

Standard Operating Procedure 6:

Rapid Habitat Assessment in High Gradient Wadeable Streams (Version 1.0)

Summary

After benthic macroinvertebrate (BMI) samples and water quality data have been collected, the sampling crew conducts a visual-based habitat assessment of the stream reach using methods extracted directly from the USEPA (2004) Wadeable Streams Assessment (WSA). The methods summarized here are only a portion of those provided in that document; for example, instructions for assessing low gradient streams are not included because the ERMN samples BMIs only in high gradient streams.

The habitat assessment procedures used are those included in EPA's Rapid Bioassessment Protocols (RBP), originally published by Plafkin et al. (1989), and revised by Barbour et al. (1999). The procedures used for WSA are modified from those published previously for EMAP-SW (Lazorchak et al., 1998), and the original RBP procedures (Plafkin et al., 1989) to include additional assessment parameters for high gradient streams. These modifications are based on refinements from various applications across the country. The approach focuses on integrating information from specific parameters on the structure of the physical habitat.

Revision Log

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
NA	2/23/2016	C. Tzilkowski	NA	Protocol Implementation Plan publication	1.0

Procedure

Blank Rapid Habitat Assessment Forms are available in the ERMN office and in USEPA (2004). Be sure that there are ample copies printed prior to the field season. For each of the 10 habitat parameters (Table 1), determine the general “quality” category (“POOR”, “MARGINAL”, “SUB-OPTIMAL”, or “OPTIMAL”) of the entire sampling reach while at every site. Assign and circle a score from the values available within each quality category (Figure 1).

For Parameters 1 through 7, the sampling reach can be scored from 0 (worst) to 20 (best). For Parameters 8 through 10, each bank is evaluated separately (from 0 to 10), and the cumulative score for both right and left banks are used.

The first 5 parameters are rated for the sampling reach. Contiguous reaches may be evaluated for the last 5 parameters to provide a more robust rating for these large-scale parameters. If the sampling reach is less than 150 m in length, incorporate contiguous reaches into the assessment.

After the sampling reach has been scored for all parameters, transfer the score circled for each category to the corresponding “SCORE” box in the “HABITAT PARAMETER” column of the assessment form.

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Table 1. Descriptions of parameters used in the rapid habitat assessment of streams (continued).

Habitat Parameter	Description and Rationale
1. Epifaunal Substrate/Available Cover	Includes the relative quantity and variety of natural structures in the stream, such as cobble (riffles), large rocks, fallen trees, logs and branches, and undercut banks, available as refugia, feeding, or sites for spawning and nursery functions of aquatic macrofauna. A wide variety and/or abundance of submerged structures in the stream provide macroinvertebrates and fish with a large number of niches, thus increasing habitat diversity. As variety and abundance of cover decreases, habitat structure becomes monotonous, diversity decreases, and the potential for recovery following disturbance decreases. Riffles and runs are critical for maintaining a variety and abundance of insects in most high gradient streams and serving as spawning and feeding refugia for certain fish. The extent and quality of the riffle is an important factor in the support of a healthy biological condition in high-gradient streams. Riffles and runs offer a diversity of habitat through variety of particle size, and, in many small high-gradient streams, will provide the most stable habitat. Snags and submerged logs are among the most productive habitat structure for macroinvertebrate colonization and fish refugia in low-gradient streams. However, "new fall" will not yet be suitable for colonization.
2. Embeddedness	Refers to the extent to which rocks (gravel, cobble, and boulders) and snags are covered or sunken into the silt, sand, or mud of the stream bottom. Generally, as rocks become embedded, the surface area available to macroinvertebrates and fish (shelter, spawning, and egg incubation) is decreased. Embeddedness is a result of large-scale sediment movement and deposition, and is a parameter evaluated in the riffles and runs of high-gradient streams. The rating of this parameter may be variable depending on where the observations are taken. To avoid confusion with sediment deposition (another habitat parameter), observations of embeddedness should be taken in the upstream and central portions of riffles and cobble substrate areas.
3. Velocity and Depth Regimes	Patterns of velocity and depth are included for high-gradient streams under this parameter as an important feature of habitat diversity. The best streams in most high-gradient regions will have all 4 patterns present: (1) slow-deep, (2) slow-shallow, (3) fast-deep, and (4) fast-shallow. The general guidelines are 0.5 m depth to separate shallow from deep, and 0.3 m/sec (~1 ft./sec) to separate fast from slow. The occurrence of these 4 patterns relates to the stream's ability to provide and maintain a stable aquatic environment.
4. Sediment Deposition	Measures the amount of sediment that has accumulated in pools and the changes that have occurred to the stream bottom as a result of deposition. Deposition occurs from large-scale movement of sediment. Sediment deposition may cause the formation of islands, point bars (areas of increased deposition usually at the beginning of a meander that increase in size as the channel is diverted toward the outer bank) or shoals, or result in the filling of runs and pools. Usually deposition is evident in areas that are obstructed by natural or manmade debris and areas where the stream flow decreases, such as bends. High levels of sediment deposition are symptoms of an unstable and continually changing environment that becomes unsuitable for many organisms.
5. Channel Flow Status	The degree to which the channel is filled with water. The flow status will change as the channel enlarges (e.g., aggrading stream beds with actively widening channels) or as flow decreases as a result of dams and other obstructions, diversions for irrigation, or drought. When water does not cover much of the streambed, the amount of suitable substrate for aquatic organisms is limited. In high-gradient streams, riffles and cobble substrate are exposed, thereby reducing the areas of good habitat. Channel flow is especially useful for interpreting biological condition under abnormal or lowered flow conditions. This parameter becomes important when more than one biological index period is used for surveys or the timing of sampling is inconsistent among sites or annual periodicity.
6. Channel Alteration	Is a measure of large-scale changes in the shape of the stream channel. Many streams in urban and agricultural areas have been straightened, deepened, or diverted into concrete channels, often for flood control or irrigation purposes. Such streams have far fewer natural habitats for fish, macroinvertebrates, and plants than do naturally meandering streams. Channel alteration is present when artificial embankments, riprap, and other forms of artificial bank stabilization or structures are present; when the stream is very straight for significant distances; when dams and bridges are present; and when other

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	such changes have occurred. Scouring is often associated with channel alteration.
7. Frequency of Riffles	Is a way to measure the sequence of riffles and thus the heterogeneity occurring in a stream. Riffles are a source of high-quality habitat and diverse fauna; therefore, an increased frequency of occurrence greatly enhances the diversity of the stream community. For high gradient streams where distinct riffles are uncommon, a run/bend ratio can be used as a measure of meandering or sinuosity. A high degree of sinuosity provides for diverse habitat and fauna, and the stream is better able to handle surges when the stream fluctuates as a result of storms. The absorption of this energy by bends protects the stream from excessive erosion and flooding and provides refugia for benthic invertebrates and fish during storm events. To gain an appreciation of this parameter in some streams, a longer segment or reach than that designated for sampling may be incorporated into the evaluation. In headwaters, riffles are usually continuous and the presence of cascades or boulders provides a form of sinuosity and enhances the structure of the stream. A stable channel is one that does not exhibit progressive changes in slope, shape, or dimensions, although short-term variations may occur during floods (Gordon et al. 1992).
8. Bank Stability	Measures whether the stream banks are eroded (or have the potential for erosion). Steep banks are more likely to collapse and suffer from erosion than are gently sloping banks, and are therefore considered to be unstable. Signs of erosion include crumbling, unvegetated banks, exposed tree roots, and exposed soil. Eroded banks indicate a problem of sediment movement and deposition, and suggest a scarcity of cover and organic input to streams. Each bank is evaluated separately from 0-10, and the cumulative score (right and left) is used for this parameter.
9. Bank Vegetative Protection	Measures the amount of vegetative protection afforded to the stream bank and the near-stream portion of the riparian zone. The root systems of plants growing on stream banks help hold soil in place, thereby reducing the amount of erosion that is likely to occur. This parameter supplies information on the ability of the bank to resist erosion as well as additional information on the uptake of nutrients by the plants, the control of instream scouring, and stream shading. Banks that have full, natural plant growth are better for fish and macroinvertebrates than are banks without vegetative protection or those shored up with concrete or riprap. This parameter is made more effective by defining the native vegetation for the region and stream type (i.e., shrubs, trees, etc.). In some regions, the introduction of exotics has virtually replaced all native vegetation. The value of exotic vegetation to the quality of the habitat structure and contribution to the stream ecosystem must be considered in this parameter. In areas of high grazing pressure from livestock or where residential and urban development activities disrupt the riparian zone, the growth of a natural plant community is impeded and can extend to the bank vegetative protection zone. Each bank is evaluated separately and the cumulative score (right and left) is used for this parameter.
10. Riparian Vegetated Zone Width	Measures the width of natural vegetation from the edge of the stream bank out through the riparian zone. The vegetative zone serves as a buffer to pollutants entering a stream from runoff, controls erosion, and provides habitat and nutrient input into the stream. A relatively undisturbed riparian zone supports a robust stream system; narrow riparian zones occur when roads, parking lots, fields, lawns, bare soil, rocks, or buildings are near the stream bank. Residential developments, urban centers, golf courses, and rangeland are common causes of anthropogenic degradation of the riparian zone. Conversely, the presence of "old field" (i.e., a previously developed field not currently in use), paths, and walkways in an otherwise undisturbed riparian zone may be judged to be inconsequential to altering the riparian zone and may be given relatively high scores. For variable size streams, the specified width of a desirable riparian zone may also be variable and may be best determined by some multiple of stream width (e.g., 4 x wetted stream width). Each bank is evaluated separately from 0-10 and the cumulative score (right and left) is used for this parameter.

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Reviewed by (Initials): RC

RAPID HABITAT ASSESSMENT FORM: RIFFLE/RUN - STREAM																					
SITE ID: <u>WXXP99-9999</u>		DATE: <u>07/01/2000</u>																			
HABITAT PARAMETER	CONDITION CATEGORY																				
	OPTIMAL					SUB-OPTIMAL			MARGINAL			POOR									
1. Epifaunal Substrate/ Available Cover Score: <u>12</u>	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential; (i.e., logs/snags that are NOT new fall and NOT transient.)					40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).			20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.			Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.									
	20	19	18	17	16	15	14	13	<u>12</u>	11	10	9	8	7	6	5	4	3	2	1	0
2. Embeddedness Score: <u>8</u>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.			Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.			Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.									
	20	19	18	17	16	15	14	13	12	11	10	9	<u>8</u>	7	6	5	4	3	2	1	0
3. Velocity/Depth Regime Score: <u>15</u>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is less than 0.3 m/s, deep is greater than 0.5 m.)					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).			Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).			Dominated by 1 velocity/depth regime (usually slow-deep).									
	20	19	18	17	16	<u>15</u>	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment Deposition Score: <u>14</u>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increases in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.			Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.			Heavy deposits of fine material; increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.									
	20	19	18	17	16	15	<u>14</u>	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel Flow Status Score: <u>12</u>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills over 75% of the available channel; or less than 25% of channel substrate is exposed.			Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.			Very little water in channel and mostly present as standing pools.									
	20	19	18	17	16	15	14	13	<u>12</u>	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel Alteration Score: <u>18</u>	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, (greater than past 20 yr) may be present, but recent channelization is not present.			Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.			Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.									
	20	19	<u>18</u>	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

03/31/2000 2000 Riffle Run

Draft



Figure 1. Rapid Habitat Assessment Form for riffle/run prevalent streams(continued).

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Reviewed by (Initials): LC

RAPID HABITAT ASSESSMENT FORM: RIFFLE/RUN (continued) - STREAM																					
SITE ID: <u>WXXP99-9999</u>			DATE: <u>07/01/2000</u>																		
HABITAT PARAMETER	CONDITION CATEGORY																				
	OPTIMAL		SUB-OPTIMAL			MARGINAL			POOR												
7. Frequency of Riffles (or bends) Score: 13	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream greater than 7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.		Occurrence of riffles infrequent; distance between riffles divided by width of stream is between 7 to 15.			Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by width of stream is between 15 to 25.			Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by width of stream is a ratio of over 25.												
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
8. Bank Stability (score each bank) NOTE: Determine left or right side by facing downstream. Left Bank Score: 7 Right Bank Score: 5	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; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.												
	Left Bank: 10 9		8 7 6			5 4 3			2 1 0												
	Right Bank: 10 9		8 7 6			5 4 3			2 1 0												
9. Vegetative Protection (score each bank) Left Bank Score: 8 Right Bank Score: 7	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.		70-90% if the streambank surfaces covered by native vegetation; but one class of plants is not well represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.			50-70% of the streambank surfaces covered by vegetation; disruptions obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.			Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.												
	Left Bank: 10 9		8 7 6			5 4 3			2 1 0												
	Right Bank: 10 9		8 7 6			5 4 3			2 1 0												
10. Riparian Vegetative Zone Width (score each bank) Left Bank Score: 6 Right Bank Score: 5	Width of riparian zone greater than 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted the zone.		Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.			Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.			Width of riparian zone less than 6 meters; little or no riparian vegetation due to human activities.												
	Left Bank: 10 9		8 7 6			5 4 3			2 1 0												
	Right Bank: 10 9		8 7 6			5 4 3			2 1 0												

03/15/2000 2000 Riffle Run



Figure 1. Rapid Habitat Assessment Form for riffle/run prevalent streams (page 2).

Literature Cited

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