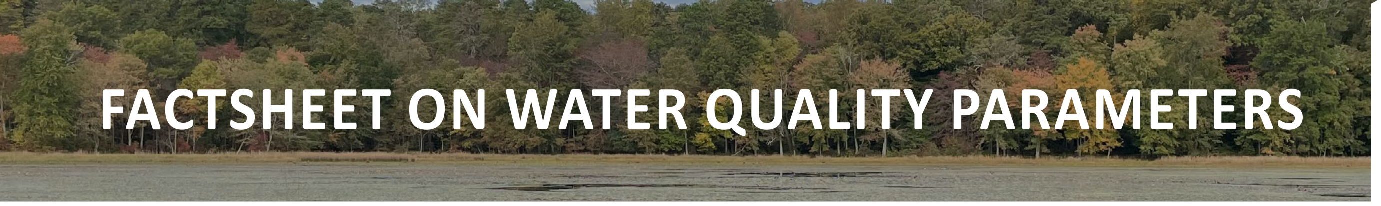

FACTSHEET ON WATER QUALITY PARAMETERS

Habitat Assessment

Habitat assessments in rivers and streams evaluate the condition of the physical and water chemistry features in the stream, and the physical features along the riverbanks (the riparian zone) such as channel type, amount of woody debris, bank stability, and vegetation type.

Why do we assess habitat?

Healthy and intact habitat is critical for supporting biological communities, protecting water quality, and preserving the overall ecological integrity of aquatic ecosystems. Fish, insects, and other organisms find food and shelter near and in streams, lakes, and wetlands. Vegetation growing in the riparian zone provides shade, stabilizes sediment, and can filter pollutants before they enter the waterbody.

Alterations to the physical structure of the habitat surrounding waterbodies can negatively impact instream physical characteristics, water chemistry, and aquatic communities. Specifically, if vegetation in the riparian zone is removed, runoff of sediment into the stream can increase. As a result, stream embeddedness (the amount of sediment covering "substrate," or bottom material) changes as excess sediment fills pools and reduces the available substrate for fish and other aquatic organisms to shelter. The water chemistry may also change as the excess sediment alters turbidity and pH levels. These changes affect the potential for the habitat to support the aquatic community.

Habitat assessments help determine whether alterations to the riparian zone or instream features may negatively impact water quality and aquatic communities. Table 1 lists examples of parameters that habitat assessments evaluate and the reasons for assessing each parameter. These parameters are from the Rapid Bioassessment Protocols (RBPs), which is a popular, efficient, and cost-effective method to assess habitat. Evaluating changes in the condition of habitat parameters helps anticipate potential effects on the aquatic ecosystem, provides clues towards sources of degradation, and can inform restoration projects and waterbody management strategies.

Table 1. Examples of habitat parameters and why we assess them.

Habitat Parameter	Why We Assess this Parameter
Channel flow status, or the percent of existing channel that is filled with water	The degree to which the stream channel is filled with water affects the amount of suitable substrate for aquatic organisms. Low flows can expose riffles and logs, reducing areas of good habitat.
Channel alteration, or any activity that changes the natural channel	Streams that have been straightened, deepened, or diverted into concrete channels have far fewer natural habitats for aquatic organisms than naturally meandering streams. For example, streams that are dammed prevent fish passage upstream for spawning.
Vegetative protection, or plant cover on the streambanks	Native vegetative protection allows the streambank to resist erosion, absorb nutrients, resist instream scouring, and provide stream shading. Streambanks that have full, natural plant growth are better for aquatic organisms than those without vegetative protection.
Riparian vegetative zone width, or the width of the riverbank vegetation	The vegetative zone controls erosion, serves as a buffer to pollutants entering a stream from runoff, and provides habitat and nutrient input into the stream.

Source: USEPA (1999)

For factsheets on other water quality parameters, visit: **epa.gov/awma/factsheets-water-quality-parameters.**

For more information about the CWA Section 106 Grants Program, visit: **epa.gov/water-pollution-control-section-106-grants.**

What affects habitat condition?

Habitat condition is affected by both natural influences and human activities, including:

- **Invasive species** - Humans introduce and spread nonnative species to an area that can cause harm. Invasive aquatic vegetation, such as hydrilla, can harm native aquatic and riparian vegetation by altering water chemistry and outcompeting them for space, light, and resources such as dissolved oxygen and nutrients.
- **Flooding** - Flooding can increase water depth, width, and velocity, and it can alter the location of woody debris (Figure 1), sediments, and substrate in and around a waterbody. For example, flooding can bring in or remove fish habitat (such as woody debris).

Figure 1. Example of woody debris in a stream. Credit: Photo courtesy of Zach Prause

- **Excess sediment deposition** - Excess sediment deposition (Figure 2) refers to sediment that has been washed into a waterbody from the nearby landscape or from upstream sources. As a result, stream embeddedness can change as the sediment settles on the stream bottom, where it can bury important habitat features and bottom-dwelling biota such as fish eggs and macroinvertebrates.

Figure 2. Example of sediment deposition in a stream. Credit: Photo courtesy of Laura Shumway

- **Channel and riparian modification** - Human disturbances – including channel straightening (channelization), damming, or removal of riparian vegetation – negatively affect habitat condition. The removal of riparian vegetation is particularly harmful and can change water chemistry, water temperature, and turbidity.
- **Runoff** - Runoff from urban and agricultural areas contains chemical contaminants and nutrient pollution that harm habitat by affecting water chemistry, causing algal blooms, eutrophication, and altered pH levels. Riparian vegetation can absorb and prevent runoff from entering a waterbody. When vegetation is removed from the habitat, pollutant runoff can increase.

What are EPA's recommended criteria for habitat condition?

EPA does not have recommended criteria for habitat condition. However, water resource agencies have developed methods for assessing and rating habitat condition. Examples of these include:

- The RBPs, which also report information associated with optimal ratings for habitat parameters. Information on the parameters in the RBPs field data sheets are described in more detail below.

- The National Aquatic Resource Survey (NARS) habitat protocols for rivers, streams, lakes, and wetlands which are more intensive sampling methods (see EPA's website *Manuals Used in the National Aquatic Resource Surveys* for NARS field methods).
- State agency protocols.

The optimal rating criteria for four RBP habitat parameters in high gradient streams (steep sloped) and low gradient streams (gently sloped) are in Table 2 below.

Table 2. Examples of habitat parameters and their optimal rating criteria for high and low gradient streams.

Habitat Parameter	Optimal Rating Criteria
Channel flow status	Water reaches the base of both lower banks, and a minimal amount of channel substrate is exposed.
Channel alteration	Channelization or dredging is absent or minimal; the stream has a normal pattern.
Vegetative protection	More than 90% of the streambank surface and immediate riparian zone are covered by native vegetation.
Riparian vegetative zone width	The width is larger than 18 meters; human activities have not impacted the zone.

Source: USEPA (1999)

How do we assess habitat?

Using the RBPs, habitat is assessed in field data sheets, which are a compilation of ten parameters used to assess habitat condition. The field data sheets are available for both high gradient streams and low gradient streams (Figure 3). The RBPs data sheets are found in Appendix A of EPA's *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers Periphyton, Benthic Macroinvertebrates, and Fish* (1999). Other habitat protocols typically collect information on similar types of parameters but may be more or less quantitative and time intensive. It is important to consider your objectives to determine which protocol is most appropriate for your program.

For the RBPs, during the habitat assessment, field staff evaluate and rate parameters on a scale from 0 (poor) to 20 (optimal) at each sampling reach. Descriptions of the parameters and relative criteria are included in the RBPs to ensure consistency in evaluations and ratings.

Figure 3. The Manistee River in Michigan, an example of a low gradient stream. Credit: Photo courtesy of Zach Prause

The ratings are summed and compared to a reference condition for a final habitat ranking. Field staff establish reference conditions by monitoring sites that represent the natural range of variation in minimally disturbed habitat, water chemistry, and biological conditions.

Weather can affect the conditions evaluated during the habitat assessment. For example, storms can impact the velocity, debris, sediment, and substrate present in the waterbody. Thus, assessments should not be conducted until after the impacts caused by inclement weather subside.

What are the challenges of using habitat condition to assess water quality?

Habitat degradation may be the result of physical and/or chemical alterations to waterbodies. Typically, habitat assessments are conducted when collecting other data. If field staff collect data at a site multiple times each year, the habitat assessment may only need to be conducted during one visit. If field staff collect data just once a year or once every few years, the habitat assessment should be conducted each visit. This allows staff to evaluate how changes in habitat condition are related to changes in other biological and chemical indicators.

Using habitat condition to assess water quality can be challenging because:

- Methods for habitat assessments often rely on the judgment of field staff and results may be inconsistent from one field staff member to the next. Adequate training is needed to ensure consistency in applying methods.
- Different types of waterbodies, such as low gradient streams and high gradient streams, generally require different methods for habitat assessment because of varying habitat traits and optimal conditions. For example, channel sinuosity (or meandering) is evaluated in low gradient streams only. This can complicate comparisons or summaries of results among different waterbody types.

It is important to ensure that the right habitat assessment methods are being applied comprehensively and consistently to the given waterbody type.