Field Procedures

STORMWATER MONITORING PROJECT

Background

The Washington Department of Ecology and Puget Sound Partnership acknowledge stormwater is the largest contributing factor to pollution in Puget Sound. Monitoring stormwater draining into Puget Sound is inadequate, as readily acknowledged by stormwater managers. Communities lack funding and capacity to monitor and characterize their stormwater systems. Southern Resident Killer Whales (SRKW) as top-tier predators in the Puget Sound food web experience serious consequences from pollution and necropsies of dead whales have revealed high levels of toxic pollutants.

This project will build capacity by using community science volunteers to help city/county/tribal stormwater managers to identify stormwater pollution sources, focus mitigation and/or corrective actions, and improve water and habitat quality for SRKWs and other marine inhabitants of the Salish Sea.

Goals

- Monitor pollution levels in stormwater outfalls and streams discharging into the Salish Sea
- Provide city and state regulators high quality data on stormwater pollution levels to assist them in conducting investigations to identify and eliminate illicit discharges
- Improve the water quality of the Salish Sea and tributary streams for all the wildlife that depend on it

Before You Head Out

- Print out Stormwater Monitoring Worksheets from https://friendsofsalishsea.org/
- Fill out top of the Field, Test Strip & Lab Datasheets

- Assemble Equipment:

- Map of Sites
- Clipboard
- Datasheets - Field, Water Quality & Lab
- Field Notebook - reference docs
- Pen/pencil
- Sharpie
- Hand sanitizer
- Plastic gloves (if using)
- Thermometer
- YSI -Turn on before packing
- Water Quality Test Strips
- Sampling Buckets
- Distilled water (if using)
- Phone/camera
- Bottles for bacteria (one for each outfall + 1 for duplicate)
- Cooler & ice/icepack (*Bellingham*)

- Determine the tide height at start of sampling: www.tidesandcurrents.noaa.gov. Most sites require a low tide to sample.
- Record the rainfall for the 24 hours just preceding start of sampling. For best source of rainfall data for your city visit www.friendsofsalishsea.org

In the Field

1. **As you are leaving to sample, turn on the YSI meter** by pressing and holding the ON/OFF button. At the first monitoring location, (turn meter on if you forgot) remove the gray vinyl sleeve and place meter in the shade while you get set up. You can leave the instrument on in between outfalls.

2. **Arrival Time:** Record the time when you reach the site, even if dry or stagnant.

3. **Flow**:
    a. Record water flow in the creek or coming out of the pipe and record as N, T, M or H.
    b. Indicate if flow is greater or less than expected given the last 24 hours of rain.

Flow Rate	Stormwater Outfall	Creek
N = none	no flow/stagnant pooled water	creek bed is dry
T = trickle	fills 16 oz. cup in 2 minutes	lots of exposed rocks/sediment
M = moderate	between trickle and high	between trickle and high
H = high	fills 16 oz. cup in 1 second	flow close to high water mark

4. Air Temp: Record air temperature using field thermometer placed in the shade, at shoulder height. Depending upon the type of thermometer used, it may take up to 3-4 minutes for it to stabilize.

5. **Water sample**: Be sure hands are clean or wear nitrile gloves to avoid sample contamination and protect yourself from potential contaminants. Collect sample water from the outfall or creek by rinsing the plastic bucket 3 times with the water to be sampled and then collecting a 4th sample to measure. Avoid collecting sediment with the water sample, avoid touching the water or inside of the bucket. If you cannot directly sample from the creek or outfall for bacteria and turbidity measurements, you may want to collect 2 buckets.

6. Bacteria/Turbidity Sample:
    a. Collect the water sample from flowing water at the site (preferred method) using a sterile bottle, rinse the bottle and cap 3 times with sample water before collecting the sample. If the flow is too low, rinse and collect the sample from the sampling bucket that has been rinsed 3 times prior. Do not touch or contaminate the inside of the bottle or cap.
    b. Tightly screw the lid back on the sample bottle. Record the bottle letter on the worksheet.
    c. Keep the samples at 4°C (40°F) by placing them in an ice-filled cooler. Within 6 hours of sampling either begin culture procedures or place in a refrigerator.

7. **Water Temperature** (T) C°**, Dissolved Oxygen** (DO) mg/L**, Specific Conductivity** (SPC) µS/cm**, Salinity** (ppt)**,** and **pH:**
    a. Measure using the YSI Meter. Rinse the meter to remove any remaining droplets from prior outfall. This can be done with your 3x rinsing of sample container or directly in the outflow.
    b. Dip the probe in the water sample and stir gently for 15 seconds. Parameters should be measured as soon as possible after the sample has stabilized as conditions in the bucket will change quickly.
    c. DO will take the longest to stabilize. Swirl the probe quickly, but slow enough to not spill the sample. If you are swirling too fast, DO will keep increasing. If you are swirling too slow, DO will keep decreasing. When DO is both increasing and decreasing slightly with a random pattern, it is time to take the reading.

Troubleshooting: If the DO probe provides unusual measurements;

- abnormally high values greater than 20 mg/l,
- negative numbers,
- never stabilizes,
- or values swing up and down no matter if you stir or not,
- then the membrane in the yellow cap may be perforated or split.
- Disregard the DO values for the rest of the survey. The yellow cap requires replacement.
- Email the person who calibrates the instrument when you return the instrument. Report that the DO cap membrane is possibly perforated or split.

d. Record the values shown on the meter on the worksheet.
e. Replace the gray vinyl sleeve.

10. Observations of the outfall or creek, the sample and immediate downstream area: Record both a number representing severity of the condition observed and write out a short description in the space provided. Use the Notes section if additional space is needed.
    a. **Color**: Assess color qualitatively using visual observations of how severely a sample is discolored. Observations included brown, reddish brown, light green etc… Record the color seen followed by a 1 to 3 scale. Ex: Brown, 3. See below.
    b. **Odor**: Assess odor by describing the intensity or severity of odor. Observations may include sulfur, fossil fuel, sewer, perfume etc. Record 0 or the odor/smell followed by a 1 to 3 scale. Ex: Rotten eggs 2. See below.
    c. **Visual Indicators**: Document the visual observations by describing objects that are on the surface of the water. Observations include sheen, floaters, foam etc... Record 0 or the visual followed by a 1 to 3 scale. Ex: Sheen 1. See below.
    d. Take a photo to document any unusual observations.

Color Severity Scale		**Odor Severity Scale**		**Visual Indicators Scale**	
0	None	0	None	0	None
1	Faint color in sample	1	Faint odor	1	Few/slight
2	Color clearly visible in sample	2	Odor easily detected	2	Moderate
3	Color clearly visible in outfall flow or creek	3	Odor noticeable from a distance	3	Excessive/severe

    e. **NOTE**: If the situation is complex with multiple odors, color and other visuals, fill out a detailed Color, Odor & Visual Indicators Worksheet for the outfall.

11. **At any time, if you note a significant source of pollution (ex: large oil sheen, rushing water when it hasn't rained, very strong color or odor) immediately call one of the contact numbers listed below in the section "Contacts to Report Pollution"**.

Back at the Lab

12. Pack up equipment and clipboard and proceed to the next site, repeat steps 1-10.

13. Turn off the YSI meter after the last sampling site.

1. Create a digital copy of your worksheets using your smartphone, or any other method, to generate a clear, readable pdf (preferred), jpg, or HEIC file.

2. Email to surveydatasheets@googlegroups.com as soon after incubation as possible. This helps us get the news to the cities as quickly as possible!

3. Go to https://friendsofsalishsea.org/volunteer-resources/ to access the VI Data Entry Form.

4. Put your worksheet in the appropriate file.

5. Clean & Store Equipment:
    a. Wipe YSI meter down with Clorox sanitizing wipes.
    b. Wipe YSI cable down with Clorox wipes.
    c. Remove gray vinyl probe cover and set it in white tub in an upside-down position.
    d. Knock out yellow sponge and leave in the tub, also.
    e. Place YSI probe into 1 qt storage container filled with pink pH 4 solution, in the tub.

Reporting Pollution

OIL SPILLS

Call Immediately!

WA Emergency Management Division (800) OILS-911 (800) 645-7911

National Spills Response (800) 424 8802

OTHER POLLUTION

Including sick salmon

Ecology NW Regional Office (Island, King, Kitsap, San Juan, Skagit, Snohomish and Whatcom) (206) 594-0000 or nwroerts@ecy.wa.gov

LOCAL STORMWATER HOTLINES

Anacortes (360) 293-1921
Bellingham (360) 778-7979
Edmonds (425) 771-0235
Everett (425) 257-8821
Mukilteo (425) 263-8088
Oak Harbor (360) 279-4764
Shoreline (206) 801-2700
Poulsbo (360) 779-4078

OTHER HOTLINES

Derelict Boats (Dept of Natural Resources) (360) 902-2628
Derelict Fishing Gear (Dept of Fish & Wildlife) (855) 542-3935
Large marine debris, creosote debris, abandoned boats: https://mycoast.org/wa
Navigation Hazards (US Coast Guard Puget Sound (206) 217 6200
West Coast Marine Mammal Stranding Network (888) 767-6114

Parameters - What they Indicate

Flow: Flow in an outfall during dry weather is an indicator that a water source other than stormwater is flowing through the storm drainage system. It could be natural groundwater flow but could also be sanitary sewer cross-connection, potable water (swimming pool, hydrant flushing), or illegal dumping.

Color: The color of water is influenced by the presence or absence of substances such as metallic salts, organic matter, dissolved or suspended materials. Color can indicate when stormwater has been contaminated by an illicit discharge or illicit connection, but not all illicit discharges will have a color.

Odor: Odor should be assessed qualitatively in the field using your nose to determine if a water sample has a distinct smell. Odor observations are subjective and may include descriptions such as a petroleum, sewage, or chemical odor.

Visual Indicators: Visual indicators other than color, odor, and flow can often indicate when stormwater has been contaminated by an illicit discharge or illicit connection; however, not all illicit discharges will have visual indicators. Visual indicators are assessed qualitatively by field staff using simple visual observations. Ex: abnormal vegetation, algae/bacteria/fungus, deposits/staining, fish kills, floatable, surface film/sum/sheen, or trash/debris.

Water Temperature (T) ºC: Temperature extremes can threaten the health and survival of fish and other aquatic species in many life stages including embryonic development, juvenile growth, and adult migration. Water temperature can be useful in identifying contamination by sanitary wastewater or industrial cooling water. Household and commercial sewage produces heat due to microbial activity during anaerobic decomposition, while industrial cooling water is heated as it is circulated through heat exchangers. Water temperature measurements are typically the most useful for IDDE when indicator sampling is being conducted during cold weather and temperature differences can be significant.

Dissolved Oxygen (DO) mg/L*:* DO is an important parameter for salmonids and other aquatic organisms. Low dissolved oxygen levels can be harmful to larval life stages and respiration of juveniles and adults. DO depends on local hydraulic conditions affecting the oxygenation of the discharge. For this reason, DO is not a widely useful indicator for illicit discharges.

Specific Conductivity (SPC) µS/cm*:* Specific conductivity, also referred to as specific conductance, is a measure of how well water can conduct an electrical current based on ionic activity and content. Specific conductivity is an indicator of dissolved solids from potential pollutant sources such as sewage and wash water, and can help distinguish groundwater from illicit discharges and identify commercial/ industrial liquid waste if used in combination with another parameter such as Hardness, Turbidity, or Detergents/ Surfactants. Specific conductivity can also be used in combination with caffeine or pharmaceuticals (see Other Indicators) to indicate sanitary wastewater.

Salinity (ppt)*:* This is the saltiness or dissolved inorganic salt content of water. The Pacific Ocean has an average salinity of 34 parts per thousand (ppt) compared to 29 ppt in Puget Sound. Measuring salinity will indicate if there is saltwater intrusion in the outfall or creek which will affect conductivity (make it higher).

pH*:* pH measures the hydrogen ion activity on a scale from 1 to 14. Water with a pH below 7.0 is acidic and water with a pH above 7.0 is alkaline or basic. pH values that are lower than 6.5 or higher than 8.5 may be harmful to fish and other aquatic organisms. A low pH can cause heavy metals to leach out of stream sediments, resulting in an increase in dissolved metals concentrations. A high pH can produce a toxic environment, in which ammonia becomes more poisonous to aquatic organisms.

Turbidity (ntu): Turbidity is a measure of how transparent or clear water is based on the amount of sediment or suspended particulates. Large amounts of suspended material can affect fish growth and survival by impairing their vision, gill function, and affecting egg and larval development. Higher turbidity can also increase temperature and thereby decrease dissolved oxygen concentrations in water bodies, affecting the growth of both aquatic animals and plants. High turbidity in water can be attributed to many different sources including soil erosion, construction activities, sanitary wastewater, excessive algal growth, or industrial processes.

***E. coli and Enterococci* Bacteria (cfu/100 ml)**: These bacteria indicate the presence of fecal contamination by warm-blooded animals. *E. coli is* typically used as an indication of fecal contamination of stormwater and fresh water systems while *Entero* is used as an indication of fecal contamination in marine waters. A relatively elevated test result for fecal coliform bacteria may indicate an illicit discharge or illicit connection associated with sewage or a failing septic system. However, it may also indicate waste related to large domestic animals (such as cows, llamas, etc.), pets, or wild animals.

References

- WA Stormwater Center: https://www.wastormwatercenter.org/
- Stormwater Action Monitoring (SAM) Program
- IC-ID Field Screening and Source Tracing Manual May 2020
- COB Surface and Stormwater and Comprehensive Plan 2020