benchmarking tool and read the pollution prevention resources provided in **Section 5-D.6.0**. Benchmarking should be done by a team of at least two individuals, and it may be helpful to involve other facility employees (especially maintenance staff) to enhance its training value. The assessment team doesn't need a lot to get started, as shown below:

- Standard Safety gear (blaze orange vests if there is a lot of truck traffic)
- Clipboard with notes
- Access to internet
- Digital Camera
- Site Map to Scale

5-D.5.0. DESCRIPTION OF THE STORMWATER BENCHMARKS

The team assesses benchmarks inside the building, outside of the building and along the stream or receiving water that the facility discharges to. The ensuing section outlines how to assess and score each benchmark through 22 profile sheets. Each profile sheet shows:

- The specific conditions to look for at the site
- Photographs that show how the indicated activity or operation can enhance or degrade stormwater runoff quality. These help show the survey team what is good or bad practice at their facility
- A specific description of the one to four different tasks that must be completed to earn points under each benchmark
- Guidance on how to score each benchmark
- Tips for evaluating each benchmark at your facility, including the recommended resources to learn more about best practices for your facility

The team should review the profile sheets carefully so they can better "see" the correctible stormwater problems present at the site, and then identify the most cost-effective solutions to address them.

5-D.5.1. Benchmark 1: Define Your Watershed Address

What to look for: The team uses a GIS or the internet (Google Earth or other mapping) to determine the stream to which the facility ultimately drains, as well as the larger watershed in which it resides.

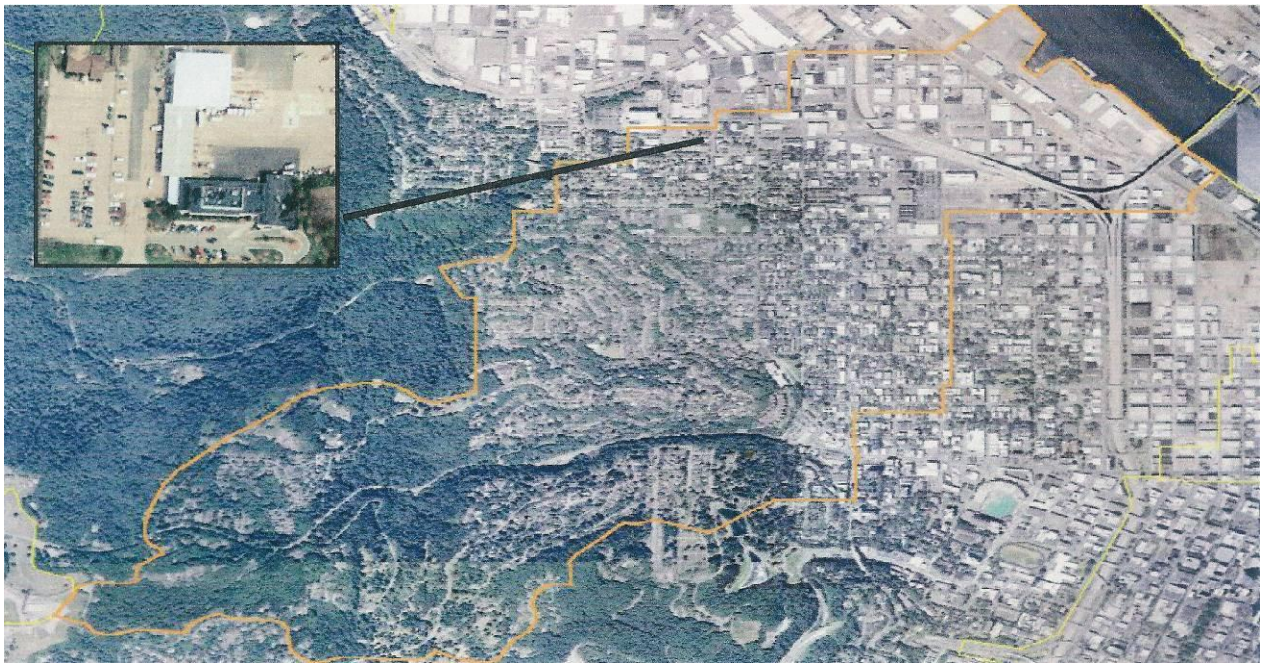

Figure 5-D.1. A Watershed Map Image Showing a Specific Facility Location

Tasks. Four specific tasks must be completed to meet this benchmark:

1. Use Google Earth to find the location of the facility in relation to the nearest named stream.
2. Determine the larger watershed in which it resides.
3. Do a web search to identify local or regional groups working to protect or restore the watershed and get basic contact information for those organizations.
4. Contact the groups to learn more about the key water quality and habitat issues that are a problem in your watershed.

Scoring: A **total of 4 points**. One point is awarded for each of the above tasks that is completed.

Tip: Several handy websites in **Section 5-D.6** below can quickly help to find your watershed address by simply entering the zip code of your facility. Other websites can help you find your local watershed group and learn about the key pollutants of concern.

5-D.5.2. Benchmark 2: Develop a Stormwater Profile for Your Facility

What to look for: Analyze the land cover present on the site plan to estimate the total site area and area/percentage of impervious cover so that you can quickly compute the annual stormwater runoff volume and pollutant load generated by your facility. Try to express the annual stormwater runoff volume in analogous terms your employees can relate to, such as cases of product shipped or the number of standard forty-foot shipping containers filled with product each year. Once employees understand the magnitude of their stormwater pollution "footprint," they are more likely to take action.

Figure 5-D.2. A Municipal Equipment Martialing Yard (nearly two 55-gallon drums of Oil Washed Off the Site Every Year).

For this site:

- Site Area = 24.1 acres
- % Impervious Cover = 92%
- Average Annual Runoff = 50 inches
- Total Phosphorus in Runoff = 56 lbs/yr
- Total Sediment in Runoff = 8.7 tons/yr
- Total Nitrogen in Runoff = 452 lbs/yr
- Oil and Grease in Runoff = 865 lbs/yr = 104 gal/yr
- Zinc in Runoff = 43 lbs/yr

Tasks. Four specific tasks must be completed to meet this benchmark:

5. Analyze the site plan to estimate the total site area, the area/percentage of impervious cover, and the runoff coefficient.
6. Determine the average annual rainfall at the site (you can find this at http://maps.howstuffworks.com/united-states-annual-rainfall-map.htm .
7. Compute the annual stormwater runoff volume produced at your site, and compare it to the volume of your annual production.
8. Compute the annual sediment, nutrient (phosphorus and nitrogen), zinc, and oil/grease loads generated from your facility.

Scoring: A **total of 4 points**. One point is awarded for each of the above tasks that is completed.

Tip: **Sections 5-D.7 and 5-D.8** show how to compute the annual runoff volume and pollutant load that washes off your site using the Simple Method (Schueler, 1987).

5-D.5.3. Benchmark 3: Improve Your On-Site Employee Training Efforts

What to look for: Use the stormwater benchmarking tool to train employees to spot stormwater runoff problems and opportunities across the site, and then create a team to work together to improve benchmark scores for the facility. The best training involves hands-on assessment out in and around the facility. Initially, many employees are not aware of how stormwater travels through their site and the potential for pollutants to wash off site surfaces into local streams. Experience has shown that "outside the building" training, using the benchmarking method, is an extremely effective learning tool.

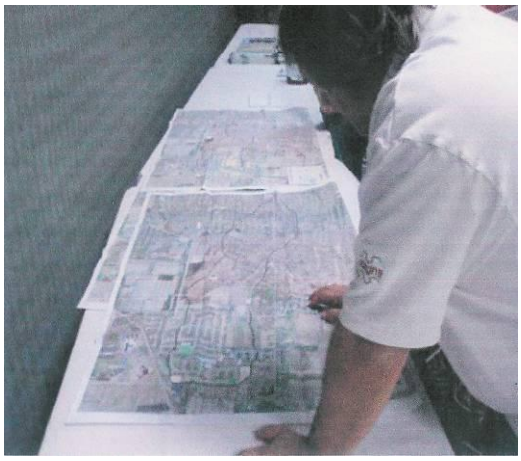

Figure 5-D.3. Employee Training

Tasks. Four specific tasks must be completed to meet this benchmark:

9. Involve key employees in the stormwater benchmarking exercise and discuss the results with them and the plant or facility manager. Current stormwater benchmark scores should be posted in a prominent location in the facility.
10. Customize a basic stormwater pollution prevention training program for your site's employees, using data specific to your site.
11. Provide the new training program for all employees at least once a year.
12. Include tips on watershed stewardship that all employees can practice at home or in their community.

Scoring: A **total of 5 points**. Two points are awarded for Task 9, and one point is awarded for each of Tasks 10 through 12 that are completed.

Tips: Some guidance on employee training can be found in Profile Sheet MO-10 ("Employee Training") from the Center for Watershed Protection's *Manual 9* of their *Small Watershed Restoration Manual Series*. Another great resource for finding posters and brochures related to stormwater pollution and watershed stewardship is the U.S. EPA's *Nonpoint Source Outreach Tool Box* (online at www.epa.gov/nps/toolbox), which has more than 800 posters, brochures, and other watershed educational tools. These can be posted in employee lunch or meeting rooms to heighten employee awareness.

5-D.5.4. Benchmark 4: Update Your Stormwater Pollution Prevention Plan

What to look for: Check your files to see if you have an existing Stormwater Pollution Prevention Plan (SWPPP) for your site, if required by EPA's industrial or municipal stormwater NPDES/VPDES permit regulations. If you can't fine one, do some internet research to determine the regulatory status of your site. The objective of the benchmarking exercise is to develop an action plan that reflects your site-specific problems and opportunities.

Figure 5-D.4. Example Site Photo

At this facility, the action plan included one immediate corrective action, five actions to implement in the next 90 days, and 12 more by the end of the year. Five more actions that require capital funds or more detailed engineering were scheduled over the following three years.

Tasks. Three specific tasks must be completed to meet this benchmark:

13. Find and review your existing stormwater pollution prevention plan (if your facility is regulated under the NPDES/VPDES stormwater permit program). If not, find a good quality site plan or aerial photograph of your facility.
14. Designate a lead staff member or a small group to conduct annual stormwater benchmarking and to implement the SWPPP.
15. Create an annual work plan or punch list outlining new practices and retrofits to improve future benchmark scores.

Scoring: A **total of 5 points**. One point for each of the first two tasks, and three points for the annual work plan..

Tips: If you are not sure if your facility is covered by industrial stormwater regulations, then check online at http://cfpub.epa.gov/NPDES/stormwater/indust.cfm to learn more. Many municipal and federal facilities do not meet the strict definition of "industrial" but still contain operations or activities that can make them a stormwater hotspot. Refer to the Center for Watershed Protection's *Manual 8 ("Source Control Practices")* of their *Small Watershed Restoration Manual Series* and the web links in **Section 5-D.6** to learn more about stormwater pollution prevention.

5-D.5.5. Benchmark 5: Understand the Stormwater Plumbing at Your Site

What to look for: After carefully analyzing the facility plan, walk around to discover the pathways by which stormwater runoff flows across and, sometimes, underneath the site. The basic idea is to proceed from the roof (the highest point) to the lowest point where stormwater is discharged from the site. The team should trace how runoff flows from roof leaders, across pavement, into stormwater inlets, and then into channels or storm drain pipes. The pathway of stormwater flows can be complex at many facilities, particularly given the presence of sanitary sewer and drinking water pipes that are also present at the site. The survey is best done when it is raining. It should also pinpoint the location of storm drain outlets, which may be located off the site. Once you're done with the survey, make sure to mark all storm drain inlets on the site with the following label/tag: *Keep pollutants out – drains to XXX (stream or river or reservoir or bay).* Then employees will realize they are stormwater inlets and not connected to the wastewater treatment plant.

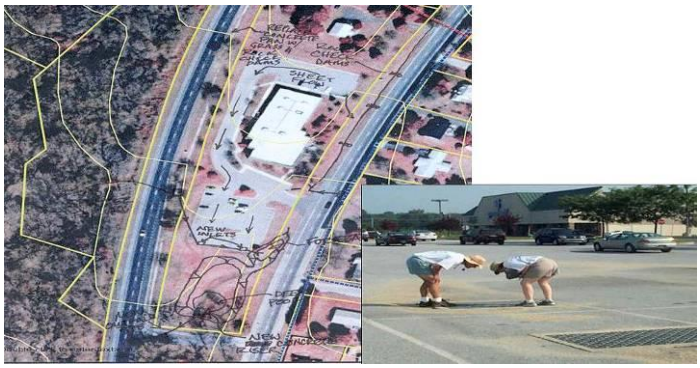

Figure 5-D.5. Surveying a Site's Stormwater "Plumbing"

Tasks. Four specific tasks must be completed to meet this benchmark:

16. Walk the site with the plan to determine the actual stormwater flow paths.
17. Confirm the locations of sanitary, stormwater and water pipes.
18. Mark the actual locations of these on the site plan or aerial photographs.
19. Provide permanent markers at each storm drain inlet (see first photo above)

Scoring: A **total of 5 points**. One point for each of the first three tasks, and two points for the Task 19.

Tips: Your survey should locate where underground stormwater, wastewater and drinking water pipes are currently going. Often, the pipes can be quickly identified by looking at the markings on surface manhole covers. If you are in doubt, simple dye testing may be needed to confirm which pipes are used to carry sewage, drinking water or stormwater. Guidance on storm drain marking can be found in Profile Sheet N-16 of the Center for Watershed Protection's *Manual 8 ("Source Control Practices")* of their *Small Watershed Restoration Manual Series* or from an EPA fact sheet that can be accessed online at http://cfpub.epa.gov/NPDES/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=15 .

5-D.5.6. Benchmark 6: Look for Opportunities to Reduce Rooftop Runoff

What to look for: Survey the perimeter of the building to find the points where rooftop runoff discharges to the ground (known as downspouts or roof leaders). Check to see which ones can be diverted to adjacent pervious or turf areas, where the runoff can be filtered or infiltrated into the ground. Roof downspouts that discharge to a paved surface and subsequently to a storm drain do not allow for any treatment of stormwater before it is discharged to the stream. There are a wide range of options for disconnecting and treating roof runoff, from simple disconnection over a pervious area to collecting the water in rain tanks or cisterns for reuse of the stormwater onsite, increasing the facility's water use efficiency.

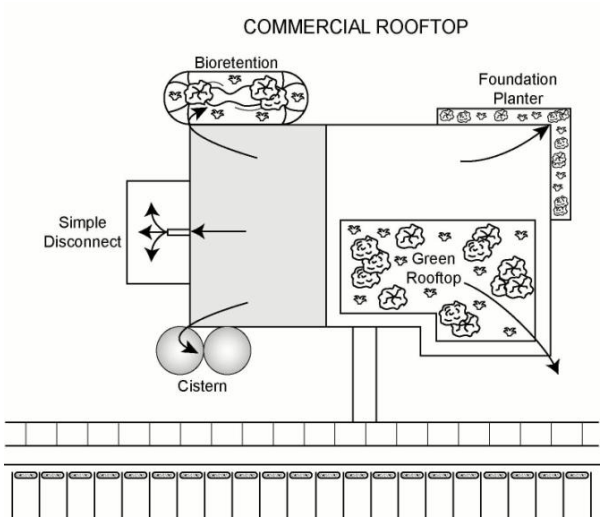

Figure 5-D.6. Reducing Rooftop Runoff

Tasks. Three specific tasks must be completed to meet this benchmark:

20. Evaluate every downspout to determine if it can be safely disconnected to filter runoff over an adjacent pervious area.
21. Evaluate the feasibility of rain tanks or re-use of stormwater in the site's landscaping.
22. Retain an engineering consultant to design a roof retrofit (e.g., a vegetated roof).

Scoring: A **total of 5 points**. One point for Task 20, and two points each for the Tasks 21 and 22.

Tips: Guidance on retrofitting rooftops can be found in Profile Sheet OS-10 of the Center for Watershed Protection's *Manual 3* of their *Small Watershed Restoration Manual Series*. Simple disconnections may involve using flexible pipes from the roof leader to divert runoff several feet to a more appropriate discharge point. If this is not possible, an engineering consultant can recommend the most cost-effective roof retrofit option for your facility, such as a vegetated roof, foundation planter, bioretention area, rain tank, etc.

5-D.5.7. Benchmark 7: Investigate Loading and Unloading Areas

What to look for: Nearly every facility has a distinct area where bulk inputs are delivered and products are shipped out. Spills and leaks are common at these loading and unloading areas, which are compounded by the fact that they are often located near an outdoor storm drain inlet. Consequently, spilled pollutants can enter the storm drain during a storm or be carried in wash-water when loading and unloading areas are cleaned. Covered loading areas at least prevent spilled materials from being washed away by rainwater.

Figure 5-D.7. Investigate Loading and Unloading Areas

Tasks. Two specific tasks must be completed to meet this benchmark:

23. Keep loading areas clean by regular sweeping (never by hosing to a storm drain).
24. Make sure loading areas are covered or redesigned to send any runoff to the sanitary sewer..

Scoring: A **total of 4 points**. Two points for successful completion of each task.

Tips: Some best practices for loading and unloading areas are described in Profile Sheet H-5 in the Center for Watershed Protection's *Manual 8* of their *Small Watershed Restoration Manual Series*. The facility team should look for outdoor water spigots in close proximity to the loading areas, which indicate that employees may often hose down the area to keep it clean. This practice should be avoided unless it is clear that the wash-water goes into the sanitary sewer system. The alternative practice is to manually sweep or vacuum the loading area and ensure disposal of solids is done properly.

5-D.5.8. Benchmark 8: Investigate Loading and Unloading Areas

What to look for: Walk all the employee and fleet parking lots to assess their condition. Look for the presence of obvious pollutants such as trash, oil stains and sediment deposits. Based on how dirty the lots are, the team can change current parking lot maintenance practices to improve the quality of parking lot runoff. Often the dirtiest parking lots occur when vehicles or heavy equipment are parked or stored for a long time. Monthly seeping of parking lots helps reduce wash-off of pollutants in storm water. Routine trash and litter pickup can sharply reduce trash loading delivered to nearby streams. Oil and hydraulic fluid leaks can be a problem in long-term parking lots, but they can remedied easily with spot applications of adsorbents. Unpaved parking lots can be a major source of sediment. These should either be stabilized or protected with erosion and sediment controls.

Figure 5-D.8. Parking Lot Pollution

Tasks. Two specific tasks must be completed to meet this benchmark:

25. Walk each lot monthly to find and fix fluid leaks.
26. Pick up trash and litter weekly and sweep at least once a month with a vacuum sweeper. Stabilize unpaved lots to prevent erosion, and exercise special care with routine pavement maintenance activities, such as power-washing and seal-coating.

Scoring: A **total of 5 points**. Two points for Task 25, and three points for Task 26.

Tips: Best practices for parking lot maintenance can be found in Profile Sheet H-11 of the Center for Watershed Protection's *Manual 8* of their *Small Watershed Restoration Manual Series*.

5-D.5.9. Benchmark 9: Prevent Spills and Runoff from Fueling Areas

What to look for: Check to see if there are any vehicle fueling areas at the site. If they are present, carefully inspect them to see if there is any risk that petroleum products can spill or wash into the storm drain system. Covered fueling areas are designed and constructed to keep rainwater away from any spilled gasoline or diesel fuel.

Figure 5-D.9. Covered vs. Uncovered Fueling Areas

Tasks. Three specific tasks must be completed to meet this benchmark:

27. Cover fueling islands to prevent rainwater contact with spilled fuel.
28. Ensure that dry spill response kits are readily available.
29. Redesign flow paths to prevent "run-on" or runoff from the fueling area into the storm drainage system.

Scoring: A **total of 4 points**. One point each for Tasks 27 and 28, and two points for Task 29.

Tips: Best practices for vehicle fueling areas are described in Profile Sheet H-2 in the Center for Watershed Protection's *Manual 8* of their *Small Watershed Restoration Manual Series*. Just because a fueling area is covered does not automatically mean that it will be clean. Stormwater from adjacent paved areas can "run-on" to the fueling area and wash off petroleum products into the storm drainage system. So it is important for the facility team to find these adjacent storm drains and make sure they are protected by storm drain inserts that can capture hydrocarbons.

5-D.5.10. Benchmark 10: Deal with Outdoor Wash-Water and Winter Deicing Operations

What to look for: Locate all outdoor water spigots and identify what, if any, seasonal outdoor washing operations occur at the site. Find out where outdoor wash-water is directed, to make sure it is disposed of in the sanitary sewer system and ***not*** in the storm drainage system. Assess winter de-icing operations at the facility to ensure that salt is safely stored and excess chlorides are cleaned up in the Spring. Uncovered piles of road salt can send toxic pulses of high-salinity water to the drainage system and into nearby streams with each rainfall.

Figure 5-D.10. Outdoor Garden Center Wash Water Directed to the Storm Drain

Figure 5-D.11. Uncovered Pile of Road Salt

Tasks. Two specific tasks must be completed to meet this benchmark:

30. Ensure that water from seasonal outdoor washing operations do not enter storm drain inlets. This can be done by shifting them to pervious areas, or temporarily closing off storm drain inlets to prevent the entry of wash-water.
31. Assess winter de-icing operations to reduce entry of sediment and chlorides into the storm drainage system. This typically involves a spring cleanup of excess salt, spot revegetation, and environmentally safe storage of salts and de-icers.

Scoring: A **total of 4 points**. Two points each for successful completion of Tasks 30 and 31.

Tips: Best practices for vehicle washing are described in Profile Sheet H-3 in the Center for Watershed Protection's *Manual 8* of their *Small Watershed Restoration Manual Series*. Operations at a site vary from season to season, so it may be a good idea to interview long-term workers to get a better idea of the range of operations during the course of a year. Then design effective pollution prevention practices. Best practices for managing road salt piles can be found online at
http://cfpub1.epa.gov/NPDES/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=106 .

5-D.5.11. Benchmark 11: Keep Rain and Runoff Away from Vehicle Repairs

What to look for: Investigate all indoor and outdoor areas where vehicles and equipment are maintained or repaired to ensure that fluids and wash-water cannot enter the storm drainage system. Check to make sure that used batteries, vehicle fluids, solvents and tires are recycled properly and stored in a manner that prevents their exposure to rainfall. Ideally, shop drains should be connected to the sanitary sewer system, not the storm drainage system.

Figure 5-D.12. Indoor Truck Maintenance Area (with Proper Storage for Used Fluids, Rags, Solvents and Other Materials)

Tasks. Three specific tasks must be completed to meet this benchmark:

32. Do not allow or provide for outdoor vehicle maintenance or repairs.
33. Ensure that indoor shop drains are connected to the sanitary sewer system, ***not*** the storm drain system.
34. Properly store and recycle all used materials (e.g., oil, solvents, batteries, hydraulic fluids, etc.) so they are not exposed to rainfall or runoff.

Scoring: A **total of 4 points**. Two points for Task 32 and one each for Tasks 33 and 34.

Tips: Best practices for vehicle maintenance are described in Profile Sheet H-1 in the Center for Watershed Protection's *Manual 8* of their *Small Watershed Restoration Manual Series*. Interview a few long-term workers to find out it, when and where any outdoor repairs are made at the site. Also, look for where used fluids, batteries, tires and other waste products are stored. Both activities should be inside, or be designed in such a manner that they are fully covered and disconnected from the storm drainage system.

5-D.5.12. Benchmark 12: Evaluate Spill Control and Response Procedures

What to look for: Walk around the facility to identify the specific areas with the greatest risk of spills or leaks. Then create an unannounced "training drill" (using water and green dye) to critically analyze how quickly and effectively employees respond to finding and fixing the spill. Even small spills of oil, diesel fuel, paint, solvents or other fluids can have a dramatic impact on local streams. Although most facilities have some type of spill response plan, many employees may not be aware of it or know who to contact to make sure a spill is rapidly cleaned up and reported to the appropriate authority.

Figure 5-D.13. A Spill that Got Away

Tasks. Three specific tasks must be completed to meet this benchmark:

35. Make sure dry spill kits are readily available at all high risk areas; train key employees how to use these kits and assign them responsibility for spill cleanups.
36. Update emergency contact numbers and procedures and distribute these to employees.
37. Achieve a rapid and effective response to routinely scheduled training drills.

Scoring: A **total of 5 points**. Two points for each of Tasks 35 and 37, and one point for Task 36.

Tips: Best practices for spill prevention and response are described in Profile Sheet H-7 in the Center for Watershed Protection's *Manual 8* of their *Small Watershed Restoration Manual Series*. One facility created a simple business card for employees to carry in their wallets so they would know the correct internal and external people to notify and quickly understand the company's spill response procedures.

5-D.5.13. Benchmark 13: Prevent Runoff from Materials Stored Outside

What to look for: Walk the outside of the facility to look for any materials that are temporarily or permanently stored outside that could come into contact with rainfall or runoff. Keep in mind that items stored outdoors may change seasonally or even day-to-day, so it is useful to do this scan periodically. Simple best practices can prevent materials stored outside from becoming a stormwater runoff problem.

Figure 5-D.14. Exposed Pile of Mulch (Subject to Rainfall-Runoff)

Figure 5-D.15. Leaking Drums of Restaurant Cooking Grease

Tasks. Three specific tasks must be completed to meet this benchmark:

38. Make sure outdoor materials are placed on pallets to stay above runoff.
39. Make sure outdoor storage areas are covered or have secondary containment measures in place.
40. Make sure outdoor storage areas are located in a manner to prevent or minimize the opportunity for waste to enter a storm drain (as confirmed by a lack of stain or streak lines).

Scoring: A **total of 4 points**. One point for each of Tasks 38 and 39, and two points for Task 40.

Tips: Best practices for outdoor materials storage are described in Profile Sheet H-6 in the Center for Watershed Protection's *Manual 8* of their *Small Watershed Restoration Manual Series*. Key practices include: (a) temporary or permanent covers; (b) storing material on pallets or raised surfaces; (c) providing secondary containment to capture any fluids or particulate matter before they reach a storm drain; and (d) changing the location of material storage areas to maximize the distance to a storm drain.

5-D.5.14. Benchmark 14: Prevent Dumpster and Compacter "Juice"

What to look for: Walk the site to locate any outdoor dumpsters, compactors or solid waste receptacles to ensure that overflowing wastes or leaking "dumpster juice" cannot reach the storm drainage system. Dumpsters can be problematic if they handle fluids or are exposed to rainfall. Compactors that compress materials with fluids can cause chronic water quality problems when located close to storm drain inlets.

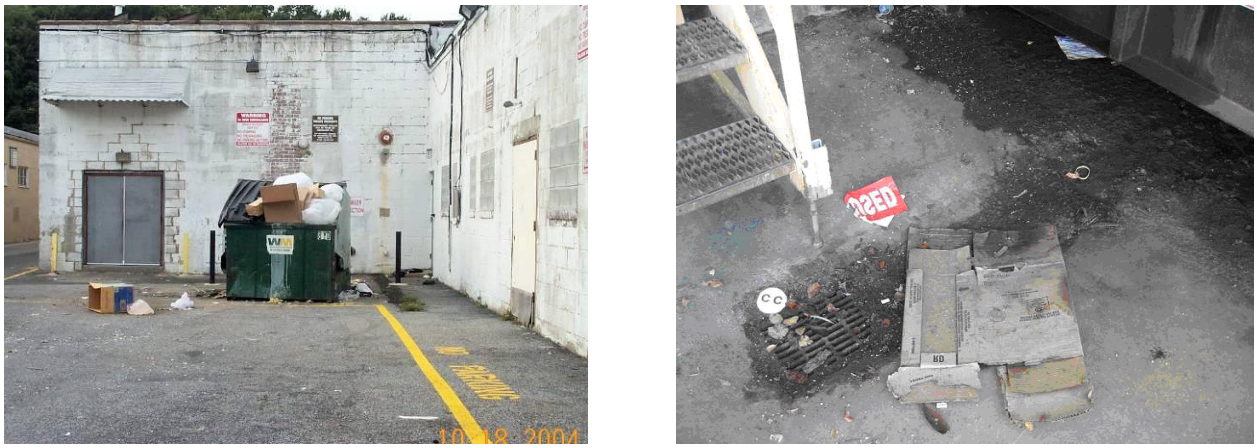

Figure 5-D.16. Dumpster Waste and Trash Compactor "Juice"

Tasks. Two specific tasks must be completed to meet this benchmark:

41. Make sure dumpsters and compactors are covered, have lids, are in good condition, and are water-tight.
42. Make sure dumpsters are located in areas that are disconnected from the storm drainage system.

Scoring: A **total of 4 points**. Two points each for successful completion of Tasks 41 and 42.

Tips: Best practices for dumpster management are described in Profile Sheet H-8 in the Center for Watershed Protection's *Manual 8* of their *Small Watershed Restoration Manual Series*. Work with your solid waste contractor to make sure dumpsters are water-tight, frequently emptied, and located well away from storm drain inlets.

5-D.5.15. Benchmark 15: Improved Turf Management and Turf Conversion

What to look for: Evaluate every area of turf and landscaping within the boundary of the facility to identify opportunities to convert existing turf cover into native forest or meadow, or modify turf so that it more effectively filters and treats stormwater runoff from adjacent impervious areas.

Figure 5-D.17. Turf Can Generate High Runoff Rates of Nutrients and Pesticides to Streams

Figure 5-D.18. Turf Areas Can Be Converted to Native Forest, Meadow, or Filter Infiltration Type Stormwater BMPs

Tasks. Two specific tasks must be completed to meet this benchmark:

43. Evaluate all turf areas present at the site to identify alternatives to turf cover or to enhance its ability to filter and infiltrate runoff.
44. Implement reduced mowing, soil restoration, reforestation, filter strips, or rain gardens on existing turf cover.

Scoring: A **total of 10 points**. Three points are awarded for the initial turf cover evaluation (Task 43), and then one point is awarded for each 5% increment of existing turf cover converted at the site (Task 44, up to a maximum of seven total points for conversion).

Tips: The *Urban Watershed Forestry Manual Series*, produced by the Center for Watershed Protection, can be accessed online at http://www.cwp.org . BMP Design Specifications for soil restoration, filter strips, bioretention and rain gardens can found at the Virginia Stormwater BMP Clearinghouse website at http://www.vwrrc.vt.edu/swc/NonProprietaryBMPs.html .

5-D.5.16. Benchmark 16: Investigate the Feasibility of Parking Lot BMP Retrofits

What to look for: Walk around your parking lot to determine where stormwater flows to identify possible locations to treat runoff from all or part of the lot. Open areas in close proximity to the lot and comprise 3% to 5% of the parking lot area are excellent locations for BMP retrofits. If such areas exist, retain an engineering consultant to assess the feasibility and cost of designing and building them.

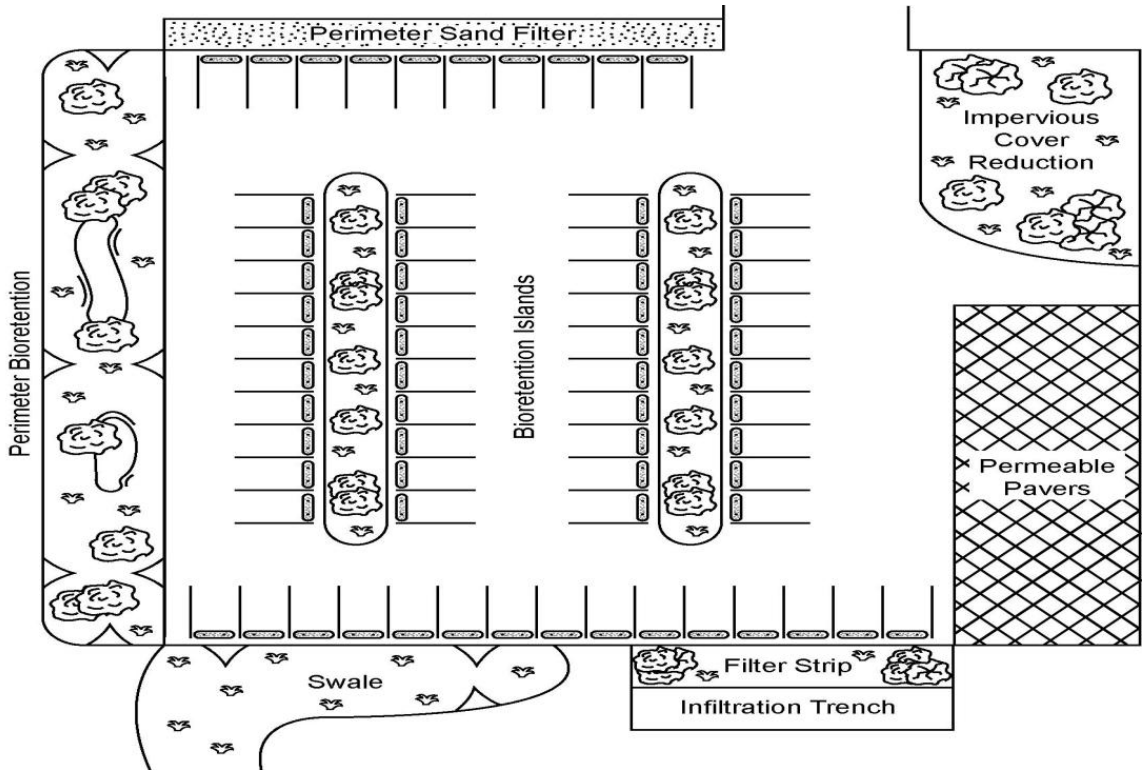

Figure 5-D.19. Different BMP Retrofit Options Available to Treat Parking Lot Runoff

Tasks. Two specific tasks must be completed to meet this benchmark:

45. Identify potential candidate BMP retrofits to treat parking lot runoff.
46. Retain an engineering consultant to assess their feasibility and cost.

Scoring: A **total of 5 points**. Two points Tasks 45 and three points for Task 46.

Tips: The tips and tricks for retrofitting large and small parking lots are described in Profile Sheets SR-6 and OS-7 in the Center for Watershed Protection's *Manual 3* of their *Small Watershed Restoration Manual Series*. There may be several small drainage areas within each parking lot that discharge to different points. It is often quite easy to integrate retrofits into landscaping setbacks or unoccupied turf areas found at these discharge locations.

5-D.5.17. Benchmark 17: Adopt "Green" Landscaping Practices

What to look for: Inspect all remaining turf and landscaping areas present at the site and work with landscaping contractors to reduce fertilization, pesticide application and irrigation and apply best practices to keep clippings and leaves out of the storm drain system.

Figure 5-D.20. The Clean Fence Line and Dead Vegetation Are Signs that Herbicides Have Been Applied

Figure 5-D.21. Lawn Clippings Left Along the Curb Can Be Washed Into the Storm Drain

Tasks. Three specific tasks must be completed to meet this benchmark:

47. Review and modify all landscaping contracts to minimize fertilizer and chemical use (or train employees if they perform this function), consistent with guidelines in the *Virginia Urban Nutrient Management Handbook* (DCR et al., 2011) or hire a lawn management contractor who is certified by the Virginia DCR as a Nutrient Management Planner in the Turf and Landscape category.
48. Use native species in all landscaping areas present at the site.
49. Avoid using herbicides along fence lines; use mechanical trimmers instead.

Scoring: A **total of 5 points**. Two points for successful completion of Tasks 47 and 48, and one point for completing Task 49.

Tips: Several useful best practices for better turf management and landscaping can be found in Profile Sheets H-12 and H-13 in the Center for Watershed Protection's *Manual 8* of their *Small Watershed Restoration Manual Series*. These profile sheets can be attached to landscaping contracts or provided to landscaping and grounds maintenance crews. *The Virginia Urban Nutrient Management Handbook* can be accessed online at http://www.ext.vt.edu and entering Publication number 430-350. Access information about the Virginia DCR's nutrient management certification program and water-friendly lawn management practices at http://www.dcr.virginia.gov/stormwater_management/nutmgt.shtml .The landscaping at your facility should reflect the native plant species found in your region of Virginia. Several excellent guides can be found online at http://www.acb-online.org/project.cfm?vid=85 ,or http://www.nps.gov/plants/pubs/Chesapeake/toc.htm .

5-D.5.18. Benchmark 18: Check for Illicit Dry Weather Flows at Storm Drain Outlets

What to look for: Follow your storm drain pipe(s) until they discharge into a ditch or stream channel, and check for the presence of dry weather polluted flows (or past evidence that they have occurred). Then do the necessary detective work to stop them. Even small-diameter storm drain pipes can be a source of episodic or transitory illicit discharges of pollutants. Keep in mind that sloped vegetated areas may discharge groundwater to the surface for a while (sometimes days) due to saturated soils following a rainstorm, so ideally these investigations should be conducted during the periods of the year in order to increase the chance of identifying illicit discharges.

Figure 5-D.22. Suspicious Flow from Storm Drain Pipe Outlet

Figure 5-D.23. Sample of Illicit Discharge From a Storm Drainage Pipe Outlet

Tasks. Two specific tasks must be completed to meet this benchmark:

50. Check for dry weather flows at storm drain outfalls at least four times a year.
51. If flows exist, perform an Outfall Reconnaissance Investigation (ORI) at all stormwater outfalls to find and fix the problem.

Scoring: A **total of 3 points**. One point for successful completion of Tasks 50, and two points for completing Task 51. If no dry weather flows are detected over the course of a year, award yourself the two points for Task 51.

Tips: Some simple detective methods to evaluate dry weather flows can be found in the *Outfall Reconnaissance Investigation and Field Sheet*, Chapter 11, of the Center for Watershed Protection's *Illicit Discharge Detection and Elimination Manual*, available online at: http://www.cwp.org .In many cases, the flows from large diameter storm drain pipes are derived from high ground water, so the flows are relatively clean. More detailed investigations should be triggered if the team notices suds, stains, odors, or turbid or discolored waters.

5-D.5.19. Benchmark 19: Regularly Maintain Your Stormwater Infrastructure

What to look for: Inspect all storm drain inlets, sumps and stormwater BMPs present at your facility for excessive sediment accumulation, and clean them out on a regular basis to keep sediment and other pollutants from reaching local streams, rivers, and the Bay.

Figure 5-D.24. Catch Basin Cleanout

Figure 5-D.25. Storm Drain Inlet Inspection

Tasks. Two specific tasks must be completed to meet this benchmark:

52. Perform an annual maintenance inspection of your stormwater infrastructure.
53. Clean out storm drain inlets (and any stormwater management practices) at least once a year.

Scoring: A **total of 5 points**. Two points for successful completion of Tasks 52, and three points for completing Task 53.

Tips: If your facility was built within the last two decades, there is a strong probability that there is some kind of stormwater BMP present at your site, usually a detention (dry) or retention (wet) pond. If one of these is present, you may want to consult the *Pond and Wetland Maintenance Guidebook* available at the Center for Watershed Protection's website (http://www.cwp.org) to assess the pond's maintenance condition and determine which specific maintenance tasks are needed. Sediments that accumulate in storm drain inlets and catch basins can be removed manually or by using a vactor truck. Make sure to properly dispose of these polluted sediments in a landfill or other approved facility.

5-D.5.20. Benchmark 20: Natural Area Conservation and Restoration

What to look for: Many facilities contain small fragments of forest, wetlands, floodplains, steep slopes or buffer areas that have been reserved for environmental protection. Over time, the habitat quality of these natural areas may become degraded by illegal dumping, invasive plant species, encroachment and clearing, disease, or poor soils. The facility team should walk through natural areas to assess their condition and diversity, and identify conservation and restoration practices that can improve their function and diversity.

Figure 5-D.26. A Typical Small Natural Area Remnant at An Industrial Site

Tasks. Two specific tasks must be completed to meet this benchmark:

54. Inventory the condition of any natural areas present at the site (e.g., forests, wetlands, meadows, buffer areas, etc.).
55. Implement conservation and restoration practices to improve the function and diversity of the natural areas.

Scoring: A **total of 5 points**. Two points for successful completion of the inventory (Task 54), and three points for implementation of the conservation practices (Task 55). If no natural areas are present at the site, then award yourself all five points.

Tips: Several resources can be consulted for the habitat assessment, including articles in the *Wetlands and Watershed Series* and the *Urban Watershed Forestry Manuals*, both of which can be accessed at the Center for Watershed Protection's website (http://www.cwp.org). For guides about how to identify and manage invasive plant species, consult the following websites: http://www.fws.gov/chesapeakebay/bayscapes/bsresources/bs-invasives.htm or http://www.plant-materials.nrcs.usda.gov/technical/invasive.html .

5-D.5.21. Benchmark 21: Become a Local Watershed Partner

What to look for: Meet with a local or regional watershed group (identified in Benchmark 1) to find ways to strengthen their efforts through volunteer work, product donations, board service or other cooperative measures. Hundreds of watershed groups exist in the Chesapeake Bay watershed, and it is very likely that at least one is located near your facility. These groups are your local connection to the local stream, river basin, or the Bay. They are an important source of watershed education, information and stewardship. Many of them exist on a shoestring budget, but are deserving of your support. After you have identified your local watershed organizations, you can gradually develop a strong mutually supportive relationship. Keep in mind that environmental stewardship also provides strong marketing opportunities in modern American culture.

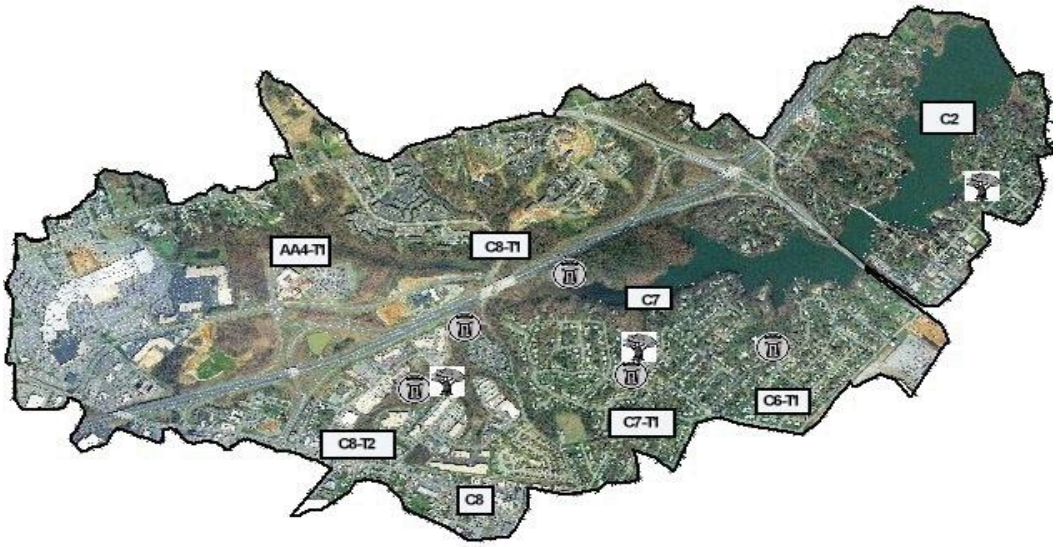

Figure 5-D.27. Partnering Watershed Organizations with Facilities Needing Help

Tasks. Two specific tasks must be completed to meet this benchmark:

56. Meet at least once with an appropriate local or regional watershed group.
57. Provide tangible evidence of your support to the group in the first year of association with them.

Scoring: A **total of 4 points**. Two points each for successful completion of Tasks 56 and 57.

Tips: What is tangible support? It can be as simple as attending a few board meetings, serving on a board of directors, becoming a corporate sponsor, encouraging your employees to make tax deductible donations, or donating surplus office equipment. One Coca-Cola bottler in Baltimore stored plastic syrup barrels in an old truck and made them available for free to local watershed groups to help make rain barrels. To find out which watershed organizations are active in your area, you can click on this directory of Bay region watershed groups:
http://www.chesapeakebay.net/findabaygroup.aspx?menuitem=14797 or find it using a map:
http://archive.chesapeakebay.net/georss/WatershedOrgsMap.kmz

5-D.5.22. Benchmark 22: Support a Local Stream Cleanup

What to look for: Take a walk down the closest thousand feet of stream to your facility (that has safe access from public property) to see if it needs a stream cleanup or adoption, in partnership with the local watershed group. Most watershed organizations offer a wide range of volunteer opportunities for your employees to have fun, make a difference, and demonstrate your commitment to community involvement and environmental stewardship.

Figure 5-D.28. A Stream Cleanup Martialing Area

Tasks. Two specific tasks must be completed to meet this benchmark:

58. Take a stream walk at the nearest accessible and safe stream segment downstream of your facility to better understand the waters to which your facility discharges stormwater runoff.
59. Participate in a stream cleanup or other watershed restoration activity conducted by a local or regional watershed organization.

Scoring: A **total of 4 points**. One point for successful completion of Task 58, and three points for completing Task 59.

Tips: The *Unified Stream Assessment (USA)* is an excellent tool to document urban stream problems and identify restoration opportunities. It is available online (http://www.cwp.org) as *Manual 10 of* the Center for Watershed Protection's *Small Watershed Restoration Manual Series*. Some helpful guidance on how to conduct a stream cleanup or adopt a stream can be found in Profile Sheets C-1 and C-2 of *Manual 4* in the *Small Watershed Restoration Manual Series*. Most watershed groups offer many different opportunities throughout the year for you and your employees to engage in a watershed restoration activity.

5-D.6.0. THE STORMWATER BENCHMARKING TOOL SCORE SHEET

This section provides a simple score sheet to keep track of your facility benchmarking activity.

STORMWATER BENCHMARKING TOOL SCORING SHEET FOR SURVEY			
Benchmark No.	**Description of Benchmark**	**Maximum Points**	**Points Awarded**
1. DEFINE YOUR WATERSHED ADDRESS			
1	Google Earth to find stream closest to facility	**1**	
2	Determine which major watershed stream drains to	**1**	
3	Identify the stream's major watershed group(s)	**1**	
4	Learn stream's key water quality and habitat issues	**1**	
	Subtotal	**4**	
2. DERIVE A STORMWATER PROFILE FOR THE SITE			
5	Analyze land cover on site plan	**1**	
6	Determine your annual rainfall	**1**	
7	Compute annual runoff from site	**1**	
8	Compute annual pollutant loads from site	**1**	
	Subtotal	**4**	
3. REVIEW PAST EMPLOYEE TRAINING			
9	Involve key employees to discuss benchmarks	**1**	
10	Customize stormwater training for the site	**1**	
11	Post Benchmark scores & train employees each year	**2**	
12	Give employees personal stewardship tips	**1**	
	Subtotal	**5**	
4. YOUR FACILITY'S STORMWATER POLLUTION PREVENTION PLAN			
13	Find and review existing SWPPP	**1**	
14	Designate lead staff responsible for it	**1**	
15	Full update of SWPPP and annual work plan	**3**	
	Subtotal	**5**	
5. UNDERSTAND THE STORMWATER PLUMBING AT YOUR SITE			
16	Walk the site to trace stormwater flows	**1**	
17	Identify water, wastewater, and stormwater lines	**1**	
18	Produce final site plan showing each	**1**	
19	Stencil or mark all storm drain inlets	**2**	
	Subtotal	**5**	

STORMWATER BENCHMARKING TOOL SCORING SHEET FOR SURVEY			
Benchmark No.	**Description of Benchmark**	**Maximum Points**	**Points Awarded**
6. REDUCE RUNOFF FROM THE ROOF			
20	Check for downspout disconnection potential	**1**	
21	Evaluate feasibility of rain tank or rainwater reuse	**2**	
22	Retain consultant to design system	**2**	
	Subtotal	**5**	
7. INVESTIGATE LOADING AND UNLOADING AREAS			
23	Keep loading areas clean by sweeping	**2**	
24	Cover loading docks or redesign drainage	**2**	
	Subtotal	**4**	
8. PREVENT POLLUTION FROM PARKING LOTS			
25	Walk areas monthly to find and mitigate fluid leaks	**2**	
26	Weekly trash/litter pickup, monthly vac/sweeping	**3**	
	Subtotal	**5**	
9. PREVENT SPILLS FROM FUELING AREAS			
27	Cover fueling islands	**1**	
28	Install dry spill response kits conveniently	**1**	
29	Redesign flows to prevent storm drain entry	**2**	
	Subtotal	**4**	
10. DEAL WITH SEASONAL OPERATIONS AND OUTDOOR WASH-WATER			
30	Assess seasonal operations (e.g., salting, etc.)	**2**	
31	Keep outdoor wash-water out of storm drains	**2**	
	Subtotal	**4**	
11. KEEP RAIN AND RUNOFF AWAY FROM VEHICLE REPAIRS			
32	No outdoor vehicle repairs	**2**	
33	Make sure indoor shop drains go to sanitary sewer	**1**	
34	Indoor storage of used fluids/batteries, etc.	**1**	
	Subtotal	**4**	
12. EVALUATE SPILL CONTROL AND RESPONSE			
35	Provide spill kits at high risk areas of site	**2**	
36	Update emergency contact numbers	**1**	
37	Adequate response during spill training drill	**2**	
	Subtotal	**5**	

STORMWATER BENCHMARKING TOOL SCORING SHEET FOR SURVEY			
Benchmark No.	**Description of Benchmark**	**Maximum Points**	**Points Awarded**
13. PREVENT RUNOFF FROM MATERIALS STORED OUTSIDE			
38	Place materials on pallets or raised surfaces	**1**	
39	Temporary covers or secondary containment	**1**	
40	No streak or stain lines on path to storm drain	**2**	
	Subtotal	**4**	
14. EXTERIOR DUMPSTER MANAGEMENT			
41	Dumpsters covered, have lids or are water-tight	**2**	
42	Dumpsters disconnected from storm drains	**2**	
	Subtotal	**4**	
15. TURF MANAGEMENT			
43	Evaluate all turf areas at site for alternative mgmt.	**3**	
44	Implement reduced mowing, soil restoration, reforestation, filter strips or rain gardens on existing turf areas (1 point per 5% of turf area)	**7**	
	Subtotal	**10**	
16. PARKING LOT BMP RETROFITS			
45	Identify candidate retrofit projects at parking lot(s)	**2**	
46	Retain engineer to investigate feasibility	**3**	
	Subtotal	**5**	
17. ADOPT "GREEN" LANDSCAPING PRACTICES			
47	Modify contracts to reduce chemical inputs	**2**	
48	Use native species in landscaping areas	**2**	
49	Avoid use of herbicides along fence lines	**1**	
	Subtotal	**5**	
18. CHECK FOR DRY WEATHER FLOWS AT STORM DRAIN OUTFALLS			
50	Check for illicit dry weather flow in storm drains	**1**	
51	If flows exist, perform outfall investigation to correct	**2**	
	Subtotal	**3**	
19. REGULARLY MAINTAIN YOUR STORMWATER INFRASTRUCTURE			
52	Perform semi-annual maintenance inspections	**2**	
53	Clean out storm drain inlets & catch basins annually	**3**	
	Subtotal	**5**	

STORMWATER BENCHMARKING TOOL SCORING SHEET FOR SURVEY			
Benchmark No.	**Description of Benchmark**	**Maximum Points**	**Points Awarded**
20. NATURAL AREA CONSERVATION			
54	Assess condition of existing forests/wetlands on site	**2**	
55	Implement conservation/restoration practices	**3**	
	Subtotal	**5**	
21. BECOME A LOCAL WATERSHED PARTNER			
56	Join a local watershed group	**2**	
57	Provide tangible evidence of support for the group	**2**	
	Subtotal	**4**	
22. ORGANIZE OR PARTICIPATE IN A LOCAL STREAM CLEANUP			
58		**1**	
59		**3**	
	Subtotal	**4**	
	GRAND TOTAL	**100**	

SCORING NOTES:

5-D.7.0. HANDY INTERNET LINKS TO FIND YOUR WATERSHED ADDRESS AND LEARN MORE ABOUT WATERSHEDS AND STORMWATER POLLUTION PREVENTION

5-D.7.1. Find Your Watershed Address

The U.S. EPA has two handy websites to help you find your watershed address by simply entering the zip code of your facility:

http://cfpub.epa.gov/surf/locate/index.cfm

http://www.ctic.purdue.edu/KYW/glossary/whatiswsaddress.html

5-D.7.2. Learn More About Watersheds

To find out which watershed organizations are active in your area, you can click on this directory of Chesapeake Bay region watershed groups:

http://www.chesapeakebay.net/findabaygroup.aspx?menuitem=14797

or find organizations by zooming into a Chesapeake Bay Map as found at:

http://archive.chesapeakebay.net/georss/WatershedOrgsMap.kmz

Several websites provide excellent information about watersheds including:

BAY PROGRAM: http://www.chesapeakebay.net/index.aspx?menuitem=13853
USEPA: http://www.epa.gov/owow/watershed/
CWP: http://www.cwp.org
RN: http://www.rivernetwork.org

5-D.7.3. Pollution Prevention Resources

- Urban Subwatershed Restoration Manual 11: *Unified Subwatershed and Site Reconnaissance: A User's Manual* (Center for Watershed Protection, 2005) http://www.cwp.org/Store/usrm.htm

- Urban Subwatershed Restoration Manual 10: *Unified Stream Assessment: A User's Manual* (Center for Watershed Protection, 2005) http://www.cwp.org/Store/usrm.htm

- Urban Subwatershed Restoration Manual 9: *Municipal Pollution Prevention/Good Housekeeping Practices* (Center for Watershed Protection, 2008) http://www.cwp.org/Store/usrm.htm

- Stormwater Phase II Final Rule Fact Sheet 2.8: *Pollution Prevention/Good Housekeeping* (US EPA, 2005)
  http://www.epa.gov/npdes/pubs/fact2-8.pdf

- Stormwater Fact Sheet No. 5: *Municipal Pollution Prevention Planning* (Land of Sky Regional Council (NC), 1994)
  http://h2o.enr.state.nc.us/su/PDF_Files/Land_of_Sky_factsheets/FactSheet_5.pdf

- Model Urban Runoff Program: *A How-To Guide for Developing Urban Runoff Programs for Small Municipalities* (California Coastal Commission, 2002)
  http://www.coastal.ca.gov/la/murp.html

Source Control Practices General Resources

- National Menu of Stormwater Best Management Practices: *Pollution Prevention/Good Housekeeping* (US EPA, 2007)
  http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

- Urban Subwatershed Restoration Manual 8: *Pollution Source Control Practices* (Center for Watershed Protection, 2005)
  http://www.cwp.org/Store/usrm.htm#8

- *California Stormwater Best Management Practice Handbook: Municipal* (California Stormwater Quality Association, 2003)
  http://www.cabmphandbooks.org/municipal.asp

- *Stormwater Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices* (US EPA, 1992)
  http://cfpub1.epa.gov/npdes/docs.cfm?document_type_id=1&view=Policy%20and%20Guidance%20Documents&program_id=6&sort=name

- King County (WA) Stormwater Pollution Prevention Manual (King County (WA) Department of Natural Resources and Parks, 2005)
  http://www.kingcounty.gov/environment/waterandland/stormwater/documents/pollution-prevention-manual.aspx

Vehicle Operations

- Auto Repair and Fleet Maintenance Pollution Prevention Website (US EPA Region 9, 2007)
  http://www.epa.gov/region09/waste/p2/autofleet/

- *Vehicle and Equipment Wash Water Discharges Best Management Practices Manual* (Washington State Department of Ecology, 2007)
  http://www.ecy.wa.gov/pubs/95056.pdf

Outdoor Materials

- Stormwater Management Fact Sheet: *Spill Prevention Planning* (US EPA, 1999) www.epa.gov/owm/mtb/spillprv.pdf

- Community Partners for Clean Streams Fact Sheet 1: *Housekeeping Practices* (Washtenaw County (MI), 1996) http://www.ewashtenaw.org/content/dc_drnbmp1.pdf

Turf/Landscaping Areas

- Integrated Pest Management Manual (US Department of the Interior National Park Service, 2003) http://www.nature.nps.gov/biology/ipm/manual/ipmmanual.cfm

- Best Management Practice Fact Sheet: Landscape and Grounds Maintenance (Alameda County (CA) Clean Water Program, 1998) http://www.cleanwaterprogram.org/land_ground_main.pdf

5-D.8.0. ESTIMATING THE ANNUAL POLLUTANT LOAD FOR A FACILITY USING THE SIMPLE METHOD

The Simple Method estimates the annual pollutant load exported in stormwater runoff from small urban catchments (Schueler, 1987). The Simple Method sacrifices some precision for the sake of simplicity and ease of use, but is a reasonably accurate way to predict annual pollutant loads. The annual pollutant load exported in pounds per year from the contributing drainage area of a plant can be determined by solving the Pollutant Export Equation (each of the terms in the equation can be extracted from data contained in a facility plan).

$$L = [(P)(Pj)(Rv) \div 12] \times [(C)(A)(2.72)]$$

Where:

L = Average annual pollutant load (pounds)
P = Average annual rainfall depth (inches)
Pj = Fraction of minor rainfall events that produces runoff
Rv = Runoff coefficient, which expresses the fraction of rainfall converted to runoff
C = Event mean concentration of the pollutant in urban runoff (mg/l)

Depth of Rainfall (*P*)

P represents the depth of precipitation that falls on the contributing drainage area of the retrofit site during the course of a normal year. Annual rainfall data for select U.S. cities can be obtained from "official" local rainfall gages (usually located at an airport or a NOAA-National Weather Service office) with reliable, long-term (> 20 years) records. Another reliable source of rainfall data is the NOAA Atlas 14 website (http://hdsc.nws.noaa.gov/hdsc/pfds/orb/va_pfds.html), although this data is not as locally-specific and precise as a local rain gage. For most of Virginia, an annual value of 45 inches can be used.

Adjustment for Minor Storms (*Pj*)

Some of the storms that occur during a given year are so minor that they generate no stormwater runoff. The rainfall from these small storms is stored in surface depressions and either evaporates into the air or infiltrates into the ground. To account for these storms, the correction factor (***Pj***) is used. The design team can analyze local rainfall-runoff patterns to determine the value of *Pj* or simply use prior analyses from the Washington DC area, which indicate *Pj* is approximately 10% of the annual rainfall depth (Schueler, 1987). The default value for *Pj* should be 0.9 unless local rainfall-runoff analyses result in a different number.

The Runoff Coefficient (*Rv*)

The runoff coefficient (***Rv***) is a useful measure of a development site's response to rainfall events. In theory, it is calculated using the following equation:

$$Rv = 0.05 + 0.009(I)$$

Where:

I = The amount of impervious cover on the site, expressed as a percentage of the total site area. ***I*** should be expressed as a whole number within the equation (i.e., a site that is 75% impervious would use ***I*** = 75 when calculating the ***Rv***)

The designer is trying to solve the equation for *R* and does not know the value of *Rv*. A study of rainfall/runoff relationships for many small watersheds across the U.S. showed that *Rv* has a distinctly linear relationship with impervious cover (Schueler, 1987). The runoff coefficient increases in direct proportion to the percent impervious cover (*I*) present in a catchment. The resulting equation (above) can be used to estimate *Rv* for the contributing drainage area (CDA) of the facility.

Contributing Drainage Area (*A*)

The contributing drainage area (*A*, in acres) can be directly obtained from the drainage area provided in the facility site plan.

Event Mean Pollutant Concentration (*C*)

The last input datum needed is the event mean concentration (EMC) for five different pollutants. Designers can consult national stormwater quality monitoring databases that define event mean concentration statistics derived from a large population of runoff monitoring samples. The National Stormwater Quality Database (NSQD) is an extremely helpful tool to define expected EMCs for a wide range of different stormwater pollutants (Pitt *et al.*, 2004). **Table 5-D.2** below summarizes EMCs for five common pollutants as measured for industrial land uses in the NSQD.

Table 5-D.2. National Averages of Pollutant Event Mean Concentrations for Industrial Land Uses

POLLUTANT	CONCENTRATION (mg/l)
Total Suspended Solids (TSS)	81.0
Total Phosphorus (TP)	0.26
Total Nitrogen (TN)	2.09
Oil and Grease	4.0
Zinc (Zn)	0.20

5-D.9.0. ESTIMATING THE ANNUAL RUNOFF VOLUME FOR A FACILITY USING THE SIMPLE METHOD

Many of the same parameters can be used to determine the annual runoff volume generated by your facility. The annual volume of stormwater runoff per acre of impervious cover at your facility is calculated by the following equation:

$$ARI = [(P)(Pj)(Rv) \div (12)]$$

Where:

ARI = annual runoff volume in acre-feet produced from one acre of impervious cover (i.e., one foot of water depth over an acre)

P, ***Pj*** and ***Rv*** = as previously defined.

The total annual stormwater runoff volume produced by your facility can be quickly computed as:

$$TAR = (ARI)\ (IA)$$

Where:

TAR = total annual runoff volume (in acre feet) produced by the entire facility

ARI = annual runoff volume per impervious acre (from equation above)

IA = number of impervious acres at your facility

The final *TAR* number you calculate will be a big number, but it is hard for most people to comprehend. So the next step is to convert it to gallons of runoff.

$$Gallons = (TAR)(3.259 \times 10^5)$$

It will be useful to translate this into terms a facility's employees can relate to. For example, at a bottling facility, the standard unit of production is a case of soda, which comprises about 2.25 gallons per case. Over a course of a year a bottling facility might ship 12 million cases of soda, and also generate 12 million "cases" of stormwater runoff. As another example, a Bay port facility measures its production in the number of standard forty-foot shipping containers it moves each year. Assuming about 18,500 gallons per container, a single impervious acre of port facility in the Chesapeake Bay watershed produces the equivalent of more than 50 shipping containers of runoff each year. By converting annual runoff into gallons and then comparing it to a common measure of site capacity, it is possible to educate employees about the scope of their runoff problems.

5-D.9.0. REFERENCES

Center for Watershed Protection (CWP). 2005. *Unified Subwatershed and Site Reconnaissance: A User's Manual*. *Urban Subwatershed Restoration Manual 11*. Ellicott City, MD.

Center for Watershed Protection (CWP). 2006. *Pollution Source Control Practices. Urban Subwatershed Restoration Manual 8*. Center for Watershed Protection. Ellicott City, MD

Center for Watershed Protection (CWP). 2009. *Municipal Pollution Prevention/Good Housekeeping Practices. Urban Subwatershed Restoration Manual 9*. Center for Watershed Protection. Ellicott City, MD

National Research Council (NRC). 2008. *Urban Stormwater Management in the United States*. National Academies Press. Washington, DC.

Schueler, T. 1987. *Controlling urban runoff: A Practical Manual for Planning and Designing Urban Best Management Practices*. Metropolitan Washington Council of Governments. Washington, DC.

U.S. Department of Defense (DOD). 2009. *Stormwater Management at Federal Facilities and Federal Lands in the Chesapeake Bay Watershed*. A report prepared to fulfill Section 202-c of Executive Order 13508. U.S. Environmental Protection Agency. Annapolis, MD

U.S. Environmental Protection Agency (EPA). 2009. *Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act*. EPA-841-B-09-001. Office of Water. Washington, DC.

Virginia Cooperative Extension (VCE), Virginia Tech (VT), Virginia State University (VSU) and the Virginia Department of Conservation and Recreation (DCR). 2011. *Urban Nutrient Management Handbook*. Extension Publication No. 430-350. Blacksburg, VA. Available online at http://www.ext.vt.edu .