

How To Do Stormwater Sampling

A guide for industrial facilities



Washington State
Department of Ecology
December 2002 (rev. 1/05)
Publication #02-10-071



The Department of Ecology is an equal opportunity agency and does not discriminate on the basis of race, creed, color, disability, age, religion, national origin, sex, marital status, disabled veteran's status, Vietnam Era veteran's status, or sexual orientation.

If you have special accommodation needs or require this document in an alternative format, please call Melinda Wilson at (360) 407-6401. The TTY number is 7-1-1 or 1-800-833-6388. Email may be sent to mewi461@ecy.wa.gov

Table of Contents

Introduction

Advance Planning for Stormwater Sampling	page 1
Deciding What To Sample	page 1
Selecting a Laboratory to Test Your Sample	page 1
Contacting the Lab in Advance	page 1
Deciding How You Will Take The Sample	page 3
Collecting Oil and Grease Samples	page 3
Determining which Discharges to Sample	page 4
Selecting Sampling Points	page 5
Obtaining Supplies for Sampling	page 6

Planning Just Prior to Stormwater Sampling	page 7
Being Prepared	page 7
Choosing the Storm Event	page 7

Conducting Sampling at Your Facility	page 9
Checklist for Sampling	page 9
How to Fill Sample Bottles	page 9
Keeping Records	page 10
Determining if the Sampled Storm Event Met the Recommended Criteria	page 11
When the Sampled Storm Doesn't Meet the Recommended Criteria	page 12

Special Sampling Considerations	page 13
Sampling as Stormwater Discharges from a Pipe	page 13
Sampling from a Manhole	page 13
Sampling from a Drainage Ditch or Swale	page 14
Sampling Sheet Flow	page 14
Sampling from a Stormwater Detention Pond or other BMP	page 15
Ecology Wants to Hear from You	page 15

Appendix - Proper and Improper Methods of Sampling	page 16
---------------------------------------------------------------------	---------

References	page 18
-----------------------------	---------

Introduction

The purpose of this guide is to help those who operate facilities do their own sampling.

The *Industrial Stormwater General Permit* requires that your facility conduct at least quarterly visual monitoring and sampling of stormwater and report the sampling results to Ecology. These requirements are outlined in the permit under *Section S4. MONITORING REQUIREMENTS*. This guide supports the sampling portion of the general permit but does not substitute for it.

The purpose of this guide is to help those who operate facilities do their own sampling by more fully describing the steps and procedures to be followed. This guidance will lead you to be able to sample in a way that will provide you and Ecology with meaningful results.

Sources of pollutants that may enter surface water, sediments, or ground water can be identified by sampling stormwater discharges. The results of sampling will be helpful when developing your Stormwater

Pollution Prevention Plan (SWPPP), determining if your existing plan is adequate, and when implementing or assessing Best Management Practices (BMPs).

Some effort is required up front to prepare for sampling in a way that will meet requirements and provide useful data. What follows is a step-by-step procedure of what you need to do to gather and report data that will represent the quality of stormwater leaving your facility. The steps are organized to guide you through the process from start to finish of stormwater sampling.

This guidance is an update to “How to do Stormwater Sampling” which was originally developed by Ecology’s Environmental Assessment Program in 2002. The update was made in accordance with the modified The Industrial Stormwater General Permit which became effective in January 2005.



Advance Planning for Stormwater Sampling

Deciding What To Sample

Before beginning your sampling, you'll need to determine the specific pollutants (water quality parameters) you are required to sample and test for. Ecology has listed these parameters on your permit cover sheet. Your parameters are based on:

- ◆ the standard set of parameters for all facilities,
- ◆ your facility's primary Standard Industrial Code (SIC Code),
- ◆ whether your facility discharges to an impaired (303 (d) listed) water body, and
- ◆ any requirements that apply to water cleanup plans (TMDLs).

All facilities must monitor for turbidity, pH, zinc, and oil and grease. Oil and grease are grouped together as a single parameter tested in the lab with a single analysis. Turbidity can be measured directly in the field using a handheld meter, or sampled and analyzed in the lab. pH must be measured in the field using either a calibrated pH meter or pH paper. You can get pH paper from a distributor of scientific/laboratory supplies or through the same laboratory that will be doing your sample analysis. Zinc, oil and grease and other parameters required by the permit (other than turbidity and pH) are measured by sending bottled samples to a laboratory for analysis.

Selecting a Laboratory to Test Your Sample

Having identified the parameters you will need tested, the next step is to select a laboratory to perform the tests. You are required to select a lab accredited by Ecology. Accreditation assures Ecology that the lab is able to do quality testing using the analytical methods specified under Monitoring Requirements in your permit. A list of labs can be found on Ecology's website: www.ecy.wa.gov/programs/eap/labs/lablist.htm.

Contacting the Lab in Advance

You should contact the lab well ahead of time. They will be providing you with the sampling bottles you'll need. For some water quality parameters, such as oil and grease, it is not only desirable but necessary to collect the sample directly into a specially-cleaned container, so you will need to have bottles from the lab on hand before you sample. You can also ask your lab to send pH paper along with your sample bottles.

Discuss with the lab the analytical methods they will use, as specified in the sample parameter tables included in S4. D of the general permit. The lab will provide you helpful information and explanations that go beyond the scope of this guide. If you must meet discharge limits listed in S3, Discharge Limitations, you should carefully review them with the lab.

All facilities must monitor for turbidity, pH, zinc, and oil and grease.

Contact the lab well ahead of time.

*Ask questions -
your lab can
help you.*

Issues you may want to cover with the lab include:

The type and size of bottle that will be supplied for each water quality parameter to be sampled and tested.

How full to fill the bottle.

Any safety concerns with materials supplied by the lab.

What you need to know about preserving your samples: Make a note of the parameters for which bottles will have preservative inside. For some tests, a preservative is necessary. The preservative is a substance that stabilizes certain chemicals at the time of sampling so that a valid test can be done later. It is critical that you use the correct bottles because tests requiring preservative will not be valid without the correct preservative. In some cases, the wrong preservative will interfere with a test. It is important not to lose the preservative that comes in the bottles supplied by the lab.

The kind of labels the lab will supply for the bottles and how the labels should be filled out. The labels or tags you use to identify the samples you take must be waterproof, and if you write on them, the writing must be waterproof also.

A description of forms or other paperwork to submit to the lab with the samples and how to fill them out.

Whether the lab will supply pH paper as well as sample bottles, tags or labels for the bottles, and blank forms.

How bottles and other supplies from the lab will be delivered to you.

The holding times for each water quality parameter to be sampled and tested. A holding time is the maximum time allowed between taking the sample and doing the lab analysis. If you exceed holding time, the sample analysis is not acceptable.

How and when you will deliver samples to the lab. Plan with the lab how you will get the samples to them in time to begin analysis before the parameter with the shortest holding time reaches that holding time. The fastest way to deliver samples to the lab may be to do so in person, but it may be possible to ship samples (cooled in picnic coolers) and still meet holding times. If you deliver samples in person, you can pick up bottles and supplies for the next quarter at the same time.

The table (left) shows typical sampling information for the three water quality parameters that must be monitored under the Industrial Stormwater General Permit. The information you obtain from your lab may differ somewhat from this:

In many cases, the preservatives listed above come pre-measured in the sampling bottles and there is no need to check pH. Ask your lab about this.

Sampling requirements tend to use scientific words and units of measure. Temperature is measured in degrees Celsius, "C". Thermometers that we typically use in the United States measure temperature in Fahrenheit, "F" and 4° C is about 39° F. But for your purposes, "Cooling to 4° C" means putting the samples on crushed ice or packed with blue ice in

Typical Sampling Information

Parameter	Bottle Type	Minimum Sample Required	Holding Time	Preservation
Turbidity	500 mL wide-mouthed poly	100 mL	48 hours	Cool to 4° C
Total Zinc	1liter (L) bottle cleaned according to protocol	500 mL	6 months	HNO ₃ to pH<2 Cool to 4° C
Oil and Grease	1L glass jar	750 mL (jar ¾ full)	28 days Jar preserved in lab within 24 hours of arrival to lab.	HCl to pH<2 Cool to 4° C

an ice chest so they will be kept just above freezing. Metric units are used to measure weight, volume and distance. Liquid volumes do not use “quarts” and “cups” but use measures such as liters, “L” and milliliters “mL”. Chemicals use their own scientific notation. Nitric acid for example is HNO₃. Be sure to have the lab explain any words or expressions that you do not understand.

Deciding How You Will Take The Sample

Section S4.A.1 of the Industrial Stormwater General Permit states that a grab, time-proportionate, or flow proportionate sample may be taken. A grab sample is a single sample “grabbed” by filling up a container, either by hand or with the container attached to a pole. It is the simplest type of sample to collect and it is expected that most Permit holders will choose to collect grab samples. The general permit recommends that grab samples be collected within the first hour after stormwater discharge begins.

As we will discuss in the next section, oil and grease samples *must* be collected as grab samples. Some Permit holders may choose to better represent water quality parameters other than oil and grease by collecting time-proportionate or flow-proportionate samples. These samples consist of a number of subsamples taken at intervals rather than a single grab sample. The general permit recommends that time-proportionate and flow-proportionate samples be started within the first 30 minutes after discharge begins, and be taken over a two-hour period.

A time-proportionate sample is one made up of a number of small samples (subsamples) of equal volume collected at regular time intervals combined into a single large sample. A flow-proportionate sample is one made up of a number of subsamples where each subsample is collected in such a way as

to represent a given amount of stormwater discharge. Time-proportionate and flow-proportionate samples provide the advantage of including a number of smaller samples (subsamples) in the sample so that the stormwater discharge is better represented than with a grab sample. Time-proportionate and flow proportionate samples can be collected either by hand or with automated equipment. Collecting them by hand is somewhat difficult and collecting them with automated equipment involves additional expenses. Additionally, flow-proportionate sampling requires some knowledge of how to measure fluid flow. A reference for automatic stormwater sampling is the book *Automatic Stormwater Sampling Made Easy* (Thrush and De Leon, 1993) published by the Water Environment Federation. It can be purchased at www.wef.org.

Collecting Oil and Grease Samples

The general permit requires that oil and grease samples be collected by all permit holders. Because of the particular way oil and grease samples must be collected, this requirement may govern your overall approach to sampling.

For some parameters other than oil and grease, it is possible to sample in difficult situations by filling a container and transferring it to the sample bottle to be sent to the lab. Oil and grease samples, however, must be collected from the stormwater source directly. The sample cannot be transferred from another container because oil and grease tends to stick to the inside surfaces of containers. Since you must sample directly into the oil and grease bottle (grab sample), taking grab samples may be the easiest way to collect additional samples for the other parameters. Take samples by collecting stormwater directly from the discharge into the bottles supplied by the lab, filling each bottle one after another.

Oil and grease samples must be collected directly into the bottle you send to the lab.

Because oil and grease samples cannot be transferred between containers, a sample cannot be formed from separate grab samples combined together. If more than one oil and grease sample is desired from a sampling site during a storm event, additional oil and grease grab samples must be collected and analyzed separately.

Because oil and grease samples must be collected directly and not through the tubing of an automatic sampler, those using automatic samplers will still have to grab oil and grease samples by hand.

Determining which Discharges to Sample

The first step in selecting sampling points is to consider the areas draining your facility. The site map in your SWPPP should show the drainage areas. Areas of particular concern are those where raw materials or finished product are exposed to rainfall and/or runoff, and areas where leaking fluids such as petroleum products and hydraulic fluids have the potential to enter stormwater runoff.

The next step is to determine where the runoff from each drainage area is discharged from your facility. If there are separate drainage areas with separate discharge points, stormwater sampled at one discharge sampling point may not represent the facility's stormwater quality overall.

Section S4.A.5 of the Industrial Stormwater General Permit describes the requirements for selecting sampling points:

"Sampling must be conducted to capture stormwater with the greatest exposure to significant sources of pollution. Each distinct point of discharge offsite must be sampled and analyzed separately if activities and site conditions that may pollute the stormwater are likely to result in discharges that will significantly vary in the concentration or type of pollutants. Where

pollutant types do not vary, the Permittee may sample only the discharge point with the highest concentration of pollutants. However, the SWPPP must include documentation on how these determinations were made and in the description of each point of discharge, including the relative quantity (volume) of discharge and pollutants likely to be found."

If your facility discharges stormwater collected over areas that are used for similar activities and have similar site conditions, and there is reason to believe pollutant types will be similar in such areas, a single sampling point can be used to represent several discharge points. For example, if a facility has separate discharge points but the industrial activities are similar, you can sample at just one of the discharge points. The site chosen must be the one where there is reason to believe the pollutant concentration is highest (the worst case). For example, select the discharge that drains an area with greater use and/or more equipment activity. Determining where to sample can be approached as a logical deduction, or you may want to take samples at multiple sites and use the results to determine sampling location. Documentation of how sampling sites were chosen is required in the SWPPP, as described above in the general permit.

If your facility has multiple discharge points from areas with different uses or activities, you need to determine if that will result in significant differences in the type of pollutants that may be discharged. For example, if one portion of the site is used to store raw materials and discharges separately from another portion of the site where finished product is stored, it may be necessary to take separate samples. Some initial sampling and analysis may be necessary to make this determination. Ecology expects that most facilities will be able to choose a single sample location for their site.



Making a determination of whether a discharge is likely to have stormwater quality that differs from other discharges and require separate sampling requires a review of the site map in the SWPPP with consideration to sources of pollutants in each drainage area. This should be followed up with an on site assessment of activities, sources and quantities of pollutants in each drainage area. This information will help you document your decision as to whether two or more drainage areas can be represented by a single sample site.

Selecting Sampling Points

- ◆ Pipes discharging your facility's stormwater offsite.
- ◆ Ditches carrying your facility's stormwater offsite.
- ◆ Manhole access to storm sewer's carrying your facility's stormwater, so you can lower a sample bottle attached to a pole into the manhole. In general, manhole access on your property may be simpler and safer than access off property and more readily verifiable as carrying only your facility's stormwater.

These three types of sampling points are not too difficult to access and the flow within them tends to be fast enough, with enough turbulence, to allow you to collect well mixed, representative samples. In some cases, portions of industrial stormwater runoff leave a site as sheet flow. Specific approaches to sampling of pipes, ditches, manholes, grated storm drains, and sheet flow will be covered in the final section of this guide manual.

Make sure your sampling points will provide for sampling only the stormwater that comes from your facility. If the stormwater in a pipe (storm sewer) contains other discharges, move your sampling point upstream to a point where the flow is from your facility only. Also check to

see that there is no base flow in the storm sewer during dry periods. Report in your SWPPP the presence of any base flow and measure or estimate its flow rate. If it is not possible to sample only flow from your facility, document the reason for this and provide information concerning the source of the flow you are sampling.

If possible, the stormwater your facility samples should not be a mixture of your facility's stormwater with other water. Some examples of situations where a sample would be of a mixture of water sources, situations in which you should **not** sample:

Examples of mixed water sources situations in which you should not sample:

A ditch that carries additional stormwater from properties upstream. In this case, the stormwater from your facility is mixed with other water and you should find a location or locations where your facility's stormwater alone can be sampled.

A stormwater sewer or pipe (culvert) discharges to a creek or other receiving water, the pipe being partially submerged where it discharges into the receiving water. In this case, this final discharge point will not be able to be used as a sampling point because the stormwater flow is mixed with the receiving water.

A manhole that carries stormwater, not only from your facility but from other stormwater sources as well. If you are grabbing a sample from a manhole but from the point where a storm sewer from your facility ends at a municipal manhole, make sure that the flow in that pipe is entirely from your facility, that the pipe is not submerged or partly submerged and that you are otherwise not prevented from collecting stormwater from your facility only. If you are not sure that a storm sewer carries only flow from your facility, the municipality may

Base flow here refers to any water in the ditch that is not a direct result of stormwater runoff. Ground water seepage into the ditch, for example, would add base flow.

Manhole access can be a good sample point if it can be accessed safely and the stormwater is solely from your facility. Do not climb into the manhole. Use a sample bottle attached to a pole to take the sample.

Practice sampling before you do the real thing.

Take time to get ready for sampling.

have storm sewer plans to help you determine this. Contact the municipality beforehand to discuss sampling from the manhole and associated safety issues, particularly for manholes in areas with vehicular traffic.

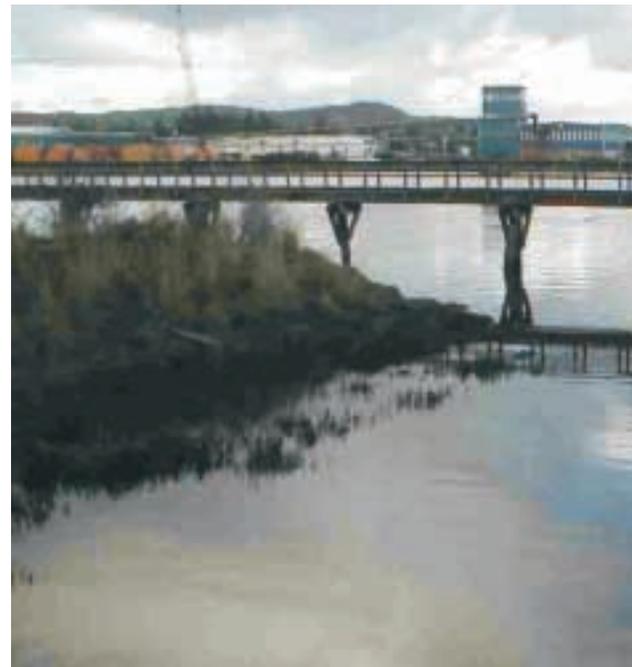
It is important to sample flow from only your facility if possible because otherwise it cannot be determined what the sample actually represents. If you discharge stormwater to a stormwater conveyance system that includes stormwater from other sources, you need to sample before your stormwater commingles with stormwater from other sources. However, if stormwater runs onto your property in an uncontrolled fashion (for example, sheet flow) from adjacent property, into areas of industrial activity on your site so that it becomes a part of the stormwater discharge from your site, this should be included in your sample of stormwater discharge. If you are concerned about this offsite source, you may want to sample that stormwater where it enters your property. If the results show significant pollution, you may want to provide Ecology with a narrative description of the contributing site and sample results to document the relative contribution of the other property or upstream source.

It is a good idea to observe the sampling point(s) you have chosen during actual stormwater runoff conditions to see how readily stormwater can be sampled there. Keep in mind that changing tides and flow conditions in receiving waters, including flood stages may occur during storm events. This may cause a pipe that is discharging your facility's stormwater to become submerged or partly submerged, preventing you from sampling during some conditions.

Obtaining Supplies for Sampling

The supplies you will want to have on hand before sampling include:

- ◆ Sampling bottles from the lab, including a few extra of each type.
- ◆ When needed, a pole to hold sample bottles and filament strapping tape.
- ◆ Powder-free disposable nitrile or latex gloves (sold by medical and laboratory suppliers). Do not use powdered gloves as the powder may contain metals that could contaminate metals samples such as zinc.
- ◆ Foul-weather gear.
- ◆ One or more picnic coolers (depending on the number of samples to be stored and transported or shipped).
- ◆ A bound notebook to serve as a field book for keeping records concerning sampling. Notebooks with waterproof pages are available for these field notes at office supply stores. The information to be included in the notes will be described in the "Keeping Records" section of this guide.



Planning Just Prior to Stormwater Sampling

Now that the bulk of the planning for sampling is complete, there are a few things to keep in mind before deciding to actually begin sampling.

Being Prepared

It is important to assemble everything that will be needed for the sampling event ahead of time because opportunities to sample during storm events often come with little advanced notice. Complete the identification tags and Lab Services Required form. Place the tags, lab form, field notebook, permanent ink pen, meter, and pH paper in the cooler with the sample bottles. Have re-sealable plastic bags or other means on hand to keep the pH paper dry. If you are using a turbidity meter or pH meter, be prepared to protect them from the rain. Have foul-weather gear ready and available. It will be necessary to keep sufficient ice on-site or plan to purchase ice that day.



Choosing the Storm Event

Now you are ready to sample. Successful sampling is first and foremost a matter of being at the right storm event at the right time. What follows is some guidance on how to do that.

The general permit recommends that the storm event to be sampled must meet the following two conditions:

1. Be preceded by at least 24 hours of no greater than trace precipitation.
2. Have an intensity of at least 0.1 inches of rainfall (depth) of rain in a 24-hour period.

If the above criteria can't be met, the permittee must still collect and submit stormwater sampling results in accordance with the general permit. A permittee is required to sample only once in a sample collection period and use its best efforts to achieve the above recommended sample collection criteria. If a sample is taken and the recommended sample collection criteria are not met, the permittee is not required to conduct additional sampling for that sample collection period.

Success in collecting grab samples requires being ready to go as soon as the decision is made to sample during a particular storm event. It is especially important to be at-the-ready because the permit recommends that grab samples be collected during the first hour of stormwater discharge. Note that the permit recommends that the sample be taken within the first hour after discharge from your facility to a point off site, not from when rainfall begins.

You will increase your chances of meeting the second recommended criterion for rainfall intensity at a minimum of effort if you evaluate weather forecasts before deciding whether or not to sample a particular rain event.

Sample during a hard (intense) rain event.

*Check
weather
forecasts.*

If your facility is located in an area that is covered by a standing snow pack for days at a time during a year of normal precipitation, you may alternatively sample a snowmelt event during the winter or spring quarter. The recommended sampling conditions for a snowmelt event are as follows:

- 1.** It is preceded by at least 24 hours of no greater than *trace* precipitation.
- 2.** The snowmelt is generated by a rainfall or warm weather melt-producing event on a standing snow pack of at least one inch in depth.
- 3.** The sample is collected during the first hour of discharge from your facility that was produced by the melting snow.

Keeping up with the weather forecast and planning so that sampling can be carried out on short notice are the keys to successful sampling.

Local forecasts, including televised satellite and radar images can give an indication of the expected intensity of coming storms. The National Weather Service is an excellent source of information on upcoming storms. It also includes local current radar and

satellite images. Their website:

<http://www.wrh.noaa.gov/seattle>.

A number of commercial websites, such as <http://www.weather.com/> and *Yahoo* also provide weather information and forecasts.

When evaluating a weather forecast, consider indications of expected intensity, for example “90% chance” rather than “50% chance” and “rain” rather than “showers.” Over the telephone, National Weather Service personnel can often provide estimates of anticipated rainfall amounts. In addition to intensity, consider the predicted duration of the storm. It will be very helpful to spend time observing rain events at your site with attention to how rain intensity relates to stormwater discharges from your site, before you begin sampling.

Once the decision has been made to attempt to sample a storm event, the personnel who will be sampling should be notified and they should prepare to sample. If it does rain, they should be at the sampling sites before stormwater begins discharging so they can document the time of discharge and be ready to sample.



Conducting Sampling at Your Facility

After you have selected a storm event and it begins raining, the personnel conducting the sampling should prepare their equipment and go to the sampling site(s). They will be collecting grab samples at the sampling site(s), placing the samples in picnic coolers containing ice, and keeping notes in a field book.

Sampling for the first time may require working out some difficulties, but after performing these duties once, future sampling will not be difficult.

Checklist for Sampling

Because stormwater sampling is not a daily part of the workload of a facility, it is a good idea to keep a checklist of things to have prepared before sampling and to do during sampling. You can make the checklist by jotting down the things you did for the first sampling event to remember for subsequent sampling events. Update this checklist, if necessary, based on the experience you gain with each sampling event.

How to Fill Sample Bottles

This section and an illustrated appendix at the end of this guide describe how to collect a sample properly. Collecting a grab sample can be as simple as holding a bottle under the stormwater falling from a pipe and filling the bottle properly. Still, the person doing the sampling must use care in applying the principles outlined below so that the sample will be representative of the water being sampled.

Simple principles of good grab sample collection:

Wear disposable powder-free gloves when sampling.

Grab samples with the stormwater entering directly into bottles supplied by your lab rather than by transferring the samples from a container that may not be clean. Metal contamination of ordinary containers is common and household detergents often contain phosphorus, a tested parameter for some industries. Again, transferring the sample from another container is not an option for oil and grease samples under any circumstances.

When holding the sample bottle your lab has provided, keep your hands away from the opening in order to prevent contaminating the sample.

Always hold the bottle with its opening facing upstream (into the flow of water) so that the water enters directly into the bottle and does not first flow over the bottle or your hands.

Sample where the water has a moderate flow and, if possible, some turbulence, so that the stormwater discharge will be well-mixed and the sample will be representative. Sampling in still water should be avoided. Include in your field book a note about the sample location and how briskly the water appears to be moving.

Sample from a central portion of the stormwater flow, avoiding touching the bottom of channels or pipes so as not to stir up solid particles.

Have your sampling kit ready to go.

*Take notes!
Writing down
your observations
at the time of
sampling is
important.*

Do not rinse or overfill the bottles. The bottles supplied by your lab for some parameters (ammonia and phosphorus) will include small amounts of liquid preservative (generally a few drops). Fill the bottle to about ½ inch of the top (not quite full) to ensure that no preservative is lost.

As soon as the sample is collected, cap the bottle and label it. It is important that the bottles are labeled correctly so that the lab will be able to identify samples by sample site and ensure proper preservation for each parameter. It is a good idea to place sample bottles in re-closable bags. Place the samples in a picnic cooler partially filled with ice. Plan to maintain ice in the picnic cooler until the samples arrive at the lab. Remember to make certain that the samples will be delivered to the lab soon enough for the lab to meet holding times.

Oil and grease sampling raises additional concerns:

Oil and grease floats on water so sampling it requires special attention. Oil and grease samples must be collected directly into the sample bottles supplied by the lab because oil and grease tends to stick to the sides of containers. Do not rinse the sampling bottles beforehand or pour the sample from another container. Do not fill the bottle completely and do not pour out some of the sample if the bottle is overfilled by mistake. If you do overfill a bottle, use a new bottle instead to collect your sample. Because you only get one try at filling an oil and grease bottle, it is a good idea to have plenty of extra bottles on hand.

Oil and grease samples should be collected as the stormwater falls from a pipe or from a running, turbulent stream of flow when possible so the source will be well mixed. When the samples must be collected from a water surface, the person holding the bottle should plunge it below the sur-

face in a sweeping arc and then bring it upwards through the water surface again, so the water surface is broken twice by the mouth of the bottle. Be sure to note in your field book how you collected your samples as this is especially important for the oil and grease sample.

Keeping Records

Section S5. of the general permit specifies requirements for reporting and recordkeeping. In order to comply with the requirement that lab reports include sampling date and sampling location, you will need to supply this information to the lab when submitting samples. You can do this by using the sample location as the field station identification on your labels or sample tags.

You should purchase a notebook for use in the field. Water resistant “rite in the rain” notebooks serve the purpose well. Information is available at www.riteintherain.com.

Section S5.C. requires that you record the date, exact place, method, and time of sampling or measurement, and the individual who performed the sampling or measurement (the section also specifies some requirements for lab record keeping). Record these in your field book:

- ◆ Time rainfall began
- ◆ Sampling location (when there is more than one)
- ◆ Date of sampling
- ◆ Time of sampling (and time you completed sampling if different)
- ◆ How you collected the sample (for example, “from a ditch by hand” or “from a manhole with the bottles on a pole”)
- ◆ name of the sampler(s)
- ◆ number, types (parameters) of samples collected

◆ field measurement results (such as pH)

◆ unusual circumstances that may affect the sample results.

Entries in the field book should be made with ink. If you make an error in the field book, cross it out rather than whitening out or erasing. Number the pages of the field book consecutively. To ensure that the bound field book is a complete record, do not rip out pages from it.

It is desirable in addition, though not required by the general permit, to record the following information for each storm event sampled:

◆ number of dry days before the day the sample was collected, or a statement that there was at least one day of no greater than trace precipitation before sampling.

◆ inches of rain during a 24-hour period

◆ time of sampling as well as date

◆ date and time the rainfall began

◆ date and time the discharge began at the sampling site

◆ duration of the storm in hours

◆ inches of rainfall during the storm

The information you record for the first two items above (number of preceding days of no greater than trace precipitation and inches of rain during a 24-hour period) will serve to document that you met those recommended criteria for sampling specified in the general permit.

Determining if the Sampled Storm Event Met the Recommended Criteria

Section S4.A. recommends that the storm event be preceded by at least 24-hours of no greater than trace precipitation. During times of clear weather, it may be obvious that this criterion has been met.

When it is cloudy, you can verify that there has been no precipitation (including overnight) by installing a simple, inexpensive rain gauge at your site.

The same section of the permit also recommends that the storm have a rainfall intensity of at least 0.1 inches of rain in a 24-hour period. This does not mean that the rainfall must last for a full 24 hours, only that from the time it begins raining to the time you stop sampling, the rainfall be of the recommended intensity or greater. To determine this, you should observe and record the time it began raining as well as the time you stopped sampling. What the storm does after you stop sampling is of no concern. In addition to the times rainfall began and sampling ended, your rain gauge will give you all of the information you need to easily calculate the rainfall intensity.

An example rainfall intensity calculation:

Rainfall begins at 9:35 AM (you empty the rain gauge beforehand)

Stormwater discharge at your sampling site begins at 10:05

You complete sampling at 10:30

Your rain gauge shows 0.01 inches of rain when you stop sampling

Rain intensity

$= 0.01 \text{ inches} / 55 \text{ minutes}$

$= 0.00018 \text{ inches/minute}$

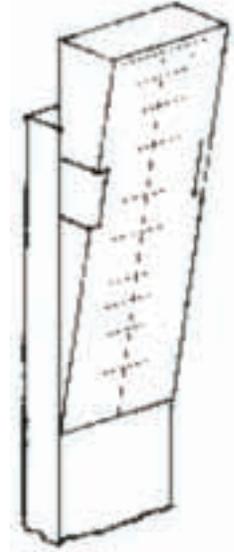
$= 0.00018 \text{ inches/minute}$

$\times 60 \text{ min/hr}$

$\times 24 \text{ hrs/24 hrs}$

$= 0.26 \text{ inches/ 24 hours}$

The criterion for rain intensity is 0.1 inches / 24 hours. 0.26 is greater than 0.1, so the storm event you sampled meets the recommended criterion.



A simple, inexpensive rain gauge mounted on a post. A rain gauge such as this one provides accurate readings at the low rainfalls often associated with the period from the beginning of rainfall to the end of sampling. The gauge can be removed and the water that has collected in it dumped out between rains.

*Get the best
sample you can.*

If you do not have a rain gauge, you will have to rely on rainfall data from other sources. The National Oceanographic and Atmospheric Administration (NOAA) posts daily rainfall records on their website: http://www.wrcc.dri.edu/state_climate.html. (Note that there is an underline between “state” and “climate,” but no space, in this web address). The data posted is only for the previous day, so you will have to make sure you don’t miss the internet posting. A disadvantage of relying on this data is that it is a measure of nearby rainfall but not that from your site. A further disadvantage is that it gives you only daily (24-hour) rainfall data and, while this may indicate a rainfall of less than 0.1 inches in some cases, you may have had sufficient rainfall intensity at your site to meet the recommended criterion of the general permit, had you measured it with a rain gauge.

When the Sampled Storm Doesn’t Meet the Recommended Criteria

There may be times when you start to sample but the rainfall intensity turns out not to meet the recommended criterion of the general permit. Or despite your best efforts, you are unable to collect grab samples during the first hour of a storm event that meets the recommended criterion for preceding dry conditions. When this happens, the general permit states that the permittee must still collect and submit stormwater sampling result, and must include an explanation with the monitoring report identifying what recommended criteria were not met and why.



Special Sampling Considerations

Safety should be the primary consideration in sampling. Samples should never be collected in a way that compromises the safety of the sampler. In cases where a physical hazard such as a trip hazard or when sampling near deep water bodies, samplers should work in pairs. Do not wade in water where the estimated depth in feet times the velocity in feet per second is equal to or greater than 8, as swift currents can lead to drowning accidents. Be aware of the slip hazard common near the banks of water bodies and decide whether a bank is too steep to negotiate safely. Safety comes down to individual judgment. Never put yourself in a position you consider to be unsafe.

Collecting grab samples of stormwater is basically a simple process but an important one since getting good results depends on proper sampling. Samples can be collected easily in some locations, but not all stormwater discharges are as readily sampled as the flow in a ditch or from a pipe falling into a receiving water. Below are some situations you may encounter and suggested approaches for handling them. Because oil and grease samples must be collected directly into the bottle supplied by the lab we will consider only methods for collecting samples directly by hand or with a bottle attached to a pole. When sampling in these or other situations, keep in mind the steps outlined in the section, *How to Fill Sample Bottles*.

Sampling as Stormwater Discharges from a Pipe into a Receiving Water

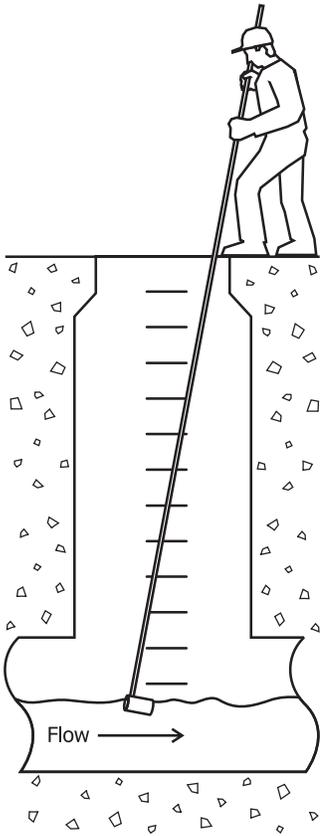
If stormwater is being discharged from your facility through a pipe into a ditch, creek, or other receiving water, it can be readily sampled as it falls from the pipe before it reaches the receiving water if the discharge pipe is safely accessible and not submerged. Hold the bottles with the bottle opening facing upstream (into the flow and be sure not to overfill them. You may need to fasten the collection bottles to a pole to reach the pipe. Attaching a bottle to a pole is described in the section below, *Sampling from a Manhole*.

*Don't take risks -
know how to
sample safely.*

Sampling from a Manhole

When sampling from the manhole of a municipal storm sewer, remember to contact the municipality beforehand. Discuss sampling being sure to cover safety concerns. Open a manhole with a hook or pick axe, exercising care not to drop the manhole cover on hands or feet. **You should not, under any circumstances, enter the manhole unless trained to safely enter confined spaces**, but you can sample the flow in a manhole from above ground by taping the sampling bottles, one at a time, to a pole and lowering the pole into the manhole.

Each bottle can be fastened to the pole by holding the bottle against it and wrapping tape tightly around the bottom and the top of the bottle as you hold the bottle firmly to the pole. Filament strapping tape works well for this purpose as it is waterproof and strong. If the flow in the storm sewer is shallow, the bottle may have to be positioned horizontally with the bottle's opening somewhat higher than its bottom. When sampling in a manhole, be



When sampling from a manhole, use a pole to safely sample from above ground. Avoid touching the sides of the manhole or pipes with the bottle to prevent contamination. Place the opening of the bottle upstream so that the flow enters the bottle directly.

careful not to scrape the bottle against the sides of the pipe to avoid picking up extras solids in your sample.

Collecting into bottles with oil and grease samples with a pole is done by plunging the bottle on the pole below the water surface and back upwards. This must be done as a single motion and only once. Because you only get one try at getting a good oil and grease grab sample, it may take some practice and extra bottles to collect the amount of sample you need without overfilling the bottle. Collecting samples other than oil and grease into bottles with preservative can be done by quickly plunging the pole into the flow repeating if necessary until the bottle is most but not all of the way full. If you overfill the bottle, remove it, tape a clean bottle to the pole, and try again. Be sure, when collecting samples with a pole, to follow clean principles by keeping the pole downstream of the bottle while sampling.

Sampling from a Drainage Ditch or Swale

If a drainage ditch carries stormwater flow from your facility offsite, and if it carries no flow other than the flow from your facility, you can sample the water in the ditch simply by placing the bottle where the flow is free, with the bottle opening facing upstream. If you cannot reach a freely flowing portion of the ditch by hand, you may need to attach the bottles, one at a time, to a pole for sampling. Follow the procedure outlined in the section, *How to Fill Sample Bottles*.

If the flow is carried in a small ditch or swale, you can install a barrier device in the channel or deepen a small area so you can gain enough depth of flow to sample directly into the bottles. Make sure to allow for sufficient time after disturbing the bottom so that the solids resulting from muddying the water will not become part of your sample.

Sampling Sheet Flow

It is not always possible to sample stormwater runoff in locations such as ditches or pipes where the flow is concentrated. Sometimes the permittee has no choice but to select sample locations for which sheet flow is sampled before it becomes concentrated. Approaches to sampling sheet flow are described below and illustrated in the figures that follow.

In some cases, a stormwater discharge from a facility is not concentrated at any point and leaves the property in the form of sheet flow as it runs off a work area or driveway or grassy area. In this case the flow may be too shallow for the collection bottle to be filled with sample. It is often possible to find a way to collect the stormwater runoff in these situations.

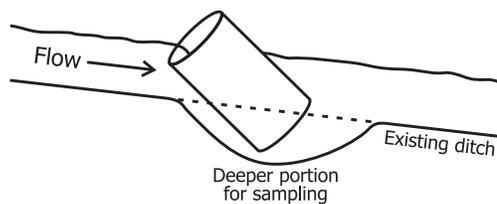
One way to concentrate sheet flow is to excavate a small basin in an existing ditch or other location where stormwater runoff flows. Another approach is to install a barrier device or trough, gutter, or ditch to intercept and concentrate stormwater flow. As with other sample sites, the flow should be moving and somewhat turbulent so the samples will be well-mixed. Be sure that any excavation you do does not expose the stormwater to be sampled to newly worked soil surfaces that the runoff may erode, increasing the solids in your samples. You may want to consider lining the trough, gutter, or ditch with plastic. Be sure not to introduce materials (such as metals that include zinc) that may contaminate the samples. Sheet flow on paved areas can be concentrated and collected by constructing small bumps, similar to speed bumps.

Another way to collect samples from sheet flow is to use a special peristaltic hand pump to pump samples from shallow surface flows. This method is of limited use for collecting the samples required by the general

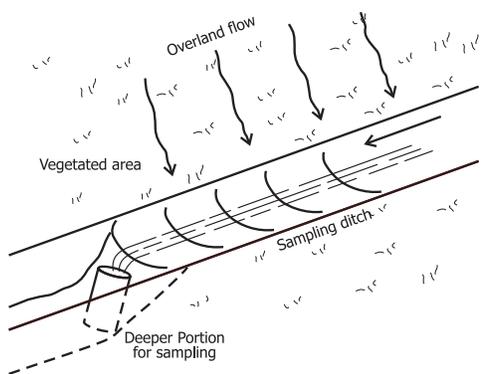
permit as it cannot be used to collect oil and grease samples.

Roger Bannerman of the Wisconsin Department of Natural Resources has developed simple devices to grab samples of sheet flow from paved areas, rooftops, and lawns. Though the devices are intended to be used for simple, automatic sampling, pouring a container of collected sample into other sample bottles, the ways in which they intercept and concentrate flows can be adopted for direct grab sampling.

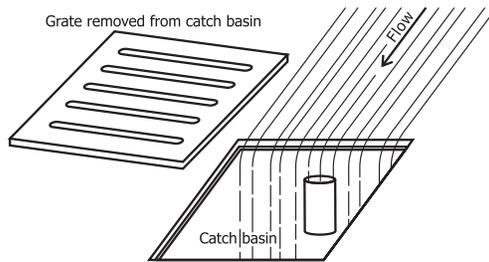
The following figures illustrate the methods of sampling sheet flow discussed above:



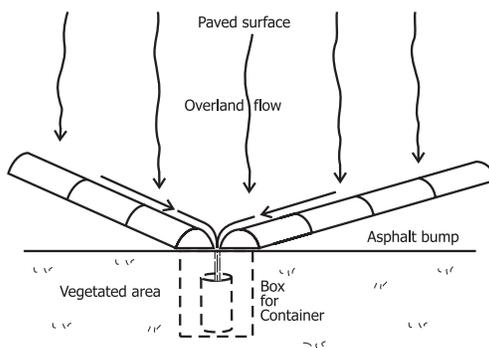
Deepening an existing ditch can allow samples to be collected directly into bottles in some cases. Be careful not to stir up solids from the sides or bottom of the ditch.



Runoff entering a catch basin can sometimes be collected directly into bottles by removing the grate and allowing the runoff to fall into the bottles.



Overland flow from vegetated areas can be sampled by constructing a shallow ditch to intercept the runoff and a deepened area to place bottles to catch the runoff.



Overland flow on paved areas can be sampled by constructing asphalt or concrete bumps to collect and concentrate the flow. A box positioned below ground surface in the paved area or the edge of an unpaved area can provide a place to collect samples directly into bottles.

Sampling from a Stormwater Detention Pond or other BMP

When stormwater from a facility discharges after flowing through a detention pond or other treatment system, sample as the stormwater flows out at the discharge point. Ponds may hold stormwater for a time before discharge begins. Sample within the first hour, preferably 30 minutes from when the pond begins to discharge.

Ecology Wants to Hear from You

If you have suggestions on how Ecology can improve this guidance document, have developed innovative sampling techniques, or just want to comment on stormwater sampling, please contact

Joyce Smith:

Email (preferred):

josm461@ecy.wa.gov

Telephone:

(360) 407-6858

Mail:

Washington State

Dept of Ecology

PO Box 47600

Olympia WA 98504-7600

Appendix - Proper and Improper Methods of Sampling



Do not touch openings of bottles. Keep bottles clean to prevent contamination.



Do not allow bottle lids to touch ground. Keep lids clean to prevent contamination.



Do not sample in stagnant areas with little flow. Do not stir up bottom sediments or allow foreign materials to enter the sample bottle. (Do be careful to grab a clean sample in cases where stormwater runoff is shallow.) If the runoff is so shallow that it is not possible to sample without the sample being contaminated in the process, then find an alternative way to sample.



Do attach a bottle to a pole for sampling in manholes or when a hand sample would be in stagnant water. A boathook is used in this example and the bottle is attached to it with filament strapping tape.



If the water is too shallow to sample with the bottle upright on the pole, try taping it on sideways, but tilted up slightly.



Do not sample with the bottle opening facing downstream, when using a pole or sampling by hand. Water flowing past your container, pole, or hand and into the container can be contaminated by such contact.



Do not allow water to overfill the bottle, particularly not for sample bottles with preservative. Oil and grease samples should be collected from water falling into the bottle when possible, or otherwise in a single swoop.



Do sample with the opening of the bottle facing upstream, into the flow so the water will enter directly into the bottle. This is true when sampling either by hand or with a pole. Do sample water that is rapidly flowing rather than stagnant.



Do collect samples without overfilling the bottles.

References

- Bannerman, R.T.; Owens, D.W.; Dodds, R.B.; Hornewer, N.J., 1993. *Sources of Pollutants in Wisconsin Stormwater*, Wat. Sci. Tech. Vol. 28. No. 3-5, pp 241-259.
- Colorado Department of Public Health and Environment; Water Quality Control Division; Colorado Discharge Permit System, 1996. CDPS Stormwater Sampling Guidance Document.
- Dodson, Roy D., 1995. *Storm Water Pollution Control: Municipal, Industrial, and Construction NPDES Compliance*, 1999, 1995. Second Edition. McGraw-Hill.
- Ecology, 2005. *The Industrial Stormwater General Permit: A National Pollutant Discharge Elimination System and State Waste Discharge General Permit for Stormwater Discharges Associated with Industrial Activities*. State of Washington Department of Ecology, January 14, 2005.
- Ecology, 2000, 1999. *Field Operations and Safety Manual: Environmental Assessment Program*, Washington State Department of Ecology, Environmental Assessment Program, Updated August 2000.
- New Jersey Department of Environmental Protection Division of Water Quality, 1998. *General Sampling and Reporting Guidance for PAS and ADI Form*.
- Thrush, Cindy and De Leon, Dana B., 1993. *Automatic Stormwater Sampling Made Easy*, Water Environment Federation.
- United States Environmental Protection Agency, 1992. NPDES Storm Water Sampling Guidance. EPA 833-B-92-001.
- Waschbusch, R.J.; Selbig, W.R.; Bannerman, R.T., 2000. *Sources of Phosphorus in Stormwater and Street Dirt from Two Urban Residential Basins in Madison, Wisconsin, 1994-95*. National Conference on Tools for Urban Water Resource Management and Protection Proceedings, February 7-10, 2000, Chicago, IL.
- Wisconsin Department of Natural Resources Bureau of Water Management Municipal Wastewater Section – Storm Water Unit, 1994. *Wisconsin's Guidance for Industrial Storm Water Monitoring*.
- Torno, Harry C., 1995. *Stormwater NPDES Related Monitoring Needs*, American Society of Civil Engineers.

