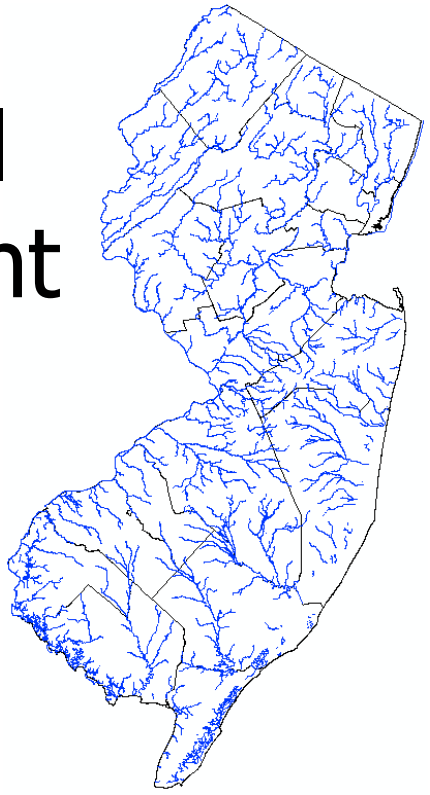
2015-2016

NJDEP Volunteer Monitoring Program

New Jersey Department of Environmental Protection

Biological Assessment Manual



Volunteer Monitoring promotes a sense of stewardship and provides the community with the opportunity to become actively involved in the health of their local watershed.

A guide to filling out the NJDEP Volunteer Biological Monitoring Assessment

Visit us on the web for more info @
http://www.state.nj.us/dep/wms/bwqsa/vm/

Table of Contents

Filling out your Monitoring Packet

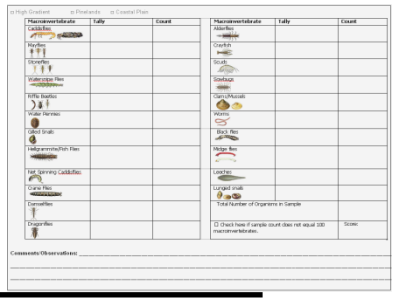
Each time you go out into the field to begin a biological assessment, make sure to have both pages of your biological monitoring packet; General and Macroinvertebrate Tally Sheet.
Fill out all sections in the field.


Biological Assessment
New Jersey Department of Environmental Protection
Volunteer Monitoring Program

The General Monitoring

This page identifies where you are performing your assessment and the weather conditions just before and during monitoring. This page also provides a description of the biological sorting process and how to properly collect macroinvertebrates depending on whether you are in a rocky or muddy bottom stream.

The Macroinvertebrate Tally Sheet



This page is designed to obtain specific biological data regarding the health of your stream. This section is to be completed stream side once you have collected your sample. After performing your biological assessment record the number of macroinvertebrates onto the tally sheet.

Before Heading into the Field

NJDEP is not liable for any event that occurs during monitoring.

1. Determine if it's the right time of year for monitoring especially if you plan to enter the stream
   - -Best times are spring, summer and fall
   - -Worst times are drought, extreme summer days and during flooding
   - -For safety reasons we do not recommend sampling during cold winter months

2. Confirm the time and location with your sampling partner
(Always monitor with another person!!)

3. Check to make sure you have all of your equipment before heading into the field

Suggested Equipment List

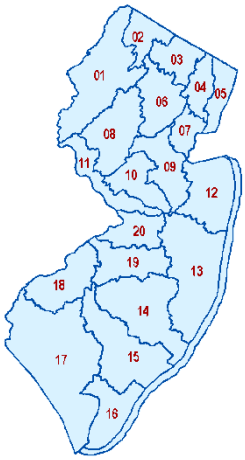
- ✓ Data Sheet
- ✓ GPS/Smartphone
- ✓ Clip Board and Pen/Pencil
- ✓ Measuring Tape and Meter Stick
- ✓ D-Frame Net
- ✓ Bug Identification Tools
  - - Bug ID Card, Magnifying Glass
- ✓ Collection/Sorting Equipment
  - -D-frame net, Bucket Spoons, Small containers, Ice cube trays
- ✓ Proper Attire (Waders, Boots, Long sleeves)

General Monitoring

Site Name and Site ID

Site Name: This is a unique name that you will give each site. The name you select should be descriptive and/or include the local name for the water body. Example, if you are going to a site on the Passaic River, your site name can be "Passaic River at intersection of Rt. 3 and Board St."

Site ID: The Site ID starts with WA (Watershed Ambassador) followed by the closest AMNET site or USGS station. Example: WA0689. Multiple assessments at the same AMNET location can be identified using a, b, c as you move upstream. Example: WA0689a. If there are no AMNET or USGS sites at the location and no other sites have been created by previous Ambassadors (you will need to check on NJ GeoWeb or ArcGIS before you go out in the field), you will use the first 4 letters of the stream. Example: Passaic River will be WAPASS. If the stream is named "Passaic Tributary", you can use WAPASSTRIB. If you are conducting multiple assessments you can use 1, 2, 3 as you move upstream. Example: WAPASS1.



Watershed Management Area & County

WMA: This refers to one of the 20 **W**atershed **M**anagement **A**reas identified by the Department. See the attached map. This information can also be obtained from NJ GeoWeb.

County: The name of the county you are doing the assessment in.

Segment Identification

Your stream reach should be no more than 100 meters.

Segment Beginning: Take a GPS point at the starting point of your assessment

Estimate of Segment Length: Estimate the length of the reach (aim for 100m)

Record the Latitude and Longitude on your data sheet.
You can also check accuracy of GPS points by identifying the latitude and longitude on a USGS topographic map, NJ GeoWeb, ArcGIS or Google Maps.

Survey Team, Activity Time & Date

Survey Team: Record the names of the people involved in the assessment. Remember, never conduct an assessment alone!
Activity Time & Date: Record the Date and Time when the assessment was performed.

Current Weather, Days Since Last Rain, & Temperature

Current Weather: Check the one that best describes the weather conditions on the day of the assessment as Clear, Partly Cloudy, Overcast, Light Rain/Showers, Steady Rain, Heavy Rain, Snow, Heavy Snow Melt.

Days Since Last Rain:
Weather can affect assessment interpretation, so it is important to record recent rainfall or drought conditions. Record the number of days since the last rainfall in the space provided. If it hasn't rained within that week write one of the following: 'More than one week since last rain', OR 'More than one month since last rain'. You can also check the volunteer weather monitoring site at http://www.cocorahs.org/ or Visit the National Weather Service at http://water.weather.gov.

Current Temperature: Enter the air and water temperature in °C. If you need to convert Fahrenheit to Celsius use the Converter at http://www.wbuf.noaa.gov/tempfc.htm.

Stream Reach Width & Depth

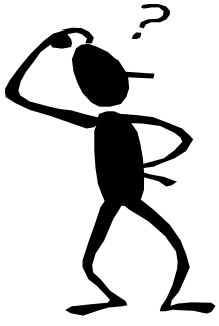
Stream Reach Width

Measure the stream width using your surveyor's tape measure. Simply have one partner stay at the water's edge and the other partner walk directly across and record the measurement. Make sure to record the units you are using. Meter is the unit of choice for the data management system. You should consider the average width of your stream by walking the whole 100m stretch first, then select areas that are accessible and representative of the stretch. Repeat this process 5 times and record each width on your data sheet. Then average the 5 measurements and record the average.

Stream Reach Depth

You should consider the average depth of your stream by walking the whole 100m stretch first, then select areas that are accessible and representative of the stretch. Repeat this process 5 times and record each depth on your data sheet. Then average the 5 measurements and record the average.

Watershed Health Question

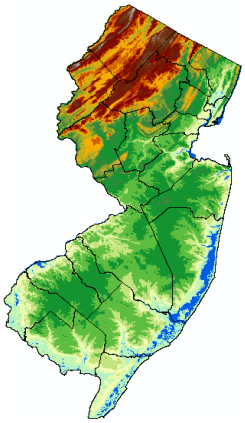


What do you believe to be the greatest potential threat to the stream both now and in the future?

Look around your monitoring site and try to determine what things may be affecting the stream's health. For example, do you see a lot of litter, cows in the stream, or new construction around? Record your answer on the data sheet.

Biological Assessment Information

There are two predominate stream types, rocky bottom and muddy bottom. Rocky bottom streams are found in areas that are high above sea level like the Highlands or the Piedmont region. Muddy bottom streams are found in low-lying areas like the Coastal Plains or the Pinelands. The protocol you follow will depend on the type of stream that you are sampling.



Rocky Bottom

Stand in a riffle area with a D-Frame net facing upstream. Vigorously shuffle your feet and rub rocks with your hands in a one foot square area upstream of your net. When you feel that the upstream area has been thoroughly disturbed, carefully move your net over (or slightly upstream in the riffle section if your stream is very narrow) and repeat this process two more times in sequence (to equal an overall 3 foot square/one meter square area sampled) in the riffle. Pick up the net and rinse it off into a bucket, making sure to check the net for any remaining clinging organisms. Take several samples from different riffle areas in your stream reach (if possible/available) to make up your one overall sample.

Mudd y Bottom

To collect your sample, you will be collecting a series of scoops. Break your scoops down into the following categories: woody debris, leaf packs, vegetated/undercut bank margins, submerged logs, cobble, coarse gravel, and other. If you are sampling undercut/vegetated banks, repeatedly jab your D-frame net vigorously into the sampling habitat. If you are sampling woody debris/submerged logs, you will vigorously scrape the wood with your net. If you have leaf packs in your stream reach, you will rub them upstream of your net to dislodge any macroinvertebrates. To sample the substrate, whether coarse gravel or fine sediment, you will disturb a one foot square area upstream of your net, taking care not to collect too much sediment/debris.

When you believe the area has been disturbed thoroughly when targeting any of these habitats, swing your net back and forth several times to collect any organisms that may be suspended in the water column. That is considered one scoop. A good starting point is to take a total of 20 scoops. Make sure scoops are taken from each of the represented habitat types with the most scoops being taken from the habitat type most common/most productive in the sampling area. If your stream bottom is muddy or silty, you will not find a large diversity of macroinvertebrates in that area, so focus your scoops on more productive habitat types.

You may want to periodically empty your net into a bucket so that macroinvertebrates captured from previous scoops do not get out.

Hint: You may need to take samples up and down your 100 meter stream reach. Find the best habitat areas to sample within each stream reach and always face upstream to avoid losing any macroinvertebrates.

Best habitat refers to places where there are:
Woody debris, Leaf Packs, Boulders, Cobble, Logs, Vegetated Bank Margins

Habitat and River Bottom Composition

Habitat Types Present

Check the boxes that represent the different habitat types present within the stream

□ Fine woody debris	□ Submerged Logs
□ Leaf Packs	□ Cobble
□ Boulders	□ Coarse Gravel
□ Vegetated Bank Margins	□ Other

River Bottom Composition

Evaluate the stream bed in a riffle of your sampling reach. If you are in a muddy bottom area and don't have a riffle evaluate an area that is not a pool. Estimate the percentage of each of the following substrate types present and record your answer in the table on the data sheet. The numbers must add up to 100.

River Bottom Composition (must = 100%)

_____ % Sand	_____ % Silt
_____ % Organic	_____ % Gravel
_____ % Cobble	_____ % Boulder
_____ % Bedrock	_____ % Other

Macroinvertebrate Sorting

Dump all of your macroinvertebrates from your net into a bucket of water. Pick your net clean of any remaining macroinvertebrates and place them in the bucket. Use your small sorting container to swirl the water and the macroinvertebrates in the bucket. Once everything is stirred up well, take a scoop (sub-sample) from the bucket with your sorting container. Sort all of the macroinvertebrates in your sorting container (ice cube trays can help you to stay organized; each compartment can be a different group of organisms). Record the number and each type of macroinvertebrate you have sorted in the table on the next page. If you have 100 or more macroinvertebrates recorded in your table you can stop, if you have less than 100 macroinvertebrates re-stir the bucket and take another sub-sample to sort in your sorting container and continue this process until you have recorded 100 or more macroinvertebrates.

If you have sorted your entire bucket and have not reached 100 macroinvertebrates you need to take another sample from the stream. If after 20 minutes you have not found 25 macroinvertebrates you are to return to the stream to collect more macroinvertebrates to add to the bucket. If after 40 minutes of sorting you have not found 50 macroinvertebrates you are to return to the stream again to collect a third round of samples to add to the bucket. If after an hour and a half and three separate attempts to collect macroinvertebrates to add to the sample bucket you are still unable to sort and identify 100

macroinvertebrates, you will stop sorting and check the box on the assessment form indicating you were unable to find 100 macroinvertebrates.

Observations

Fill in any other observations made about the reach. This can include wildlife observed, anything that appears out of the ordinary or information obtained by talking with local residents concerning the history of the land in that area.

Macroinvertebrate Tally Sheet
After you have sorted 100 macroinvertebrates, tally and record totals on this sheet.

Appendices

A Brief Introduction to Benthic Macroinvertebrates

Benthic macroinvertebrates are animals that lack backbones and are visible to the unaided eye, meaning they do not require magnification to be seen. We call them benthic when they live on the streambed or attach themselves to aquatic plants or floating wood. Common benthic macroinvertebrates include the larval stages of many insects – such as dragonflies, mayflies, and black flies – as well as permanent stream dwellers like mussels, crayfish, and snails.

The presence of benthic macroinvertebrates can tell us a lot about the health of a stream because each organism varies in its ability to tolerate pollution. Mayfly larvae, for example, are very sensitive to pollution and can only survive in clean water. Rat-tailed maggots, on the other hand, are relatively unaffected by pollution and can tolerate highly degraded waterways.

Most of the benthic macroinvertebrates found in New Jersey fall under one of three categories. These categories include pollution intolerant, pollution sensitive, and pollution tolerant. Pollution intolerant organisms can only survive in streams that contain little to no pollution. Pollution sensitive organisms can tolerate some pollution, but cannot live in heavily degraded waterways. Pollution tolerant organisms can survive in very polluted water. The chart below lists common benthic macroinvertebrates found in New Jersey and shows which category they fall under.

Pollution Intolerant	**Pollution Sensitive**	**Pollution Tolerant**
Mayfly Larva	Caddisfly Larva *(net spinning)*	Black Fly Larva
Stonefly Larva	Alderfly Larva	Midge Fly Larva
Caddisfly Larva *(case making)*	Damselfly Larva	Lunged Snail
Dobsonfly Larva/Hellgrammite	Dragonfly Larva	Aquatic Worm
Watersnipe Fly Larva	Crane Fly Larva	Leech
Riffle Beetle	Sowbug	
Water Penny	Scud	
Gilled Snail	Crayfish	
	Clam/Mussel	

Remember: a healthy stream will contain benthic macroinvertebrates from all three categories – it will not just include pollution intolerant organisms. Biological diversity is the key to a healthy stream!

2015-2016

Biological Assessment

New Jersey Department of Environmental Protection

General Sheet

*** Site ID:** _____ *** Watershed Management Area:** _____

*** Site Name:** _____ *** County:** _____

*** Segment Identification:** Latitude/Longitude: _____

Estimate of Segment Length (aim for 100m): _____

*** Survey Team:** _____

*** Time:** _____ * **Date:** _____

Current Weather: (circle one) □Clear □Partly Cloudy □Overcast □Light Rain □Steady Rain □Heavy Rain □Snow □Heavy Snow Melt

Days since last rain: _____ **Air Temp** _____ ° C **Water Temp**_____° C

Transect: Avg. Stream Width _____meters Avg. Stream Depth _____meters

Velocity _____meters/second

What do you believe to be the greatest potential threat to the stream both now and in the future?

_____

_____

_____

Biological Assessment

Rocky Bottom

Take your sample(s) within riffle areas. Record the Habitat Types Present and the percentage of each substrate type present in riffles in the River Bottom Composition tables below.

Muddy Bottom

Take about 20 scoops. The most scoops should be taken in the most representative habitat type present. Record the Habitat Types Present and the percentage of each substrate type present in the River Bottom Composition tables below.

Habitat Types Present (check all that apply)

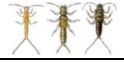
□ Fine woody debris
□ Leaf Packs
□ Boulders
□ Vegetated Bank Margins
□ Submerged Logs
□ Cobble
□ Coarse Gravel
□ Other

River Bottom Composition (must = 100)

_____ % Sand
_____ % Organic
_____ % Cobble
_____ % Bedrock
_____ % Silt
_____ % Gravel
_____ % Boulder
_____ % Other

Macroinvertebrate Sorting

Empty all of your macroinvertebrates from your net into a bucket of water. Pick your net clean of any remaining macroinvertebrates and place them in the bucket. Use your small sorting container to swirl the water and the macroinvertebrates in the bucket. Once everything is stirred up well, take a scoop from the bucket with your sorting container. Sort all of the macroinvertebrates in your sorting container and record their numbers in the table on the next page. If you have 100 or more macroinvertebrates recorded in your table you can stop, if you have less than 100 macroinvertebrates re-stir the bucket and take another scoop to sort in your sorting container, continue this process until you have recorded 100 or more macroinvertebrates. If you have sorted your entire bucket and have not reached 100 macroinvertebrates you need to take another sample from the stream.

Macroinvertebrate	Tally	Count
Mayflies 		
Stoneflies 		
Caddisflies 		
Hellgrammite/Fish Flies 		
Watersnipe Flies 		
Riffle Beetles 		
Water Pennies 		
Gilled Snails 		
Net Spinning Caddisflies 		
Alderflies 		
Damselflies 		
Dragonflies 		

Macroinvertebrate	Tally	Count
Crane Flies 		
Sowbugs 		
Scuds 		
Crayfish 		
Clams/Mussels 		
Black flies 		
Midge flies 		
Lunged snails 		
Worms 		
Leeches 		
Check one: □ High Gradient □ Pinelands □ Coastal Plain	**Total Number of Organisms in Sample**	
Check here if sample count does not equal 100 macroinvertebrates. □		Score:

General Observations (character limit 60): _____

_____

Overall Comment (character limit 250)

_____

_____

Macroinvertebrate Cheat Sheet

Flatworm/Planaria

Gilled Snail

Lunged Snails

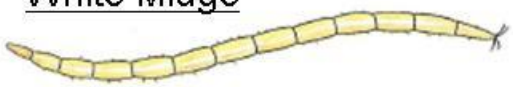
Leech

Sow Bug

Scud

Cray Fish

White Midge



Red Midge

Mussel

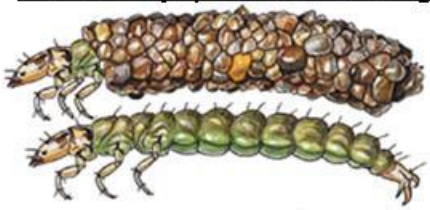
Black Fly Larvae

Aquatic Worm

Clam

Macroinvertebrate Cheat Sheet

Caddisfly (Case Building)



Riffle Beetle Larvae

Net Spinning Caddisfly

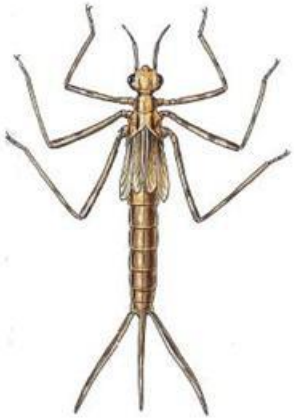
Water Penny

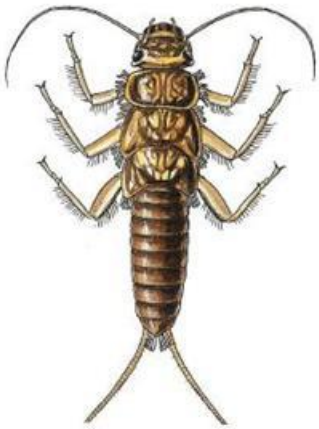
Water Snipe Fly

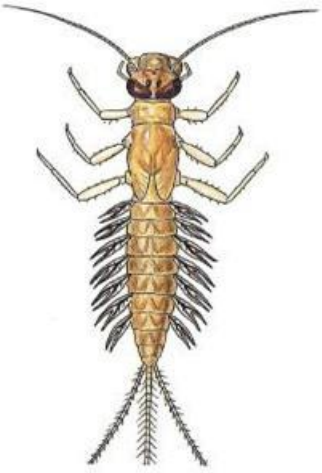
Crane Fly

Dragonfly Nymph

Dobsonfly/Hellgrammite







Damselfly Nymph

Stonefly Nymph

Mayfly Nymph

DIDYMO (Rock Snot) DECONTAMINATION

Treat all streams like they have Didymo, not just ones that have been confirmed.

Didymo is not visible to the naked eye at first and by the time you see it, it is too late.

When collecting macroinvertebrates from the stream, return them back to the same stream and the same location. No mixing samples.

If you want to do more than one assessment in a day you should only work on one stream per day. Start upstream and work downstream when changing locations (following how the river flows), to avoid contaminating any upstream locations that have not been exposed to Didymo.

You should be clean your equipment after each day in same stream or in between sampling events on different streams.

You must decontaminate all small equipment (e.g., buckets, nets, water sampling equipment) AND Personal Protective Equipment (e.g., rain gear, gloves, boots, waders and PFDs)

1. Remove all organic material from gear
2. Fill bucket with Alconox and stream water and place all equipment in the tub.
3. Scrub small and personal protective equipment.
4. Rinse or let dry completely

Glossary

Algae: A chlorophyll-containing plant ranging from one to many cells in size that lives in fresh or salt water.

Baseflow: The portion of stream flow that is derived from groundwater; average stream discharge during low flow conditions.

Benthic (Bottom-dwelling)**:** The plant and animal life whose habitat is the bottom of a sea, lake, or river.

Channelization: Straightening of a stream channel to make water move faster.

Channelized: The straightening and deepening of streams. Channelization reduces the ability of the stream to assimilate waste and disturbs fish breeding areas.

Culvert: A channel used for draining water, often enclosed in steel, concrete, or plastic; can be used to allow water to pass underneath a road or embankment.

Ecosystem: The interacting system of a biological community (plants, animals) and its non-living environment.

Effluent: The wastewater from a municipal or industrial source that is discharged into the water.

Embeddedness: The degree to which objects in the stream bottom are surrounded by sediment.

Erosion: The wearing away of the land surface by wind or water.

Eutrophication: A process where water bodies receive excess nutrients that stimulate excessive plant growth.

Floodplain: The flat area of land adjacent to a stream that is formed by flood processes.

Gradient: The slope or steepness of the stream.

Macrophytes: Aquatic plants, growing in or near water that are either emergent, submergent, or floating.

Macroinvertebrate: Organisms found attached to rocks or within the sediments of the stream bed, often larval stages of insects and are indicative of stream health.

Non-Point Source Pollution: "Diffuse" pollution, generated from large areas with no particular point of pollutant origin, but rather from many individual places. Urban and agricultural areas generate nonpoint source pollutants.

Nutrient: Any substance, such as fertilizer, phosphorus, and nitrogen compounds, which enhances the growth of plants and animals.

Point Source Pollution: A discharge of water pollution to a stream or other body of water, via an identifiable pipe, vent, or culvert.

Pool: An area of relatively deep slow water in a stream that offers shelter to fish.

Quality Assurance (QA): Quality Assurance is the larger system to see that Quality Control (QC) is maintained. QA asks if we are doing the right things (in our case are we monitoring the right things to detect changes in water quality).

Reach: A stream section with fairly similar characteristics.

Riffle: A shallow, gravely area of streambed with swift current where water is breaking over rocks, wood, or other partly submerged debris and producing surface agitation.

Riprap: A sustaining wall built of rocks.

Riparian Zone: An area, adjacent to and along a watercourse, which is often vegetated and constitutes a buffer zone between the nearby lands and the body of water.

Run: A stretch of fast smooth current, deeper than a riffle.

Runoff: The portion of rainfall, melted snow, or irrigation water that flows across the ground surface and eventually returns to streams. Runoff can pick up pollutants from the air or the land and carry them to streams, lakes, and oceans.

Sediment: Fine soil or mineral particles that settle to the bottom of the water or are suspended in the water.

Stormwater Runoff: Water that washed off the land after a rainstorm. In developed watersheds it flows off of roofs and pavement into storm drains which may feed directly into the stream; often carries concentrated pollutants.

Substrate: The material that makes up the bottom layer of the stream, such as gravel, sand, or bedrock.

Suspended Sediments: Fine material or soil particles that remain suspended by the current until deposited in areas of weaker current. They create turbidity and when deposited, can smother fish eggs or early plant growth.

Topographic: The configuration of a surface area including its relief, or relative elevations, and the position of its natural and man-made features.

Turbidity: Cloudiness of the water, caused by suspended sediments or excess organic matter.

Volunteer Pinelands Macroinvertebrate Index

Organisms	Count	% Crustacea & Mollusca Taxa	# Insect Taxa	# EPT / # Tolerant		# Tolerant Taxa	% Worm, Leech, Lunged Snail
				EPT Taxa	Tolerant Taxa		
A	B	C	D	E	F	H	I

	Pollution Intolerant							
1	Mayfly							
2	Stonefly							
3	Caddisfly (case-building)							
4	Hellgrammite/ Dobsonfly							
5	Watersnipe Fly*							
6	Riffle Beetle							
7	Water Penny*							
8	Gilled Snail							
	Pollution Sensitive							
9	Net-Spinning Caddisfly							
10	Alderfly							
11	Damselfly							
12	Dragonfly							
13	Crane Fly							
14	Sowbug							
15	Scud							
16	Crayfish							
17	Clams/Mussels							
	Pollution Tolerant							
18	Black Fly							
19	Midge Fly							
20	Lunged Snail							
21	Aquatic Worm							
22	Leech							
23	**Total Individuals**							
24	**Total Taxa**							
25	**Percent**							

* These macroinvertebrates are not found in the Pinelands

Check Box	Step	
	1	Column B- Record the number of individual organisms present in each group (taxa) in your sample. Record total number of individuals in box B23. [Aim for approximately 100 macros – you must have 100 macros +/- 10% (90-110 macros) in order for the VPMI to work]
	2	Column B- Total the number of taxa which had individual organisms present and record in box B24.

	3	Column C through H- Mark an X in each box where taxa for that category were present.
	4	Column C through H, box 24. Add together the number of Xs for each column and record sum in boxes C24-H24 for each respective category.
	5	Column I. Record the number of individual organisms in each taxa in this category in boxes I20-I22. Add totals in boxes I20-I22 and record in box I23.
	6	Divide the Total Taxa from Column C (box C24) by the Total Taxa from Column B (box B24) and multiply by 100 (C24/B24 * 100). Record this number in the Percent box of Column C (box C25)
	7	Divide the Total Individuals from Column I (box I23) by the Total Indivuals from Column B (box B23) and multiply by 100 (I23/B23 * 100). Record this number in the Percent box 25 of Column I
	8	Enter the numbers from the specified boxes into the formulas in the Metrics Table below and calculate the scores for each Metric
	9	Total the Score Column in the Metrics Table and record this number in the Total box of the Metrics Table. Divide this number by 5 to find the average Metrics Score.
	10	Compare the Average Score to the chart below to find your final stream score

Metrics Table (The scoring scale is 0 – 100. Direction of metric change with increasing stress is shown with + or – signs)

Metric #	Metric Name	Scoring Formula	Score	
1	Percent Crustacea & Mollusca Taxa (+)	100 * (47.2- C25) / (47.2-0)		
2	Number of Insect Taxa (-)	100 * D24 / 10		
3	Number of EPT Taxa/(Number of Tolerant Taxa + 1) (-)	100 * (E24/(F24+1))		
4	Percent Worm, Leech and Lunged Snail Individuals (+)	100 * (64.7 – I25) / (64.7-0)		
5	Number of Tolerant Taxa (+)	100 * (4- H24) / (4-2)		
			Total	**Average**

≤ 45	Stressed
46 - 74	Undetermined
≥ 75	Healthy

Volunteer Coastal Plains Macroinvertebrate Index

	Organisms A	Count B	# EPT Taxa C	% Non Insect Taxa D	Biotic Index E	% Intolerant Taxa G	% Worm, Leech, Lunged Snail H
	Pollution Intolerant						
1	Mayfly						
2	Stonefly						
3	Caddisfly (case-building)						
4	Hellgrammite/ Dobsonfly						
5	Watersnipe Fly						
6	Riffle Beetle						
7	Water Penny						
8	Gilled Snail						
	Pollution Sensitive						
9	Net-Spinning Caddisfly						
10	Alderfly						
11	Damselfly						
12	Dragonfly						
13	Crane Fly						
14	Sowbug						
15	Scud						
16	Crayfish						
17	Clams/Mussels						
	Pollution Tolerant						
18	Black Fly						
19	Midge Fly						
20	Lunged Snail						
21	Aquatic Worm						
22	Leech						
23	**Total Individuals**						
24	**Total Taxa**						
25	**Percent**						

Check Box	Step	

	1	Column B- Record the number of individual organisms present in each group (taxa) in your sample. Record total number of individuals in box B23. [Aim for approximately 100 macros – you must have 100 macros +/- 10% (90-110 macros) in order for the VCPMI to work]
	2	Column B- Total the number of taxa which had individual organisms present and record in box B24.
	3	Column C & D - Mark an X in each box where taxa for that category were present.
	4	Columns C & D - Total the X's in each column and record in boxes C24 & D24, respectively.
	5	Column D – Calculate the % non-insect taxa: box D24/ box B24*100. Enter result in Box D25.
	6	Column E- For each taxa present in the Pollution Intolerant Category enter a score of 2. For each taxa present in the Pollution Sensitive Category enter a score of 1.
	7	Column E- Add the total (all of the 2s and 1s) for Column E and record in box E24 (this is not Total Taxa but rather Taxa Score Total)
	8	Column G – Place an X in each box where taxa for that category were present.
	9	Column G –Total the X's in Column G and record in box G24.
	10	Column G – Calculate the % Intolerant taxa: box G24/ box B24*100. Enter result in box G25.
	11	Column H – Record the number of individuals present for each taxa in this category. Add total and record in box H23
	12	Column H – Calculate the % Worm, Leech and Lunged Snail: box H23/ box B23*100. Enter result in box H25.
	13	Enter the numbers from the specified boxes into the formulas in the Metrics Table below and calculate the scores for each Metric
	14	Total the Score Column in the Metrics Table and record this number in the Total box of the Metrics Table. Divide this number by 5 to find the Average Metrics Score.
	15	Compare the Average Score in the Metrics Table to the chart below to find your final stream score.

Metrics Table (The scoring scale is 0 – 100. Direction of metric change with increasing stress is shown with + or – signs)

Metric #	Metric Name	Scoring Formula	Score	
1	Number of EPT Taxa (-)	100 * C24 / 3		
2	Percent NonInsect Taxa (+)	100 * (62.5- D25) / (62.5-16.67)		
3	Beck's Biotic Index (-)	100 * E24 / 14 (if score > 100, use 100 as default score)		
4	Percent Intolerant Taxa (-)	100 * G25 / 44.4		
5	Percent Worm, Leech and Lunged Snail Individuals (+)	100 * (46.2- H25) / (46.2-1.85)		
			Total	Average

≤ 35	Stressed
36-64	Undetermined
≥ 65	Healthy

Check Box	Step	

	1	Column B- Record the number of individual organisms present in each group (taxa) in your sample. Record total number of individuals in box B23 [Aim for approximately 100 macros – you must have 100 macros +/- 10% (90-110 macros) in order for the VPMI to work]
	2	Column C- For each taxa present in the Pollution Intolerant Category enter a score of 3. For each taxa present in the Pollution Sensitive Category enter a score of 2. For each taxa present in the Pollution Tolerant Category enter a score of 1.
	3	Column C- Add the total and record in box C23.
	4	Compare the Total from Column C to the chart below to find your stream rating.

	Organisms	Count	Biotic Index
	A	B	C
	Pollution Intolerant		
1	Mayfly		
2	Stonefly		
3	Caddisfly (case-building)		
4	Hellgrammite/Dobsonfly		
5	Watersnipe Fly		
6	Riffle Beetle		
7	Water Penny		
8	Gilled Snail		
	Pollution Sensitive		
9	Net Spinning Caddisfly		
10	Alderfly		
11	Damselfly		
12	Dragonfly		
13	Crane Fly		
14	Sowbug		
15	Scud		
16	Crayfish		
17	Clams/Mussels		
	Pollution Tolerant		
18	Black Fly		
19	Midge Fly		
20	Lunged Snail		
21	Aquatic Worm		
22	Leech		
23	**Total**		

0 - 12	Stressed

13 - 19	Undetermined
≥ 20	Healthy

Volunteer High Gradient Macroinvertebrate Index