

Washington State Department of Ecology

Standard Operating Procedure for Collection of Stormwater Sediments Using In-Line Sediment Traps

Version 1.0

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APPROVED

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*Please note that the Washington State Department of Ecology's Standard Operating Procedures (SOPs) are adapted from published methods, or developed by in-house technical and administrative experts. Their primary purpose is for internal Ecology use, although sampling and administrative SOPs may have a wider utility. Our SOPs do not supplant official published methods. Distribution of these SOPs does not constitute an endorsement of a particular procedure or method.*

*Any reference to specific equipment, manufacturer, or supplies is for descriptive purposes only and does not constitute an endorsement of a particular product or service by the author or by the Department of Ecology.*

*Although Ecology follows the SOP in most instances, there may be instances in which Ecology uses an alternative methodology, procedure, or process.*



Standard Operating Procedure for Collection of Stormwater Sediments Using In-Line Sediment Traps

**1.0 Purpose and Scope**

- 1.1 This document delineates the Department of Ecology's Standard Operating Procedure (SOP) for field procedures to passively collect suspended particulate matter from stormwater runoff in storm drains using in-line sediment traps. These traps are deployed over periods of time (up to 6 months) with regular site visits and basic maintenance to collect suspended particulate matter. Quantity collected can range from 50 to several hundred grams (dry weight) for laboratory analysis (Ecology, 1996).
- 1.2 Volume obtained can be dependent upon site conditions and the contributing drainage area.
- 1.3 Use of this SOP ensures that sediment traps are installed in a consistent manner and are representative of the matrix being sampled, and that the data will be comparable to data collected by other existing and future monitoring programs. Laboratory data generated from the analysis of these particulates can NOT be used to determine sediment loadings due to inherent design bias of the sediment trap.

**2.0 Applicability**

- 2.1 Suspended particulate matter in stormwater runoff is transported through natural channels, ditches, culverts and engineered pipe and treatment systems. Each monitored pipe discharge system will have its own individual characteristics that require a specific configuration of equipment and installation that best enables the collection of representative samples.
- 2.2 A successful location for sediment traps features stable construction and the ability to install a sediment trap (Ecology, 1996).
- 2.3 These traps are designed to passively capture suspended particulate matter from stormwater in high energy storm drains for characterization and source control purposes.
- 2.4 These traps are not designed to capture bed load material.
- 2.5 These traps are designed to be mounted inside a stormwater conveyance system/stormwater pipe.

- 2.6 These traps should be located in pipe diameters of 24” in diameter or greater because a large storm event is generally needed to inundate the 8” tall sample bottle (Seattle, 2008).
- 2.7 The sediment trap works best where velocity flows are greater than 5 feet per second through a pipe.
- 2.8 Flexibility of trap design is allowable, but may require adjusting sampling procedures described in this SOP.

### **3.0 Definitions**

- 3.1 **Base Flow:** Water flow that occurs consistently or intermittently within a stormwater conveyance systems during dry weather.
- 3.2 **Bed Load:** Small particles that are re-suspended during periods of elevated storm flows that produce suspended sediment load (USGS, 2003).
- 3.3 **Conveyance System:** A single pipe or series of pipes that convey stormwater as part of a municipal separate storm sewer drainage system (EPA, 2008).
- 3.4 **Dry Weather:** Less than or equal to 0.02” of rain in the previous 72 hours (NPDES Phase I, 2009).
- 3.5 **High Energy Flow:** Flow with a velocity of greater than 5 feet per second through a pipe.
- 3.6 **Mounting Ring:** A mechanical device used to hold sampling equipment inside a pipe which is pressed against the inside of the pipe for mounting of the sampling device.

### **4.0 Personnel Qualifications/Responsibilities**

- 4.1 Site training by qualified personnel is mandatory prior to trap installation/sediment sample retrieval.
- 4.2 If confined space entry is required for trap installation/checking traps/sample retrieval, personnel must have OSHA 8-Hour Confined Space Entry Certification.

### **5.0 Equipment, Reagents, and Supplies**

- 5.1 Sediment Trap Hardware
  - 5.1.1 Inline sediment traps generally consist of two components: a stainless steel mounting assembly (including a mounting base plate, sample bottle cylinder, collar and arm) and a narrow or wide mouth sample bottle (Seattle, 2008).

- 5.1.2 Stormwater solids are captured by the sediment trap through fluid exchange of particle-laden flow over the downstream edge of the sediment trap bottle, causing particles to settle out into the trap.
- 5.1.3 Traps can be mounted directly in stormwater pipes or other areas of the conveyance system positioned on the side of the drainage pathway to avoid interference with base flow.
- 5.1.4 If base flow is present in the pipe, the traps should be situated just above the base flow water level to ensure storm flows will inundate the traps. The idea is to position the trap for submergence of the trap during storm flows to settle sediments into the bottle.
- 5.1.5 These sediment traps (Figure 1 and Photo 1) were originally designed and used by the Washington State Department of Ecology (Wilson and Norton 1996, Barnard and Wilson 1995, Norton 1997) and have since been modified by both the City of Tacoma and City of Seattle.
  - 5.1.5.1 Seattle's modifications uses a wide mouth bottle and expand on Tacoma's changes to enable the sample bottle to be installed in a vertical position in most field conditions (i.e., maintenance holes, vaults, and pipes).
  - 5.1.5.2 Brackets are mounted onto the wall of the pipe (Photo 2), maintenance hole, or other structure using metal hit anchors.
  - 5.1.5.3 Extension plates can be used when the sediment trap bracket is mounted to a vertical wall and the bracket is submerged below the water level.

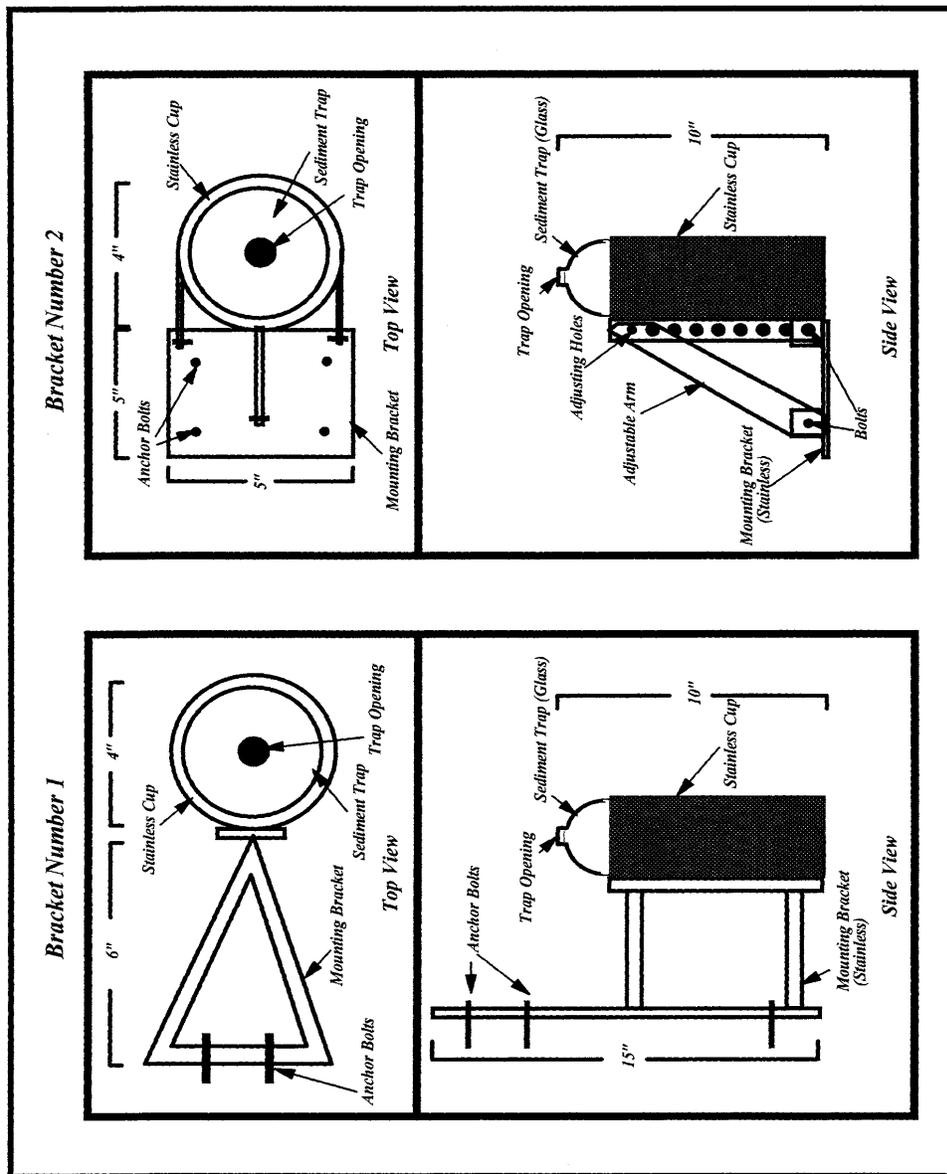


Figure 1 (Ecology, 1998)

Figure A7: Construction Details of Stormwater Sediment Trap.



Photo 1 and 2 (City of Tacoma)

- 5.2 Supplies for installation and sediment sample retrieval include but are not limited to:
- 5.2.1 Containers for sediment traps - laboratory cleaned (2 per mount for replacement of a cleaned bottle can occur while at the sampling location at the same time the sample is retrieved and transported to the laboratory for analysis). Teflon containers are recommended for sediment traps, but bottle type is dependent upon parameters to be analyzed.
  - 5.2.2 Hammer drill with 1/4" concrete drill bit.
  - 5.2.3 Stainless Steel metal hit anchors.
  - 5.2.4 Hammer.
  - 5.2.5 Latex gloves.
  - 5.2.6 Cooler with ice.
  - 5.2.7 Field notebook.
  - 5.2.8 Sample labels.
  - 5.2.9 Chain-of-custody forms.
  - 5.2.10 Personal Protective Equipment (PPE).
  - 5.2.11 Camera.
  - 5.2.12 Sample jars/containers with preservatives.
  - 5.2.13 Confined space entry equipment (if applicable). (Seattle, 2008)

## **6.0 Summary of Procedure**

### **6.1 Sediment Trap Site Selection**

6.1.1 Install sediment traps in appropriate drainage pipes once the drainage area(s) has been evaluated.

6.1.2 Note observations including nearby discharges to receiving water or other pipe connections in field books.

6.1.3 Locate sediment traps at key points throughout the entire stormwater collection system to identify sources of contaminants found in stormwater and/or stormwater outfalls representing the entire drainage area.

6.1.4 Specific monitoring locations will be based on Quality Assurance Project Plan (QAPP) or project goals and objectives.

6.1.5 Avoid locations with small diameter pipes (less than 24-inches) to avoid plugging the pipe and backing up water.

6.1.6 Where possible, mount more than one sediment trap at the sampling location. This typically provides more sediment volume for analysis. A typical mounting configuration is shown in Figure 2 below.

### **6.2 Sediment Trap Installation**

6.2.1 Personal protective equipment should be worn at all times during sediment trap installation.

6.2.2 Before installing the bracket, test fit the bracket at the intended location and adjust the angle of the bracket into the most vertical position. The angle of the bracket is adjustable in order to install the sediment trap in a vertical position (Figure 2, Seattle, 2008).

6.2.3 Mount the traps in the drainage system using a hammer drill equipped with a 1/4" concrete drill bit to drill the pilot holes for mounting the bracket. Traps can also be mounted within the stormwater pipe itself (Seattle, 2008).

6.2.4 Drill the pilot holes through the four mounting holes located on each corner of the bracket and insert stainless steel metal hit anchors through the bracket and into the pilot holes (Seattle, 2008).

6.2.5 Drive the pin of the metal hit anchors with a hammer to secure the bracket into place (Seattle, 2008).

- 6.2.7 In vaults or maintenance holes with base flow or standing water, an extension plate can be used to mount the bracket below the water level. If an extension plate is used, the bracket must be mounted to the extension plate using short 1/4" diameter bolts before mounting into place (Seattle, 2008).
- 6.2.8 For sampling locations that are equipped with sumps, mount the trap so the mouth of the sample bottle just above the base flow level or static water level in order to capture sediments in storm flows. For other locations, traps should be installed at the lowest point in the pipe, but not directly on the bottom of the pipe where interference could occur (Seattle, 2008).
- 6.2.9 Once the sediment traps are mounted and in place, insert the bottles into the mounting bracket and secure the bottles with sediment trap collar.
- 6.2.10 Tighten the trap assembly hardware.
- 6.2.11 Using clean gloves, remove the lids from sediment trap bottles.
- 6.2.12 Place the lids in aluminum foil and store in clean plastic, sealable bags for subsequent field checks and sediment trap bottle removal.

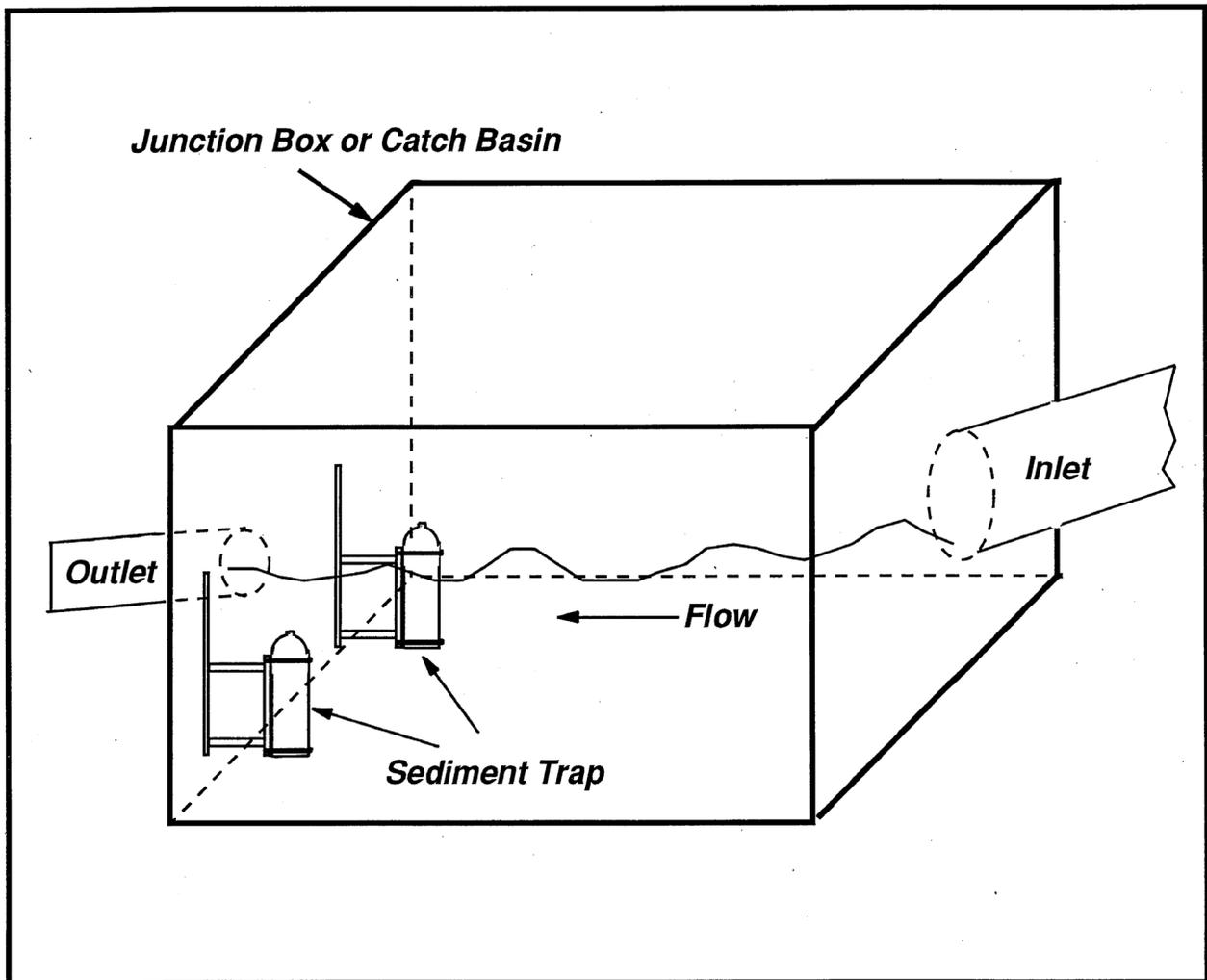


Figure 2 (Ecology 1996)

### 6.3 Sediment Trap Checks/ Evaluation

6.3.1 After initial installation, check traps within two weeks and then on a monthly basis to:

6.3.1.1 Determine that the trap assembly is still intact and structurally sound.

6.3.1.2 That the trap is not causing a flow impediment to the collection system.

6.3.1.3 Ensure that bottles are not being underfilled/overfilled with sediment.

### 6.4 Sediment Trap Retrieval/Sediment Trap Checks

6.4.1 Sediment trap retrieval typically occurs before and after winter wet season.

- 6.4.2 Winter wet season in Western Washington is from October 1<sup>st</sup> through April 30<sup>th</sup> (Ecology WWSWM 2005). Winter wet season in Eastern Washington is from October 1<sup>st</sup> through June 30<sup>th</sup> (Ecology EWSWM 2004).
- 6.4.3 Check traps for sediment volume accumulation and/or repair any damage that may have occurred.
- 6.4.4 Wear gloves prior to contact with sediment trap mounting rings, Teflon bottles and other equipment at the sampling station.
- 6.4.5 After accessing the traps, remove each bottle from the trap to inspect sediment accumulation volume.
- 6.4.6 Depending on QAPP-listed parameters for analysis, a priority list of parameters should be included in your QAPP when insufficient volumes are collected.
- 6.4.7 If sediment trap samples are retrieved, place Teflon-lined caps on the bottles and place the bottles in clean, plastic sealable bags (double-bagged).
- 6.4.8 Place samples directly on ice.
- 6.4.9 Prior to submittal and/or laboratory analysis, centrifuging may be needed. Centrifuging may be performed by the laboratory or by field staff if appropriate equipment is available. Centrifuge procedures for field staff are listed in Section 6.6 below.
- 6.4.10 Replace the Teflon bottle securely within the trap with a new laboratory-cleaned bottle.
- 6.5 Modifications to Collect More Volume
  - 6.5.1 If more volume is needed and traps are re-deployed, modify the trap installation set-up by:
    - 6.5.2 Installing more traps on the mounting ring or by inserting another mounting ring with traps secured.
    - 6.5.3 Install debris deflectors, check the trap monthly and/or after significant rainfall to prevent debris (e.g., plastic bags) from blocking the trap.
    - 6.5.4 Install a weir or other structure to enhance sediment deposition by ensuring that the sample bottle is inundated under most storm flows.
    - 6.5.5 Relocated traps to a new location.

- 6.5.6 Document all sample retrieval and modification information in a field notebook.
- 6.5.7 If delivering samples to the laboratory, fill out the Chain-of-Custody form and deliver samples immediately.
- 6.5.8 Record all observations and activities on field forms and/or in field notebooks.
- 6.6 Centrifuge Sample Processing
  - 6.6.1 Analyses of the sediment trap contents are performed on the solids fraction of the collected sample. In order to separate the liquid fraction a centrifuge is used to spin the samples and decant the overlying water. The remaining sediment/solid portion is then submitted for analysis.
  - 6.6.2 Apparatus for centrifuge includes:
    - 6.6.2.1 Centrifuge equipment.
    - 6.6.2.2 600 mL beakers, KIMAX 14005 or equivalent.
    - 6.6.2.3 Selected apparatus should meet a recommended Relative Centrifugal Force (RCF) rating of >5,000 kg (RCF).
    - 6.6.2.4 Rinse water: Retain the overlying/decanted water.
- 6.7 Centrifuge Processing Procedure
  - 6.7.1 Place the samples (Teflon bottles with sediment/water mix) in a clean area for settling. Allow the sample to settle for at least 12 hours or overnight prior to conducting the next step.
  - 6.7.2 Decant off a portion of the overlying water from the sample and retain in clean 600 mL beaker from the original 1 L sample container, slurry the remaining solids using retained decant water from the sample being processed.
  - 6.7.3 Distribute equal portions of the slurried sample into each of the two 600 mL beakers.
  - 6.7.4 Transfer the remaining solids from the 1 liter collection bottle into the 600 mL beakers.
  - 6.7.5 Use all of the retained decant water to rinse remaining solids from the 1 liter sample. If additional rinses are necessary, reagent grade water may be used.
  - 6.7.6 Place the two beakers into the centrifuge making sure both beakers are of equal weight.

- 6.7.7 Centrifuge the beakers for 15 minutes at 2000 rpm (see recommendation in 6.16.2.3) until the overlying water contains no visible suspended solids. Decant water and discard overlying liquid fraction.
- 6.7.8 Transfer the solids from the bottom of the beakers and composite into a glass jar cleaned appropriately for the analysis to be performed using clean stainless steel spatulas or scoops.
- 6.7.9 Submit centrifuged sediment solids to the laboratory for analysis.

## **7.0 Records Management**

- 7.1 Field data forms and/or field notebooks should be used during trap installation and retrieval. The following information should be recorded for each site, but is not limited to:
  - 7.1.1 Name of samplers, weather conditions, times, and date of installation and sample retrieval.
  - 7.1.2 Number of traps installed.
  - 7.1.3 Problems with installation.
  - 7.1.4 Drainage area (acres/land use).
  - 7.1.5 Confined space entry logs.
  - 7.1.6 Name of equipment installed.
  - 7.1.7 Sample retrieval procedures with any problems encountered.
  - 7.1.8 Flow conditions in the pipe at the time of retrieval.
  - 7.1.9 Volume retrieved from each trap.
  - 7.1.10 Needed maintenance/conducted maintenance of mounting bracket or traps.
  - 7.1.11 Field sample process procedures.
  - 7.1.12 Any field observations including but not limited to:
    - 7.1.12.1 Potential construction activities occurring within the sampled drainage area that could result in an increase of sediment load.
    - 7.1.12.2 Presence of sheen, odor, or discoloration.

- 7.2 Record rainfall measurements. Rainfall records should be evaluated and recorded for the days during sediment trap deployment.
- 7.3 Total precipitation and any flow records (if recorded) should be used to determine the quantity of particulates collected by the traps that represent the storm events that occurred during the sampling period. This information will help determine deployment time of each trap versus precipitation to estimate whether or not traps need to be deployed for a longer time period.

## **8.0 Quality Control and Quality Assurance Section**

- 8.1 Sediment trap retrieval should be audited by experienced staff at least once a year to ensure proper collection of samples.
- 8.2 Quality control samples are dependent upon QAPP project goals and objectives. Typically, one duplicate sample is collected for 10% of the sampling events; however, if only one or two samples are collected per year, more quality control samples may be needed to test quality.
- 8.3 At a minimum, equipment blanks of the trap bottles should be taken at least once per year to ensure the decontamination procedures are sufficient.

## **9.0 Safety**

- 9.1 There are many hazards associated with sediment sampling from stormwater. Some of these hazards include fast moving water, deep water, steep slopes to sampling sites and hostile dogs or people. Use extreme caution when exiting vehicles, walking along busy roads and approaching your sampling site.
- 9.2 Safety is top priority for field staff and supervisors. A site specific health and safety plan and/or a safety procedure manual will be read and understood by monitoring personnel before site visits are conducted and samples are collected.
- 9.3 References to help develop safety programs/manuals or site specific safety plans include (see full reference in Section 10.0, Reference Section):
  - 9.3.1 The WSDOT Safety Procedures and Guidance Manual.
  - 9.3.2 WSDOT Work Zone and Traffic Control Guidelines.
  - 9.3.3 WSDOT Pre-Activity Safety Plan (Appendix A).
  - 9.3.4 U.S. Geological Survey, Safety in Field Activities.
  - 9.3.5 An Example Health and Safety Plan (Appendix B of USDOT, 2001).

## 10.0 References

- 10.1 Washington State Department of Ecology, Norton, D, *Stormwater Sediment Trap Pilot Study*, Publication # 96-347, November 1996.
- 10.2 Washington State Department of Ecology Report # 95-309, Barnard, B. and C. Wilson, *Stormwater Sediment Trap Literature Review and Design Consideration*, February 1995.
- 10.3 City of Seattle Public Utilities, SOP WQ&S S3301 R0D1, *Sediment Trap Installation*, March 2008.
- 10.4 U.S. Geologic Survey, Water Resources Investigations Report 03-4194, *Suspended Sediment and Bed Load in Three Tributaries to Lake Emory in the Upper Little Tennessee River Basin, North Carolina*, 2003.
- 10.5 Environmental Protection Agency, Assessment and Watershed Protection Division Office of Wetlands, Oceans and Watersheds, Water Permits Division Office of Wastewater Management and Region 5, *Draft TMDLs to Stormwater Permits Handbook*, November 2008.
- 10.6 Washington State Department of Ecology, *Phase I Municipal Stormwater Permit*, January 2009.
- 10.7 Washington State Department of Ecology Report, *Sediment Trap Monitoring of Suspended Particulates in Stormwater Discharges to Thea Foss Waterway*, 1998.
- 10.8 Washington State Department of Ecology Stormwater Management Manual for Western Washington, Publication No. 05-10-029, February 2005.
- 10.9 Washington State Department of Ecology Stormwater Management Manual for Eastern Washington, Publication No. 04-10-076, September 2004.
- 10.10 Washington State Department of Transportation, Maintenance Operations Division, Safety and Health Services Office, *Safety Procedures and Guidance Manual*, M75-01.13, July 2009.
- 10.11 Washington State Department of Transportation, Maintenance and Operations Division, Traffic Operations, *Work Zone Traffic Control Guidelines*, M 54-44.01, May 2008.
- 10.12 U.S. Geological Survey, National Field Manual for the Collection of Water Quality Data, Chapter A9, *Safety in Field Activities*, October 1997.

10.13

U.S. Department of Transportation, Federal Highway Administration, *Guidance Manual for Monitoring Highway Runoff Water Quality*, Publication No. FHWA-EP-01-022, June 2001.

## **Appendix A: Example Pre-Activity Safety Plan**

# PRE-ACTIVITY SAFETY PLAN

WETLAND ASSESSMENT (UPDATED 12 MAY 09)

SITE: \_\_\_\_\_

Date: \_\_\_\_\_ Employee: \_\_\_\_\_

1. Complete pre-travel checklist prior to travel.
2. [Plan for drinking water per WAC 296-62-095](#)
3. Review / discusses the Pre-activity Safety Plan controls for each safety hazard identified on the completed hazard assessment checklist with all staff in the field.
4. Team lead maintains completed safety hazard checklist until all have checked in with their supervisor. Save document in the project folder for the next person or time that site may be visited.
5. Fill in the registration sheet (last sheet of this document).

Location: SR _____ MP _____ County _____ Region Contact: _____ Phone #: (____) _____ - _____ Nearest Medical Facility: _____ Traffic Control Needed    yes    no Cell Phone Service        yes    no Closest phone: _____ _____	Parking Location: <a href="#">SEE PAGE 5</a> <hr/> Pre-Travel Checklist ; CHECK WITH REGION TRAFFIC MANAGEMENT CENTER ABOUT RUSH HOUR SHOULDER CLOSURES ; <b>Traffic Control Plan</b> ; Environmental Safety Hazard Assessment and Mitigation Booklet ; Washington State Hospital List ; Pre-Trip Vehicle Inspection and Familiarization ; 1 <sup>st</sup> Aid Kit ; Flares/Triangles/Signs ; Radio Contact List ; Emergency Contact Phone List ; Beacons/signage/traffic cones available in vehicle ; Check SR View for parking possibilities ( <a href="http://www.srview.wsdot.wa.gov/home.htm">http://www.srview.wsdot.wa.gov/home.htm</a> )	PPE's ; Vest ; Hard Hat ; Eye Protection ; Gloves ; Work Boots ; <a href="#">Hearing Protection</a> ; Drinking Water ; Hip Boots or waders ; PFD ; Throw rope bag ; Sunblock ; Insect repellent ; Other: _____	
Task/Hazard	Control	Site Specific Comments	Requirements
1. Walking over uneven terrain. ; Yes    ; No	1. Be aware of loose material, excavation drop-offs, tripping hazards (ruts, holes, etc.), uneven ground and other obstructions. 2. Move carefully in areas with the potential for slips, trips, or falls. 3. Wear appropriate footwear with adequate traction and support.		; Work boots ; Leather gloves (Optional put recommended in areas where blackberries are dominant)
2. Working on or around rip-rap ; Yes    ; No	1. Evaluate rip-rap for loose, rolling, or unstable rocks. 2. Wear hard hat and evaluate need for leather gloves when loose or unstable rock conditions exist or when there is potential for falling rocks.		; Work boots and gloves
3. Working in noisy area ; Yes    ; No	1. Wear hearing protection if sustained noise is at or above 85db (for example next to a freeway, or if you have to shout to be heard by a person 3 feet away from you).		; Hearing Protection needed

\* The PASP's shouldn't include medical information. If employees elect to volunteer medical information to their supervisor and/or crew that's allowed, but the supervisor and/or crew shouldn't be soliciting that information and it **should not be recorded on this form**. If a worker volunteers information to co-workers or supervisor you can discuss options if that issue arises, but if they choose not to let anybody know it's their prerogative

Task/Hazard	Control	Site Specific Comments	Requirements
4. Bridge Work j Yes j No	1. Reference controls for: -Walking over uneven terrain -Working around a stream -Working around natural/manmade overhead hazards -Working around fall hazards 2. Coordinate with Maintenance personnel when working from bridge structures. Follow site specific PASP as required. 3. Box girder bridges may have confined spaces requiring training.		j Hard hat
5. Working around bridges, signs, light fixtures, power lines j Yes j No	1. Continuously assess potential for falling rock or other overhead hazards, especially in windy weather. 2. When possible, avoid, restrict time in, or work during times of least activity in hazard areas. 3. When in hazard area, wear hard hat, gloves, and safety glasses along with approved vest and footwear.		j Hard hat, gloves, boots
6. Isolated sites / 'bad neighborhoods' j Yes j No	1. Consider whether location warrants two people or a team to minimize exposure time. 2. Have cell phone or check-in plan in case of emergency.		j Two people on site j Cell phone
7. Potential for confrontation with adjacent landowner j Yes j No	1. Evaluate the need for informing local residents of purpose of field work. 2. If an adjacent landowner is known to be problematic, evaluate providing a written or phone notice prior to the visit. 3. If confronted by a disgruntled landowner, speak calmly and leave the site. If threatened, in addition to the above, contact police, as well as your supervisor.		j Known problematic land owner: Name: _____ Location: _____ Phone #: _____
8. Potential for transients or human biohazards j Yes j No	1. Avoid confrontations with transients. 2. Avoid contact with human waste, needles, or other drug paraphernalia. 3. Request assistance from maintenance to remove hazard, when necessary.		
9. Potential for confrontation with a domestic animal j Yes j No	1. If there is a known potentially dangerous animal on or around the site, contact the person responsible for that animal prior to visit. 2. Consider carrying a deterrent such as a shovel, whistle or mace. 3. If harmed, or confronted with the threat of harm, contact animal control, as well as your supervisor.		j Known problematic animal: Owner: _____ Location: _____ Phone #: _____

Task/Hazard	Control	Site Specific Comments	Requirements
10. Poisonous snake or large carnivore hazard i Yes i No	<ol style="list-style-type: none"> <li>When working in a snake or large carnivore area, consider two or more people for site visits.</li> <li>When in carnivore habitat, make your presence known by talking, whistling, etc.</li> <li>Stay in sight of partner or in radio contact.</li> </ol>		<ul style="list-style-type: none"> <li>i Two people on site</li> <li>i Radios</li> </ul>
11. Harmful / poisonous plants i Yes i No	<ol style="list-style-type: none"> <li>Be aware of what poison ivy/oak looks like (<a href="http://poisonivy.aesir.com/">http://poisonivy.aesir.com/</a> has many images and information).</li> <li>Be aware of potential for injury from vegetation around you.</li> <li>Bring hand-pruners and glasses to prevent injury in thick brush and briars.</li> </ol>		<ul style="list-style-type: none"> <li>i Hand pruners</li> <li>i Eye protection</li> </ul>
12. Risk of insect / invertebrate problems i Yes i No	<ol style="list-style-type: none"> <li>Determine if field staff are allergic to bees or yellow jackets. Bring appropriate first aid. Confirm location of nearest hospital.</li> <li>Listen and look for bees frequently in the air and on the surface. When spotted, inform others in the field of the location. Evaluate carefully flagging location for future visits.</li> </ol>		<ul style="list-style-type: none"> <li>i Person with allergy?</li> </ul>
13. Working around natural overhead hazards. i Yes i No	<ol style="list-style-type: none"> <li>Assess potential for falling rock or other overhead hazards.</li> <li>When possible, avoid or restrict time in the hazard area.</li> <li>When in hazard area, wear hard hat, gloves, and safety glasses along with approved vest and footwear.</li> <li>Request assistance from maintenance to remove hazard, if possible.</li> </ol>		<ul style="list-style-type: none"> <li>i Hard hat, gloves, boots</li> </ul>
14. Working around fall hazards* i Yes i No	<ol style="list-style-type: none"> <li>Do not work in the fall hazard area without appropriate safety equipment and training.</li> <li>Observe fall protection rules in WAC 296-155 Part C-1**. Prepare a fall protection plan, WSDOT form 750-001, prior to performing the work</li> </ol>		<ul style="list-style-type: none"> <li>i Fall protection plan needed</li> </ul>
17a. Hot weather - Is forecast is for >77 degrees? *** i Yes i No	<ol style="list-style-type: none"> <li>Consider field partner.</li> <li>Wear weather appropriate clothing.</li> <li>Bring sunscreen and hat for sun protection.</li> <li>Rest as needed; take off hat and vest on breaks.</li> <li>Replenish fluids (drink 1 quart per hour).</li> <li>Stay in sight of partner or in radio contact.</li> <li>Evaluate team for heat-related illness and monitor for need of medical attention</li> </ol>	Note in Safety Meeting documentation	<ul style="list-style-type: none"> <li>i Two people on site</li> <li>i Radios</li> <li>i Hat, sunscreen</li> <li>i Drink fluids</li> </ul>
17b. Cold weather i Yes i No	<ol style="list-style-type: none"> <li>In very cold/snow/stormy conditions, consider field partner.</li> <li>Wear appropriate clothing – gloves, hat, thermal underwear, heavy jacket.</li> <li>Stay in sight of partner or in radio contact</li> <li>Is the vehicle equipped with chains/traction tires?</li> </ol>		<ul style="list-style-type: none"> <li>i Two people on site</li> <li>i Appropriate attire</li> <li>i Vehicle equipped with appropriate cold weather gear</li> </ul>

\*\* Fall hazard area: An area where you may lose your footing, slide, trip, or loose balance.

\* WAC 296-155 is available at: <http://apps.leg.wa.gov/WAC/default.aspx?cite=296-155-24501>

\*\*\*Outdoor Heat Exposure WAC: <http://www.lni.wa.gov/rules/AO06/40/0640Proposal.pdf>

Task/Hazard	Control	Site Specific Comments	Requirements
18. Working in or around areas of shallow or slowly moving water i Yes i No	<ol style="list-style-type: none"> <li>Evaluate water depth hazard.</li> <li>Evaluate slippery/steep/hidden water edge conditions and need for avoidance or uphill partner.</li> <li>Evaluate large woody debris hazard at the work site and down stream of it.</li> <li>Assess depth of mud and evaluate safe exit.</li> <li>Evaluate potential rescue options that are safe for the rescuer. When warranted, establish person with throw rope bag down slope of work area and between work area and any downstream hazard.</li> </ol>		
19. Working <u>around</u> a stream defined as a water hazard (currents greater than 10cfs or deeper than 1-ft) i Yes i No	<ol style="list-style-type: none"> <li>Evaluate potential rescue options that are safe for the rescuer.</li> <li>Evaluate need for additional support from maintenance, bridge boat, or dive crews.</li> <li>When appropriate, establish person with throw rope bag down slope of work area and any downstream in-channel hazard.</li> </ol>		<ul style="list-style-type: none"> <li>i Throw rope bag</li> <li>i Hip boots or waders</li> <li>i PFD</li> </ul>
20. Working <u>in</u> a stream defined as a water hazard i Yes i No	<ol style="list-style-type: none"> <li>No wading under hazard conditions without safety equipment and training or specialized crews.</li> <li>For in-water work, wear hip waders, tight-fitting neoprene chest wader, or equivalent. In rocky areas, boots with slip resistant felt-like material soles are recommended.</li> <li>Wear personal flotation device in swift/deep water conditions.</li> </ol>		

Tool Used	Control	Site Specific Comments	Requirements
1. Shovel	<ol style="list-style-type: none"> <li>Wear gloves, keep handles in good condition or replace.</li> </ol>		<ul style="list-style-type: none"> <li>i Gloves</li> </ul>
2. Soils knife	<ol style="list-style-type: none"> <li>Point away from bodies, sheath when not in use.</li> </ol>		
3. Shears/clippers	<ol style="list-style-type: none"> <li>Keep fingers clear of blades</li> </ol>		

<b>PARKING ISSUES</b>			
<p><b>IF WORK OR PARKING IS ON PAVEMENT, SEE <u>LANE CLOSURE REQUIREMENTS IN M54-44</u>. Copy of pertinent parts of M54-44 are in vehicle.</b> Park in areas that provide safe entrance and exit of the work area, do not create potential conflicts with other vehicles and equipment or fire hazard on tall grass.</p>			
<ol style="list-style-type: none"> <li><b>SHOULDER CLOSURES:</b> Park and/or work on roadside &lt;15 ft. from edge of pavement <u>more</u> than 1 hour i Yes i No</li> </ol>	<ol style="list-style-type: none"> <li>Coordinate with region Traffic Management Center about rush hours</li> <li>Use beacon lights per WAC 204-38* requirements.</li> <li>Follow the signage and work provisions in the M54-44** for long duration work zones. <b>USE Chapter 2 - TCP 5 or 6. Keep appropriate TCP with you.</b></li> <li>Modify positions of cones if there is limited visibility or curves in road.</li> <li>Evaluate noise level. If over 85db, use hearing protection.</li> </ol>		<ul style="list-style-type: none"> <li>i &gt;1 hour = Stationary work zone. Use signs and cones with beacon lights: TCP 5 or 6</li> <li>i Vest needed</li> <li>i Hearing Protection</li> <li>i Hard Hat</li> </ul>

<p>2. Park and/or work on &lt;15 ft. from edge of pavement <u>less</u> than 1 hour  <input type="checkbox"/> Yes    <input type="checkbox"/> No</p>	<ol style="list-style-type: none"> <li>1. Use beacon lights if adequate sight distance per WAC 204-38*. Use signs/cones if reduced visibility</li> <li>2. Follow the signage and work provisions in the M54-44** for short duration work zones - Chapter 3.</li> <li>3. If high speed and volume, close shoulder as above.</li> <li>4. Evaluate noise level. If over 85db, use hearing protection.</li> </ol>	<p><input type="checkbox"/> &lt; 1 hour Short Duration Work Zone, vehicle beacon lights  <input type="checkbox"/> Vest needed  <input type="checkbox"/> Hearing Protection  <input type="checkbox"/> Hard Hat</p>
<p>3. Traffic an issue, but parking and/or work locations are &gt;15 ft from edge of pavement  <input type="checkbox"/> Yes    <input type="checkbox"/> No</p>	<ol style="list-style-type: none"> <li>1. Face oncoming traffic while on foot.</li> <li>2. Be aware of or develop emergency escape routes.</li> <li>3. Always wear appropriate high visibility apparel; minimum is ANSI class II vest. Avoid working alone.</li> <li>4. Evaluate noise level. If over 85db, use hearing protection.</li> </ol>	<p><input type="checkbox"/> Vest needed  <input type="checkbox"/> Hearing Protection  <input type="checkbox"/> Hard Hat</p>
<p>5. Walking from vehicle to work area near high-speed lane  <input type="checkbox"/> Yes    <input type="checkbox"/> No</p>	<ol style="list-style-type: none"> <li>1. When you can not face oncoming traffic while, try to be aware of what is happening behind you.</li> <li>2. Be aware of or develop emergency escape routes.</li> <li>3. Always wear appropriate high visibility apparel; minimum is ANSI class II vest. Avoid working alone.</li> <li>4. Be especially careful of crossing lanes of traffic and uneven footing that could cause falls into traffic lanes.</li> <li>5. Evaluate noise level. If over 85db, use hearing protection.</li> </ol>	<p><input type="checkbox"/> Vest needed  <input type="checkbox"/> Hearing Protection  <input type="checkbox"/> Hard Hat</p>

\*WAC 204-38 is available at: <http://apps.leg.wa.gov/WAC/default.aspx?cite=204-38>

\*\* M54-44 is available at <http://www.wsdot.wa.gov/publications/manuals/fulltext/M54-44/Workzone.pdf>

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