PENNSYLVANIA FISH AND BOAT COMMISSION

Stream Habitat Visual Survey Data Sheet

Instructional Guide

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Stream Habitat Visual Survey Data Sheet is a visual monitoring tool to evaluate stream conditions and the fishery with an emphasis on habitat.

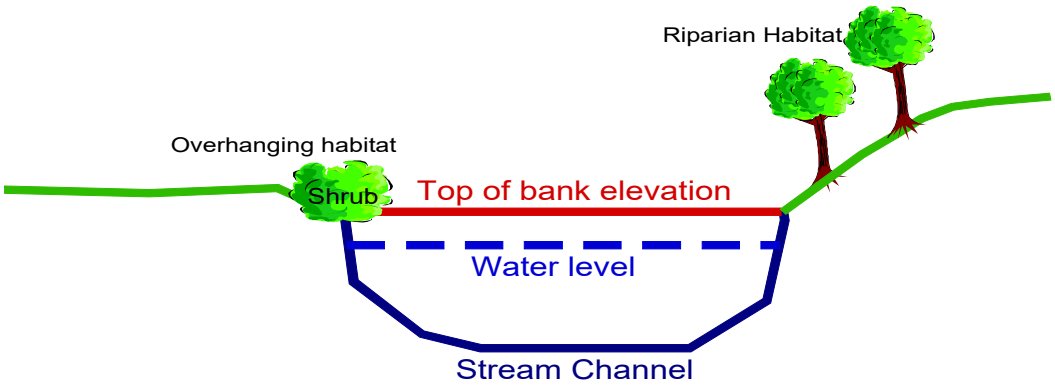
Introduction:

The stream habitat survey data sheet is a visual monitoring tool that can be done on any stream to assess 10 parameters of stream, bank, and riparian zone. The 10 parameters are scored from 0 to 20 and are broken into four condition categories: optimal, suboptimal, marginal, and poor. Two or more evaluators are recommended to discuss and determine a consensus score for each parameter. The key is to have consistent, repeatable parameters to evaluate the multitude of stream types and systems regardless of low or high gradient flow. The survey will help document what is present and prioritize what needs to be improved. As a visual monitoring tool, it can be used to compare before and after scores for evaluating the effectiveness of enhancement projects. To help keep consistency, guidelines are used for each parameter and will be discussed throughout this document. Site conditions and lengths will vary and thus this survey will focus on scoring a 300 meter reach of stream for consistency. If the site is over 300 meters, then the middle-most 300 meters will be used for the survey. If the site falls short of 300 meters, then an equal distance upstream and downstream of the site will become a part of the evaluation area to equal 300 meters. The survey area will be recorded on the data sheet as the downstream limit latitude and longitude coordinates and/or river mile. Water levels also vary throughout the year and evaluators will score all parameters by adjusting to low flow stream conditions typically found during the months of June thru September. Low flow conditions are the critical survival times for cold water species. If the stream levels are unknown, the evaluators should refer to USGS Current Water Data for Pennsylvania https://waterdata.usgs.gov/pa/nwis/rt.

1. Total instream Fish Habitat

Instream habitat includes everything that is within the stream channel to the top of the bank, but does not have to take place in the water. Fish habitat cover can be found from overhanging vegetation above the water level, but below the top of the stream bank elevation. Vegetation above the top of the bank elevation will not be considered fish habitat, but will be considered for the riparian zone vegetation. Instream fish habitat variety includes natural structures as well as man-made structures. Natural structures are logs, fallen trees, overhanging vegetation, woody debris, root masses, undercut banks, boulders, large rocks, cobble, and gravel. Man-made structures for an example can be bridge abutments, piers, footers or concrete pads that are undercut to provide habitat space. Habitat structures that are built out of natural material shall be considered as natural structures.

Substrate is a necessary instream habitat and must be taken into consideration. If fish habitat structure is available it must also reside where there is favorable substrate for instance, gravel, cobble, and boulders.



	Condition Category			
Habitat Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
1. Total Instream Fish Habitat Note: Ex. of habitat: snags, logs, undercut banks or bridge abutments, boulder, stream bottom etc.	Greater than 70% of the stream has fish habitat present in favorable substrate (gravel, cobble, boulder)	40-70% of the stream has fish habitat present in favorable substrate (gravel, cobble, boulder)	20-40% of the stream has fish habitat present in favorable substrate (gravel, cobble, boulder	Less than 20% of the stream has fish habitat present in favorable substrate (gravel, cobble, boulder
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

2. Adult Instream Fish Habitat

Adult fish habitat must apply to the same type of habitat as previously mentioned for parameter 1, Instream Fish Habitat. The determining factor for adult fish habitat is that the habitat must occur in at least 12 inches of water or greater during predicted low flow conditions. Overhanging vegetation above the water level will still be considered adult fish habitat as long as there is 12" of water depth underneath it.

	Condition Category			
Habitat Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
2. Adult Instream Fish Habitat Note: Ex. of habitat: snags, logs, undercut banks or bridge abutments, boulder, etc.	Greater than 50% of the available stable habitat occurs in 12 inches or greater water depth.	30-50% of the available stable habitat occurs in 12 inches or greater water depth.	10-30% of the available stable habitat occurs in 12 inches or greater water depth.	Less than 10% of the available stable habitat occurs in 12 inches or greater water depth.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

3. Embeddedness and Macroinvertebrates Colonization

Embeddedness is defined by the amount of silt, sand, and sediment that has covered or embedded large substrate material like gravel, cobble, and boulders. Stream bottom substrate is primarily the habitat zone for benthic macroinvertebrates and fish. It's important for these organisms to have ideal colonization to thrive and provide a food source. This parameter should be evaluated in faster moving water because finer particles are typically present in slower moving regimes like glides and pools. Riffles and runs under optimal conditions should be absent of fine particles. The stream bottom substrate should be easy to move around with minimal to no cloudy water present when the substrate is agitated.

	Condition Category			
Habitat Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
3. Embeddedness and Macroinvertebrate Colonization Note: Evaluate in fastest moving water present.	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment providing optimal diversity of niche space.	Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment and still provides suboptimal diversity of niche spaces.	Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment and provides marginal diversity of niche spaces.	Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment and provides very little diversity of niche spaces.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

4. Velocity/Depth Regime

There are four flow regime designations that make up the characteristics of moving water: **pool, glide, run, and riffle**. Optimum streams will have all four regimes present in equal proportions. A 300 meter survey site will have roughly 75 meters of each regime for optimum conditions. A **pool** is defined by slow deep water of at least 18 inches in depth and has a velocity not greater than 0.3m/sec or 1ft/sec. A **glide** is defined by slow water that is less than 18 inches in depth and has a velocity not greater than 0.3m/sec. A **run** is defined by fast moving water that is at least 18 inches in depth and has a velocity greater than 0.3m/sec. A **riffle** is defined by fast moving water that is no more than 18 inches in depth and has a velocity greater than 0.3m/sec.

	Condition Category			
Habitat Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
4. Velocity/Depth Regime Equal lengths of Riffle, Run, Pool, and Glide Note: Pool= > 18" depth Note: Slow is < 0.3 m/s	All four regimes present with a 1:1:1:1 ratio of slow-deep (Pool), slow-shallow (Glide), fast-deep (Run), fast-shallow (Riffle)	Only 3 of 4 present or 1 regime is not proportionate of slow-deep (Pool), slow-shallow (Glide), fast-deep (Run), fast-shallow (Riffle)	Only 2 of 4 present or 2 regimes are not proportionate of slow-deep (Pool), slow-shallow (Glide), fast-deep (Run), fast-shallow (Riffle)	Only 1 regime prevalent of: slow-deep (Pool), slow-shallow (Glide), fast-deep (Run), fast-shallow (Riffle)
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

5. Channel Alteration

Channel Alteration describes areas of human impacts to the natural stream channel and/or banks. There are many examples of human impacts that include urban and rural areas. Uniform or straightened stream channels lack natural meandering patterns. Dredging is an example of channel alteration to deepen the channel. Also, channel widening is an alteration to increase volume capacity. Some additional examples of channel alteration includes, bridge abutments, dams, rip-rap, dikes, gabion baskets, flood control areas, and concrete channels or banks. Exclude stream habitat improvement structures, because they are intended to enhance or replace habitat and restore the form and function of natural stream channels.

	Condition Category			
Habitat Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
5. Channel Alteration Note: Exclude Habitat devices acting as streambank shoring structures	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization i.e., dredging or old dams (greater than past 20 years), but recent channelization is not present.	Channelization may be extensive; 40-80% of stream reach channelized and disrupted. Embankments or shoring structures present on both banks i.e. rip-rap, dikes	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

6. Sediment Deposition: Island and Bar Formations

Sediment deposition is a measure of the amount of sediment that has accumulated in the stream channel that is altering channel flow and/or filling in runs and pools. Sediment deposition may cause the formation of point bars and islands. Point bars occur along the inside part of a bend along the banks when and where the flow/velocity of the stream is less. Island formation can occur from obstructions in the stream channel where deposition can collect. Island formation is evident in over-widened stream channels where and when the energy and velocity is spread out over a wider range than the natural stream width. High levels of sediment deposition are symptoms of an unstable and continually changing environment that becomes unsuitable for many organisms. Many types of stream habitat structures function to catch deposition to restore stream banks and channels to their natural width. Sediment deposited in this manner should not be considered as bar formations.

	Condition Category			
Habitat Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
6. Sediment Deposition: Island and Bar Formations Note: Exclude Habitat devices from increasing deposition along banks	Little or no enlargement of new islands or point bars and less than 20% of the bottom affected by deposition.	Some new increase in island formation or point bars, 20-50% of the bottom affected by slight deposition in pools.	Moderate deposition on old and new bars or islands; 50-80% of the bottom affected by moderate deposition in pools.	Heavy deposits of material, increased bar and island development; greater than 80% of the bottom affected by heavy deposition; pools filling in with sediment
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

7. Bank Stability

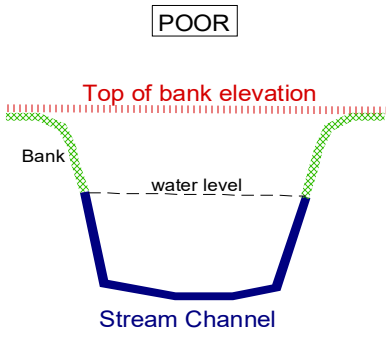
Bank stability is an observation to determine the rate at which a bank can erode. Some factors to consider are types of soil, stream velocity, energy, force, and pressure within the channel. Although steep banks and vegetation may be a part of the observation, they may not be true indicators for stability for this parameter. Vegetation can vary greatly in root structures which may be misleading to determine the overall bank stability by vegetation alone. The steepness of the bank will be observed and scored for bank slope and connectivity to the flood plain in parameter 8. Whereas, vegetation is beneficial to the riparian zone and will be observed and scored in parameter

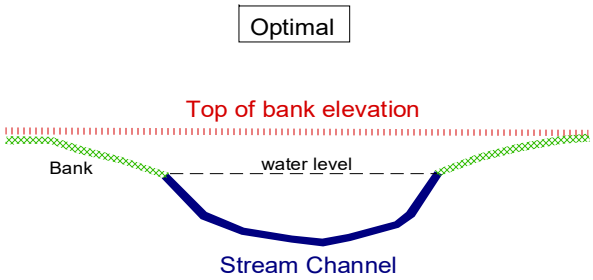
Bank stability for this parameter will focus on soil type and stream velocity, energy, force, and pressure within the channel. Faster moving water against a non-vegetated bank that has sandy or organic soils will be highly erodible and will result in a poor score. Under the same conditions, a bank composed of clay soils will result in a higher score, because the erodibility of clay is less than that of sandy soil. Also, rip-rap banks typically lack vegetation and are found on steeper banks. Even though the bank lacks vegetation and is steep, the rip-rap provides stability. A sand and/or organic soil bank that is vegetated must be observed to determine the velocity and pressure along the bank to provide the observer with a true stability score because of the unstable soil type.

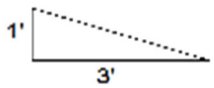
Habitat Parameter	*Condition Category*											
	Optimal		**Suboptimal**			**Marginal**			**Poor**			
7. Bank Stability Note: Determine left & right banks by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. Less than 5% of bank affected.		Moderately stable; infrequent, small areas of erosion mostly healed over. 5 – 30 % of bank in reach has areas of erosion.			Moderately unstable; 30 – 60 % of bank in reach has areas of erosion; high erosion potential during floods.			Unstable; many eroded areas; bare areas frequent along straight sections and bends; obvious bank sloughing; 60 – 100 % of bank has erosional scars.		
Score (LB):	10	9	8	7	6	5	4	3	2	1	0
Score (RB):	10	9	8	7	6	5	4	3	2	1	0

8. Bank Slope and Connectivity to Flood Plain

Bank slope and flood plains provide energy/pressure release to the stream channel during rising water levels. Stream channel energy/pressure can be a combination of velocity and/or the volume of water confined within the channel. As water level rises, so does the amount of energy/pressure in the stream channel. Excess energy/pressure is detrimental to the overall health of the stream. Banks that are vertical and high will hold greater energy/pressure within the stream channel than banks that are sloped and have lower bank heights. High vertical banks are more susceptible to erosion during rain and storm events and will lead to an unstable stream channel resulting in poor habitat conditions. When rising water levels travel up sloped banks and/or have access to the flood plain the energy can be dispersed throughout a larger area. Banks that are sloped to a less than or equal to a 3:1 ratio, every one foot of vertical height there is at least three feet of horizontal direction, offer a gradual incline to access the flood plain. Banks that have a gradual incline offer a greater dispersing area for rising water levels to spread out within the stream channel before even accessing the flood plain.



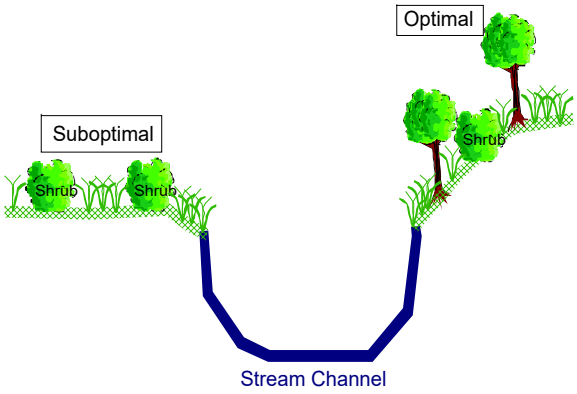


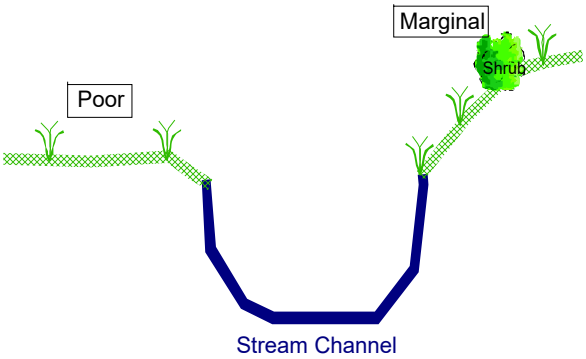
Habitat Parameter	Condition Category										
	Optimal		Suboptimal			Marginal			Poor		
8. Bank Slope and Connectivity to Flood Plain  **Note: a 3:1 slope or gradual incline is ideal for bank stability, vegetation, and flood plain access**	Greater than 80% of the bank has a minimum of a 3:1 slope and high water flow has easy to no restrictions to access the flood plain.		80-50% of the bank has a minimum of a 3:1 slope and high water flow has moderate access to the flood plain.			50-30% of the bank has a minimum of a 3:1 slope and high water flow has limited access to the flood plain.			Less than30% of the bank has a minimum of a 3:1 slope and high water flow has very limited to no access to the flood plain.		
Score (LB):	10	9	8	7	6	5	4	3	2	1	0
Score (RB):	10	9	8	7	6	5	4	3	2	1	0

9. Immediate Riparian Zone and Vegetative Protection

The riparian zone is an important ecological factor when determining the overall conditions of a stream corridor. Many organisms habituate in this area. These organisms form an important symbiotic relationship between terrestrial and aquatic species. Reptiles and amphibians frequently utilize this area for a food source as well as refuge. Many insects, terrestrial or aquatic, utilize this area and also provide an essential food source. The riparian zone is not just a habitat for insects and animals, but provides protection from stream bank erosion and shade along the stream corridor. Vegetation may also filter out some pollutants, sediment or chemical, from reaching the stream in runoff.

In order to provide optimal conditions for a multitude of functions, there needs to be three classifications of vegetation present. The three classifications are described as trees, shrubs, and non-woody plants. All three classifications have their importance, but all need to be present for optimal conditions. Plants whether native or invasive can be noted, but will not dictate the scoring conditions. All vegetation plays a role in the riparian zone.





Habitat Parameter	Condition Category											
	Optimal		Suboptimal			Marginal			Poor			
9. Immediate Riparian Zone and Vegetative Protection **Note: Water's edge to the top of the bank and back 10 Feet**	Greater than 90% of the stream bank surfaces covered by vegetation including trees, shrubs, and non-woody vegetation. Or at least 90% of mature tree canopy is present		70 - 90% of the stream bank surfaces covered by vegetation, but one class of plant may not be represented or tree canopy is lacking.			50 - 70% of the stream bank surfaces covered by vegetation; patches of bare soil obvious; or two plant classes not represented and/or tree canopy is greatly lacking.			Less than 50% of the stream bank surfaces covered by vegetation; disruption and bare soil is highly visible. Or very little to no tree canopy present.			
Score (LB):	10	9	8	7	6	5	4	3	2	1	0	
Score (RB):	10	9	8	7	6	5	4	3	2	1	0	

10. Riparian Zone

The riparian zone is an indicator of vegetation density and health in the area outside of the stream channel and banks, but is a significant part of a stream's health. The riparian zone serves to catch and buffer excess runoff. Runoff from storm events may carry excess nutrient and sediment into the waterways when a riparian zone is lacking. Elevated nutrient and sediment loads in a waterway can be detrimental to the stream's health.

An optimal riparian zone has little to no human disturbance present. A riparian zone is altered by human and/or farming practices for example: roadways, hard surface trails, urban development, houses, parking areas, golf courses, plowing, grazing animals, timber harvesting, mowing, and others. These activities alter a riparian zone, but can vary on the degree at which they may degrade it. To help determine its degrading effect, one can look at the percentage of disturbed and undisturbed area in the riparian zone. An area 90-100 percent undisturbed will result in an optimal scoring. An area 0-20 percent undisturbed will result in poor scoring.

Habitat Parameter	*Condition Category*										
	Optimal		**Suboptimal**			**Marginal**			**Poor**		
10. Riparian Zone Note: Riparian zone = 4 times stream width but not > 18 meters (59')	Vegetative disruption is minimal or not evident; almost all plants allowed to grow naturally. Human or farming activities not evident.		Vegetative disruption is present by human or farming activities but not affecting full plant growth potential to any great extent.			Vegetative disruption is obvious by human or farming activities; plant growth is moderately affected or prohibited to grow naturally.			Vegetative disruption by human or farming activities have severely impacted plant growth resulting in little or none existing; impervious surface or bare soil is present.		
Score (LB):	10	9	8	7	6	5	4	3	2	1	0
Score (RB):	10	9	8	7	6	5	4	3	2	1	0

References:

Barbour, M.T., J. Gerristen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of water; Washington D.C.