Presented below are water quality standards that are in effect for Clean Water Act purposes.

EPA is posting these standards as a convenience to users and has made a reasonable effort to assure their accuracy. Additionally, EPA has made a reasonable effort to identify parts of the standards that are not approved, disapproved, or are otherwise not in effect for Clean Water Act purposes.

STREAM CLASSIFICATION GUIDELINES FOR WISCONSIN

Technical Bulletin No.
DEPARTMENT OF NATURAL RESOURCES
Box 7921, Madison, WI 53707
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ABSTRACT

The objective of this classification system is to describe potential stream uses and provide a basis for making and supporting water quality management decisions. Only those uses which can be described in terms of biological communities are discussed. "Use" is defined by a class of organisms capable of inhabiting a stream. The "use classes" are: A - cold water sport fish, B - warm water sport fish, C - intolerant forage fish, intolerant macroinvertebrates, or a valuable population of tolerant forage fish, D - tolerant or very tolerant forage or rough fish, or tolerant macroinvertebrates, and E - very tolerant macroinvertebrates or no aquatic life.

The appropriate use class for a stream is determined by comparing the ecological needs of use class organisms with the natural ecological characteristics of a stream system. A set of procedures to evaluate stream system characteristics is presented. Stream system habitat evaluation is stressed. A matrix is used to numerically rank habitat characteristics from excellent to poor. Twelve habitat rating items are listed and include characteristics of the watershed, banks, stream substrate, stream morphology and hydrology, and aesthetics. Other factors used to determine appropriate use class are background dissolved oxygen, temperature, pH, toxics, and existing biota. A range of values for all of these stream system characteristics is provided which correlates with criteria required to support a specific use class. Although the intent of the system is to provide more objectivity to the classification process, professional judgment of a stream's potential use is still important.

STREAM CLASSIFICATION GUIDELINES FOR WISCONSIN

By
Joe Ball

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INTRODUCTION

Procedures for classifying Wisconsin streams have been developed to provide a scientific method for designating uses according to a stream's natural ability to support a certain biological community. A specific biological community is termed a "use class". The objective of the classification system is to provide a basis for making and supporting water quality management decisions. The need for classifying surface waters is based on the recognition that all surface waters will not support the same level of use, and that different use classes may require different levels of water quality to survive.

To classify streams and meet both scientific and management objectives two basic assumptions are necessary: (1) stream systems with similar characteristics will support similar biological communities and can be described as a use class, and (2) if streams within a use class are managed in a similar way they will support a similar use.

Stream classification systems have generally been based on existing conditions; e.g., fish populations, trophic state. The problem with these types of systems is that existing biological communities or trophic state may be a function of controllable pollution, not a function of stream system potential. According to Warren (1979) "classification of stream systems ought not to be based directly on just measurement of stream performance, for then it would have little value for prediction, explanation, understanding and management." He recommended that stream classification systems should be based on "watershed-environment and stream habitat-capacity," not on just biological communities inhabiting a stream when it is classified.

A stream is an ecosystem made up of climate, watershed, banks, bed, water volume, water quality, and biota. A stream's use is dependent upon the natural characteristics of the entire stream ecosystem, and on the cultural alterations or impacts which have occurred or are occurring. *Present* stream uses are *always* affected by both natural characteristics and cultural impacts. *Potential* uses are *always* affected by natural characteristics, and *may* be affected by cultural impacts. Since the management goal is to control the cultural impacts affecting stream use, it is logical to base classification on a stream's potential to support a given use in the absence of controllable impacts, not on the present state of the biological community.

To determine the biological community a stream can support it is necessary to relate the natural characteristics of the whole system to the ecological requirements of use class organisms. A stream classification system structured in this way will predict the potential use of a stream and will also serve to indicate the management necessary to attain the use.

Published stream classification systems based on stream system potential are rare. A few systems include parameters which affect use (Pennak 1971, Platt 1974, Minnesota Pollution Control Agency 1979). However, these systems do not include a method for quantifying data and observations to arrive at an objective classification. Perhaps the reason for this is lack of information on all the ecological requirements of specific organisms. There is a good data base on how temperature, dissolved oxygen, and other chemical parameters affect aquatic organisms, but not on the influence of habitat. The U.S. Forest Service comes close to providing an adequate stream classification system (U.S. Department of Agriculture 1975). It was developed to quantitatively assess the stability of mountain streams and to identify streams needing intensive management. Some of the parameters in the Forest Service are not applicable to Wisconsin streams, but the concept is sound, and has been adapted for part of this classification system.

The set of guidelines described in this report is not intended to be a rigid assessment technique. Streams cannot always be realistically classified by a totally objective system. Because of their dynamic nature, biological communities are perhaps the most difficult objects we have chosen to study. Similar stream systems should support similar uses, but each stream is an individual ecosystem and must be classified individually. A stream classification comes down to a final judgment—a judgment based on measurable factors, and perhaps just as important, on intuition gained from experience and past observation.

FACTORS AFFECTING STREAM USES

A variety of factors affect the ability of a surface water to support certain uses (Table 1). Some are "natural" and are a function of the watershed system in which the stream is embedded. Some are "cultural" and are a function of societal use of the stream system. These natural and cultural factors are characterized as either physical or chemical, and further, they may be controllable or uncontrollable. For the purpose of classification the *uncontrollable factors*, whether they are natural or cultural, ultimately determine a stream's potential or attainable use. Controllable factors such as point source discharges, which have an impact on stream use, should not influence a stream's classified use. Controllable factors are considered temporary, pending implementation of control measures. The effects of some cultural factors may be uncontrollable because they cannot be changed with the application of "reasonable" management. In many cases these cultural factors and impacts have become the "natural" characteristics of a stream.

NATURAL FACTORS

Since most streams in Wisconsin have been disturbed, it is difficult to define a totally natural factor. For classification, natural factors are defined as the characteristics of a stream system in the absence of direct cultural impacts such as dams, flow reduction by withdrawal, and point source discharges. Natural factors which affect stream uses are flow, habitat, and "natural" physical or chemical characteristics of water.

Flow Regime. The flow or quantity of water available to support aquatic organisms is of primary importance. It is an obvious fact that large fish species require a higher level of flow than small fish species to survive in a stream. Without adequate flow, large fish would not have room to move, feed or reproduce. Stream flow is directly correlated to the classes of organisms, or uses, a stream is capable of supporting. Flow stability or frequency also becomes an important factor in some streams. Flow extremes, especially in streams running through altered watersheds, can be a major factor in determining appropriate uses.

Habitat Structure. The physical structure and flow of water in a stream interact to create an environment suitable to support various classes of organisms. Substrate, pools and riffles, water depth, erosion and deposition areas, and cover provide necessary habitat. Studies by Gorman and Karr (1978) and Hunt (1971) clearly show that more diverse habitats support more abundant and diverse aquatic communities. A stream with poor habitat structure will support fewer organisms, to the extent that the life support requirements of only very tolerant fish or insects may be met. An analysis of habitat structure is an important factor in the stream classification process.

Water Quality. The natural physico-chemical characteristics of general importance in streams include dissolved oxygen, temperature, suspended solids, and dissolved ions. These parameters are of major concern in determining the ability of a stream to support certain classes of organisms. Water quality extremes are of particular importance. Deviations from water quality criteria levels, even for a short time, may stress aquatic communities beyond recovery.

Natural water quality is influenced by watershed geology, soils, and surface features. Flow regime and instream habitat structure may also have an influence on water quality. To classify a stream into an appropriate use class it is important to determine the natural water quality of a stream system.

Natural factors are generally not controllable. They are the most significant factors in determining the potential uses of a stream.

TABLE 1. *Examples of common factors affecting stream uses.*

Factor	Comments
Uncontrollable Natural Factors	
1) Flow regime	
2) Habitat structure	Habitat development may be considered in high quality streams
3) Water quality	
Uncontrollable Cultural Factors	
1) Land use	
2) Existing hydrologic modification	
a. Dam	Some management may be possible
b. Straightening	
c. Wetland drainage	
Controllable Cultural Factors	
1) Point sources	These factors are controllable within bounds
a. Municipal	
b. Industrial	
2) Nonpoint sources	
a. Agricultural runoff	
b. Urban runoff	
c. Construction site runoff	
3) Other factors	
a. Water withdrawal	
b. Septic system drainage	
c. Proposed hydrological alterations	

CULTURAL FACTORS

Culturally induced conditions are those that have been caused by certain actions on the land and in the water. Nearly all waters of the state have been disturbed, in some cases more significantly than others. Cultural factors are broadly defined as point and nonpoint sources of pollution. These factors have an impact on habitat and water quality, and on the uses that may occur in a surface water.

Culturally induced conditions can be further subdivided into controllable and uncontrollable types, or similarly, reversible and irreversible impacts. Theoretically, if cultural impacts are properly managed or removed, an altered environment will revert to its natural state. Grass and trees could be planted instead of corn, and all dams could be dismantled. However, in some cases, actions to control or reverse cultural impacts may not be reasonable.

Uncontrollable Cultural Factors. Uncontrollable cultural factors are those activities over which regulatory agencies have little or no control, or prefer to exercise no control. For purpose of stream classification, two major factors are of concern — existing land use and hydrologic modifications. These in-place activities are generally uncontrollable and may have significant impacts on stream use. When the cause of an impact is uncontrollable, the impact must be considered a normal characteristic of a stream for the purpose of classification.

The present use of land for agriculture and urban development will, in most cases, not change. The long-term impact these cultural uses may have had on a stream system will also, in most cases, not change. The impacts of land use on a stream system are not always obvious because they have occurred gradually. For example, removal of native vegetation, destruction of wetlands and paving of streets increases runoff and reduces groundwater recharge. This removal of water may alter the flow regime and water quality of a stream, and affect uses. Such actions may also increase peak flows, resulting in long-term and irreversible changes in habitat structure.

A more obvious cultural factor affecting stream use is hydrologic alteration. Existing dams, straightened portions of streams, and wetland drainage are examples of stream alterations which can affect uses and appropriate classifications. The question of controllability of these factors is technically and legally complex, but assuming no regulatory measure can be taken to revert back to an original condition, then these alterations and their impacts must be considered uncontrollable.

Controllable Cultural Factors. Sources of pollution in this category are those that can be controlled by a reasonable level of management. The primary controllable factors are the point sources of wastewater discharge. Programs are in place to regulate what, how, when, and where point sources discharge wastes. Point sources are, within certain bounds, always controllable. The impact of point sources on water quality and stream uses should not be factored into the classification process, assuming the impact can be removed.

Also possibly controllable are activities on the land — nonpoint sources. Although Wisconsin does not have a program to regulate nonpoint sources* it does have a grant and management program to encourage nonpoint source control. Controllable nonpoint sources, as envisioned here, are those associated with the application of "best management practices" on agricultural and urban lands.

In situations where application of best management practices is likely to result in stream use improvements, the impacts from nonpoint sources should be disregarded in the classification process. However, it may be difficult to show a direct cause and effect relationship between nonpoint sources and water quality. It may be equally difficult to show a direct relationship between nonpoint sources and habitat deterioration except in extreme situations. For instance, even if better land management was applied to a watershed, it may be difficult to predict how long it may take an impacted stream to recover. Classifying a stream to a higher use, based on an anticipated natural improvement, which may or may not take place, may not be logical. In some situations the impact of nonpoint sources on habitat should probably be considered uncontrollable for current actions.

According to Karr and Dudley (1981) nonpoint control efforts that improve water quality may fail to improve the biota of a stream if suitable physical habitats are absent. This does not imply, however, that nonpoint source control efforts are not worthwhile. Over a long time period stream uses will improve, and the effect of nonpoint sources on downstream uses must also be considered.

There are other cultural factors with immediate and direct effects on stream uses which can generally be controlled by regulation. For example, a flow management scheme that results in withholding or diversion of water on a routine basis may preclude certain uses and aquatic populations. Such actions are almost always controllable. Sources of pollution, such as rural septic systems, are controllable. Proposed stream alterations, such as dams and straightening, are controllable because these are regulated activities. Even an existing dam, already discussed as being uncontrollable, may be managed in certain ways to reduce impacts on stream uses.

Determining the factors affecting stream uses and their status of controllability are the most important parts of this classification procedure. The process of identifying factors and determining controllability serves two important functions: (1) it supplies much of the information required to designate appropriate stream uses, and (2) it identifies the specific management required to achieve designated uses. The most difficult task is determining controllability, especially for nonpoint sources. Another related problem is anticipating the response of a stream to management of pollution sources. To classify streams, subjective judgments regarding the status of these problems will likely have to be made for individual situations.

STREAM USE CLASSES

Stream use classes are listed in Table 2. Stream use is described by the fish species or other aquatic organisms capable of being supported by a natural stream system. Use classes in Table 2 are listed from the most sensitive to the most tolerant use. Common fish species and their representative classification categories are listed in Table 3. The designation of an appropriate use class is based on the ability of a stream to supply habitat and water quality requirements of use class organisms. Sections or "reaches" of a stream may be assigned different use classes, and the same stream or stream reach may be assigned different use classes based on seasonal differences. This concept, termed "seasonal classification," is used to describe variations in stream conditions. For example, a stream may serve as a fish spawning area in the spring, but natural changes in flow or water quality may preclude the existence of fish in other seasons. Following are descriptions of the use classes for classifying Wisconsin streams:

Class A, Cold Water Sport Fish: Streams capable of supporting a cold water sport fishery, or serving as a spawning area for salmonid species. The presence of an occasional salmonid in a stream does not justify a Class A designation (e.g., trout are occasionally taken from the Mississippi River but that fact alone does not justify a cold water sport fish designation).

TABLE 2. *Stream use classes for aquatic life.*

Use Class	Description
A	*Capable of supporting cold water sport fish*
B	*Capable of supporting warm water sport fish*
C	*Capable of supporting intolerant forage fish*, intolerant macroinvertebrates, or a valuable population of tolerant forage fish*
D	*Capable of supporting tolerant or very tolerant forage or rough fish*, or tolerant macroinvertebrates*
E	*Capable of supporting very tolerant macroinvertebrates or no aquatic life*

* *See Table 3.*

*Wisconsin does have regulatory authority for construction site runoff.

TABLE 3. *Common fish species and classification categories.*

Sport Fish	Intolerant Forage	Tolerant Forage	Very Tolerant Forage or Rough Fish
Trouts	Stoneroller	Golden shiner	Carp
Salmons	Rosyface shiner	Common shiner	Goldfish
Northern pike	Spottail shiner	Sand shiner	Mud minnow
Muskellunge	Blacknose shiner	Emerald shiner	Fathead minnow
Smallmouth bass	Blackchin shiner	Spotfin shiner	Sheepshead
Largemouth bass	Daces	Bluntnose minnow	Buffalo
Yellow bass	Hornyhead chub	Creek chub	Carp suckers
White bass	Stonecat	Johnny darter	Gars
Rock bass	Tadpole madtom	Suckers	Bowfin
Walleye	Redhorses	Brook stickleback	Mooneye
Sauger	Darters (except Johnny Darter)	Bullhead minnow	
White crappie	Log perch		
Black crappie	Sculpins		
Bluegill			
Sunfishes			
Yellow perch			
Bullheads			
Catfishes			
Sturgeons			

Class B, Warm Water Sport Fish: Streams capable of supporting a warm water sport fishery or serving as a spawning area for warm water sport fish. Although warm water sport fish are occasionally found in many small streams, a stream should be capable of supporting a "common" designated population to rate a "B" classification.

Class C, Intolerant Forage Fish, Intolerant Macroinvertebrates, or a Valuable Population of Tolerant Forage Fish: Streams capable of supporting an abundant, and usually diverse, population of forage fish or intolerant macroinvertebrates. These streams are generally too small to support cold or warm water sport fish, but have natural water quality and habitat sufficient to support forage fish or macroinvertebrates. Streams capable of supporting valuable populations of tolerant forage fish should also be included in Class C. This type of stream may provide beneficial uses, such as a food source for a downstream sport fishery, or a sucker fishery.

Class D, Tolerant or Very Tolerant Fish, or Tolerant Macroinvertebrates: Streams capable of supporting only a small population of tolerant forage fish, very tolerant fish, or tolerant macroinvertebrates. The aquatic community in such a stream is usually limited due to naturally poor water quality or habitat deficiencies.

Class E, Very Tolerant Macroinvertebrates or No Aquatic Life: Streams only capable at best of supporting very tolerant macroinvertebrates, or an occasional very tolerant fish. Such streams are usually small and severely limited by water quality or habitat. Marshy ditches and intermittent streams are examples of Class E streams.

CLASSIFICATION PROCEDURE

The objective of stream classification is to designate logical uses by evaluating and describing stream ecosystems. The classification procedure includes a list of important factors that need to be evaluated, and suggests how to merge data and perceptions into a final decision about appropriate use. Designated uses are based on the relationship and overall quality of all ecosystem components.

The stream classification procedure combines objective and subjective analysis. Objectivity in the procedure comes from pointing out the major individual factors one needs to evaluate, and by placing bounds on ecological "criteria" which separate streams into use classes. However, because ecosystems are extremely complex, professional judgment must also be part of the classification process. This flexibility is needed to allow for logical decisions about stream use.

The following guidelines do not cover all potential situations and should be viewed as starting points from which experience will dictate the scope of an investigation, including what needs to be added or what can be deleted. The classification process requires five basic steps — study design, data collection, data evaluation, impact controllability analysis, and appropriate use designation.

STUDY DESIGN

Because of the management objective of this classification procedure, water quality evaluation staff have major responsibility. However, the process should be a "team" effort and, at minimum, should be a cooperative project with fisheries staff. Staff with expertise in other areas may also be required. The team should determine the detail and scope of analysis required to classify any given stream. In some cases, file information coupled with a desk top evaluation may suffice. In complex situations, detailed studies may be needed to reach a credible decision.

DATA COLLECTION

Data located in files, studies, reports, etc. should be reviewed. If sufficient current data exist they may be adequate to form the basis for a classification. However, in all cases, a site visit is necessary to verify the evaluation. If current data are insufficient, a stream evaluation must be conducted.

Stream biota are generally dependent upon extreme conditions which normally occur during periods of low flow. Thus, samples, measurements and observations will give a more reliable indication of appropriate use if taken when the stream is at a low or at least normal flow. In situations where seasonal use changes are possible, additional data at higher flows may be needed.

The following data may be required to determine and justify a use class designation:

(1) **Stream Flow** — The flow of a stream can vary over a wide range and can be expressed in a number of ways. Stream use is often limited by annual low flow which is expressed here as representative low flow. Flow data for many streams are available from the U.S. Geological Survey (USGS), and can be used as points of reference for determining representative low flow. If flow data are not available, it may be necessary to gauge the present flow and obtain a low flow estimate from USGS.

(2) **Water Quality** — Natural, or background water quality should generally be used as the basis for classification. Daily and sometimes seasonal water quality extremes determine the class of organisms a stream is capable of supporting. The most extreme water quality conditions normally occur during low flow periods. Thus, an attempt should be made to collect data at that time.

Water samples and instream data should be collected upstream from controllable sources of pollution. In situations where this is impossible, water quality may be a function of the controllable source and cannot generally be used as a basis for classification. Many forms of water quality can have an impact on stream use. However, the parameters most directly related to use include dissolved oxygen, temperature and pH. Toxics and other parameters should be measured if a problem is suspected.

(3) **Habitat Structure** — Habitat evaluation is considered the most important factor in the stream classification process. In situations where water quality data cannot be used, habitat may be the only basis for classification. The habitat rating is based on an evaluation of watershed, stream banks, and stream bed characteristics. The habitat evaluation and rating procedure is detailed in a separate section.

(4) **Stream Biota** — The biological communities presently inhabiting a stream including fish, benthic organisms, rooted vegetation, algae, etc. should be determined. This need not be an exhaustive sample collection effort since designation of attainable use will rarely be based totally on biological data. Knowing what organisms are present in a stream helps determine what the appropriate use class should be. Many biological sampling and analysis methods are available. The methods are left to the discretion of the evaluator, but should be described in the classification report.

DATA EVALUATION

The use class a stream is capable of attaining is determined by comparing stream system data to the life support needs of use class organisms. Table 4 lists a set of stream system parameters and values for each which correspond to the five use classes. The table is used to estimate appropriate stream use based on the quality of individual parameters. Parameter values and use classes are listed from high to low quality and are intended to be mutually exclusive. Therefore, the lowest use class indicated by the lowest quality parameter is the estimated appropriate use of a stream. The values shown are not water quality standards criteria. Rather, values at the extremes are conditions which the particular biota may be able to tolerate for a short time. Criteria in water quality standards are developed to assure protection for sensitive species throughout their life history of exposure. Values in Table 4 are guides to determine if tolerable conditions exist in a surface water, but even these should be used with care because observed conditions outside the noted bounds do not necessarily preclude the existence of a use class. These values should be used to evaluate stream system data and be a major factor in the stream classification process. Following is a description of the parameters in Table 4 and other stream characteristics used in the evaluation procedure.

(1) **Flow Characteristics** — In this classification system representative low flow most nearly reflects the long-term ability of a stream to support certain organisms. Representative low flow values in Table 4 are based on a review of fish community data from various Wisconsin streams.

Streams receiving an effluent, or that are proposed to receive an effluent, should be evaluated at two representative low flows. One based on natural flow, and one based on natural flow plus design effluent flow. This evaluation is only important when design effluent flow adds significantly to a stream's base flow. For example, when an effluent going to an otherwise dry drainage way creates a stream. This procedure involves interpolation of stream conditions at a higher or lower flow, and relies heavily on professional judgment. The purpose is to provide a more complete evaluation and consideration of alternatives upon which to base a logical designation of appropriate use. The procedure also provides more complete information needed by resource managers on which to base subsequent decisions regarding effluent limits or other management practices.

(2) **Water Quality Characteristics** — Criteria in Table 4 are maximum or minimum values at which use class biota may be expected to survive during critical periods. If these extreme values were common in a stream, the corresponding biota would probably not be maintained in a healthy state. However, natural short-term fluctuations in water quality are expected in some streams, and values exceeding "standards" do not necessarily preclude associated uses. If water quality is a use limiting factor due to a controllable impact, and natural water quality cannot be determined, appropriate use should be based on flow and habitat.

(3) **Habitat Rating** — The rating values in Table 4 are a numerical ranking of the overall quality of a stream's watershed, banks and bed characteristics. The rating procedure is described in the final section of the classification guidelines. Rating values can range from 56 to 210 and lower number values indicate higher quality

TABLE 4. *Physical and chemical criteria guidelines for aquatic life use classes.*

Parameter	Use Class and Criteria A	B	C	D	E
Flow[A]	>.5	>3	>.2	>.1	>0
Water Quality					
Dissolved Oxygen[B,C]	>4	>3	>3	>1	<1
Temperature[C]	<75	<86	<86	<90	>90
pH[C]	>5,<9.5	>5,<10.5	>5,<10.5	>4,<11	<4,>11
Toxics[D]	<acute	<acute	<acute	acute	>acute
Habitat Rating[A]	<144	<144	<144	>144	>200

A Wis. DNR as on table.
B U.S. EPA (1977).
C Alabaster and Lloyd (1980).
D U.S. EPA (1980).

habitat. High quality use usually requires high quality habitat. The range of values within a specific use class also gives an indication of the quality of use. for example, a trout stream with a rating of 60 would be expected to support more fish than a trout stream with a rating of 120.

(4) **Biological Data Evaluation** — The biological community inhabiting a stream may be used as an indication of attainable use, but should generally not form the only basis for use class designation. Most streams are disturbed in some way, and their present biota may be a function of that impact. Thus, present biological communities may not indicate realistic attainable uses under proper management of the sources of impact. Even in streams with no obvious problems, the present organisms may not reflect what otherwise may be a higher quality use. For example, a stream with trout stream characteristics may not contain trout because they were never introduced. The classification of such a stream, if based only on its present community of organisms, may not indicate its true potential use.

The most important use of a biological evaluation is to determine if a water quality problem exists. For example, a stream with flow and habitat characteristic of a high use class, but not supporting that class of organisms, most likely has a water quality problem. It is then necessary to determine the source of the problem and judge if it is controllable or not. If the problem is controllable the classification should be based on flow and habitat. If the problem is uncontrollable the classification may be based on the biological evaluation.

IMPACT CONTROLLABILITY ANALYSIS

A major objective of the data evaluation process was to identify the factors limiting stream use. The objective of controllability analysis is to determine if those limiting factors can be managed in some way to improve stream use. That is, are the causes of impacts limiting stream use controllable, and further, are the impacts reversible? Controllability was discussed in the factors affecting stream uses section of these guidelines. Table 1 suggested what may or may not be controllable, but no further guidelines are provided. Determining controllability of sources and impacts can be a complex decision point and it may be necessary to obtain help from other staff with experience in the problem area.

APPROPRIATE USE DESIGNATION

The use class designated for a stream should be based on Table 4, any other available data, and the professional judgment of the evaluators. There will always be cases that do not conform to a rigid analysis process, and this system is intended to be flexible enough to account for those situations.

The evaluation of small streams receiving or proposed to receive waste discharges may result in two possible use designations. When this occurs it will be necessary to recommend one use class as more appropriate. This is one point where the classification process may, and perhaps should, digress from a purely scientific endeavor. Many factors, such as resource value, downstream uses, effluent characteristics and size, and even economics should be considered before recommending a use class designation.

As a final consideration, the biological data can serve as a check on the results of the evaluation as follows:

(1) If the biological community conforms to the indicated use class, report that classification.
(2) If the biological community is better than the indicated use class, base the classification on the biological evaluation.
(3) If the biological community is lower than the indicated use, determine the factors affecting use and if they are controllable or uncontrollable. If the factors are con-

trollable, base the classification on the use indicated by background water quality, flow, and habitat. If the factors are uncontrollable, the classification can be based on the biological evaluation.

To complete the classification process, the evaluators should file a report which recommends a use class, and outlines why the use class is appropriate. A number of management and administrative decisions may be based on the use class. These decisions may be made by people without first-hand knowledge of the stream. Thus, it is important to document all factors, both objective and subjective, which entered into the classification process. In most situations, there are key factors influencing the use class recommendation, and those should be highlighted in the report.

STREAM SYSTEM HABITAT EVALUATION

Stream system habitat is defined as watershed, stream bank, and instream habitat. Watershed and stream bank characteristics are included because they directly affect instream characteristics — e.g., flow, depth, substrate, and pool-to-riffle ratio. Stream system habitat is one of the most important factors determining attainable use, and therefore, habitat evaluation is stressed in this classification procedure. A detailed discussion of stream system habitat evaluation is presented here to insure that, where practical, uniform evaluation procedures are followed.

The purpose of this evaluation procedure is to integrate and rate stream system habitat characteristics in relation to the various use classifications. The final product is a numerical rank or score of habitat quality which is used to help identify the use (Table 4). The evaluation process used here is similar to one developed by the U.S. Forest Service (1975) to assess the stability of mountain streams. Some of the rating characteristics for stream habitats in that system have been adapted and some new parameters added to fit the character of Wisconsin streams.

Following is a description of stream system habitat characteristics and an excellent-to-poor rating scale for each. The evaluation form in the Appendix provides a method to integrate data and observations of individual characteristics into an overall habitat rating for a s[illegible]eam.

HABITAT RATING CHARA[illegible]TERISTICS

WATERSHED - The total area of [illegible] ove the extreme high water line that contributes r[illegible] a surface water. The character and condition of a wa[illegible] affects the character of a stream and stream bed. [illegible]rtion of a watershed draining directly to a surface [illegible] is usually of greatest concern.

1. **Erosion** - The existing or pote[illegible]tachment of soil and movement into a stream. [illegible]s movement of soil into a stream results in destruc[illegible] of habitat and a reduced potential to support aq[illegible] life. This item can be rated by observation of [illegible]rshed and stream characteristics.

   Excellent: No evidence [illegible]ss erosion that has reached or could reach th[illegible]eam. The watershed is well managed and usua[illegible]aracterized by mature vegetation. The strea[illegible] no evidence of siltation.

   Good: May be some erosi[illegible]t but few "raw" areas. There may be we[illegible]ged agricultural fields in the area. Areas that may have eroded in the past are revegetated and stable. The stream shows little evidence of siltation.

   Fair: Erosion from fields and some raw areas are evident. Heavy storm events are likely to erode soil resulting in periodic high suspended solids in the stream. Some siltation is evident in the stream, and has resulted in destruction of some habitat. Vegetative cover may be sparse and does not appear stable in all areas. There is moderate potential for mass erosion.

   Poor: Erosion sources are obvious. Almost any runoff will result in detachment of soil from raw areas and cause suspended solids and siltation problems in the stream. Instream habitat may be poor due to siltation. Stream flow may fluctuate widely ("flashy stream").

2. **Nonpoint Source Pollution and Other Compromising Factors** - This item refers to problems and potential problems other than siltation. Nonpoint source pollution is defined as diffuse agricultural and urban runoff. Other compromising factors in a watershed which may affect attainable use are feedlots, wetlands, septic systems, dams and impoundments, mine seepage, etc. Nonpoint sources and other compromising factors can be a major source of pollutants, or create problems which affect stream use. Examples of potential problems from these sources include pesticides, heavy metals, nutrients, bacteria, temperature, low dissolved oxygen, etc. If these types of problems are suspected, it may be necessary to conduct an intensive study to determine the problem. It is also important to determine if the problem is controllable or not. If the problem is controllable it should not be factored into the habitat evaluation process.

   Excellent: No evidence of sources or potential sources.

   Good: No obvious problems, but there may be potential sources such as agricultural fields, farms, etc. The watershed should be well managed to fit this category.

   Fair: Potential problems evident. Some runoff from farm fields, watershed intensively cultivated, urban area, small wetland area draining to stream, potential for barnyard runoff, small impoundment, etc.

   Poor: Sources of pollution which may be affecting stream use are evident. Examples of sources are runoff due to poor land management, high use ur-

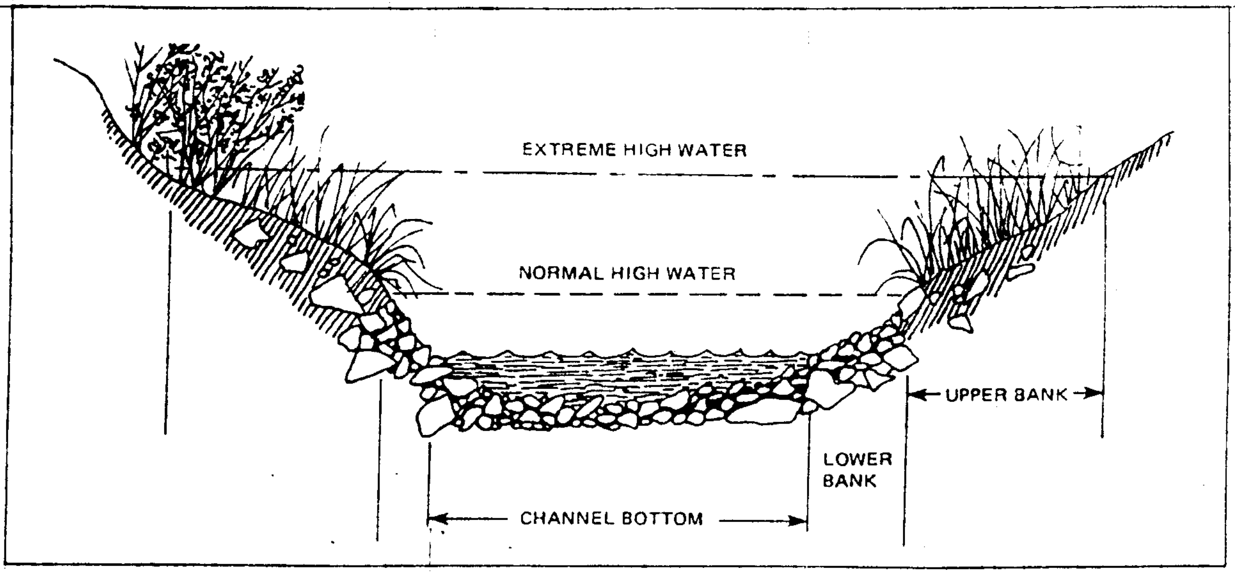

FIGURE 1. *Stream cross section.*

ban or industrial areas, feed lots, impoundments, drainage from large wetlands, mine seepage, tile field drainage, etc. An absence of intolerant organisms in streams with excellent to good habitat may be an indication of these problems.

STREAM BANKS - The stream channel is composed of an upper and lower bank, and a bottom (Fig. 1.). The upper bank is the land area from the break in the general slope of the surrounding land to the normal high water line. It is normally vegetated and is covered by water in only extreme high water periods. Land forms vary from wide, flat flood plains to narrow, steep slopes.

The lower bank is the intermittently submerged portion of the stream cross section from the normal high water line to the low water line. The lower channel banks define the stream width. This area varies from bare soil to rock, and the land form may vary from flat to steep.

Stream banks are important in rating stream system habitat because their character and stability directly affect instream characteristics and uses. The evaluation and rating is based on observation of bank characteristics combined with observation of resultant instream characteristics. Habitat rating items 3 and 4 refer to both upper and lower banks because it is sometimes difficult to distinguish a line between the two. Also, the effect on a stream is similar in situations where either bank area is a problem.

3. **Bank Erosion, Failure** - Existing or potential detachment of soil and movement into a stream. Steeper banks are generally more subject to erosion and failure, and may not support stable vegetation. Streams with poor banks will often have poor instream habitat.

   Excellent: No evidence of significant erosion or bank failure. Side slopes are generally less than 30% and are stable. Little potential for future problem.

   Good: Infrequent, small areas of erosion or bank slumping. Most areas are stable with only slight potential for erosion at flood stages. Side slopes up to 40% on one bank. Little potential for major problem.

   Fair: Frequency and size of raw areas are such that normal high water has eroded some banks. High erosion and failure potential at extreme high stream flows. Side slopes up to 60% on some banks.

   Poor: Mass erosion and bank failure is evident. Many raw areas are present and are subject to erosion at above normal flow. Erosion and undercutting is evident on bends and some straight channel areas. Side slopes greater than 60% are common and provide large volumes of soil for downstream sedimentation when banks are laterally cut.

4. **Bank Vegetative Protection** - Bank soil is generally held in place by plant root systems. The density and health of bank vegetation is an indication of bank stability and potential instream sedimentation. Trees and shrubs usually have deeper root systems than grasses and forbs and are, therefore, more efficient in reducing erosion (Kohnke and Bertrand 1959). Bank vegetation also helps reduce the velocity of flood flows. Greater density of vegetation is more efficient in reducing lateral cutting and erosion. A variety of vegetation is more desirable than a monotypic plant community.

   Vegetative protection is important in evaluating the long-term potential for erosion, and stability of the stream system. The evaluation and rating is based on observation of existing vegetation, erosion, and instream conditions.

   Excellent: A variety of vegetation is present and covers more than 90% of the bank surface. Any bare or sparsely vegetated areas are small and evenly dispersed. Growth is vigorous and reproduction of species is proceeding at a rate to insure continued ground cover. A deep, dense root mat is inferred.

   Good: A variety of vegetation is present and covers 70-90% of the bank surface. Some open areas with unstable vegetation are evident. Growth vigor is good for all species but reproduction may be sparse. A deep root mass is not continuous and erosion is possible in openings.

   Fair: Vegetative cover ranges from 50-70% and is composed of scattered shrubs, grasses and forbs. A few bare or sparsely vegetated areas are evident. Lack of vigor and reproduction is evident in some individuals or species. This condition is ranked fair due to the percent of area not covered by vegetation with a deep root system.

Poor: Less than 50% of the banks covered by vegetation. Vegetation is composed of grasses and forbs. Any shrubs or trees exist as individuals or widely scattered clumps. Many bare or sparsely vegetated areas are obvious. Growth and reproduction vigor is generally poor. Root mats are discontinuous and shallow.

5. **Channel Capacity** - Channel width, depth, gradient, and roughness determine the volume of water which can be transmitted. Over time, channel capacity adjusts to the size of watershed, climate, and changes in vegetation (stability). When channel capacity is exceeded, unstable areas are likely to erode resulting in habitat destruction. Indicators of this problem are deposits of soil on the lower banks and organic debris found hung up in bank vegetation. The objective in rating this item is to estimate normal peak flow and if the present lower bank cross section is adequate to carry the load without bank deterioration.

   The ability of a stream channel to contain flood flows can be estimated by calculating the width-to-depth ratio (W/D ratio). The W/D ratio is calculated by dividing the average top width of the lower bank by the height of the *lower bank.* This item is rated by the W/D ratio, and by observing the condition of banks, position of debris, and instream siltation.

   Excellent: The stream channel is adequate to contain peak flow volumes plus some additional flow. Overbank floods are rare. W/D ratio less than 7; i.e., 36 ft wide divided by 6 ft deep = 6.

   Good: The stream channel is adequate to contain most peak flows. W/D ratio of 8-15.

   Fair: The channel can barely contain normal peak flows in average years. W/D ratio of 15-25.

   Poor: The channel capacity is obviously inadequate. Overbank flows are common as indicated by condition of banks and accumulation of debris. W/D ratio greater than 25.

6. **Bank Deposition** - The character of above water deposits is an indication of the severity of watershed and bank erosion, and stability of the stream system. Deposits are generally found on the lee side of rocks and other objects which deflect flow. These deposits tend to be short and narrow. On flat lower banks, deposition during recession from peak flows may be quite large. The growth or appearance of bars where they did not previously exist is an indication of upstream erosion. These bars tend to grow in depth and length with continued watershed disturbance. Deposition may also occur on the inside of bends, below channel constrictions, and where stream gradient flattens out. This item is evaluated and rated by observation.

   Excellent: Little or no fresh deposition on point bars or on the lee side of obstructions. Point bars appear stable.

   Good: Some fresh deposits on old bars and behind obstructions. Sizes tend to be of larger-sized coarse gravel and some sand, very little silt.

   Fair: Deposits of fresh, fine gravel, sand and silt observed on most point bars and behind obstructions. Formation of a few new bars is evident, and old bars are deep and wide. Some pools are partially filled with fine material.

   Poor: Extensive deposits of fine sand or silt on bars and along banks in straight channels. Accelerated bar development. Most pool areas are filled with silt.

STREAM BOTTOM - The portion of the stream channel cross section which is totally an aquatic environment (Fig. 1.). The character and stability of bottom material is important in determining stream use because this area provides habitat necessary to support aquatic life. A variety of stable habitat, which provides areas for feeding, resting and reproduction, will generally support a higher class of organisms. Stream bottom characteristics are evaluated and rated by observation. The evaluation should be conducted when the stream is free of suspended material to enhance observation.

7. **Scouring and Deposition** - This item relates to the destruction of instream habitat resulting from most of the problems defined under 1-6 above. Deposition material comes from watershed and bank erosion. Scouring results from high velocity flows and is a function of watershed characteristics, stream hydrology, and stream morphology. Characteristics to look for are stable habitat and degree of siltation in pools and riffles. Shallow, uniform stream stretches ("flat areas") may be considered either scoured or silted, depending on stream velocity. The rating is based on an estimate of the percentage of an evaluated reach that is scoured or silted; i.e., 50 ft silted in a 100-ft stream length equals 50%.

   Excellent: No significant scouring or deposition is evident. Up to 5% of the stream reach evaluated may be scoured or silted; i.e., 0-5 ft in a 100-ft stream reach.

   Good: Some scouring or deposition is evident but a variety of good habitat is still present. Scouring is evident at channel constrictions or where the gradient steepens. Deposition is in pools and backwater areas. Sediment in pools tends to move on through so pools change only slightly in depth. The affected area ranges from 5-30% of the evaluated reach.

   Fair: Scoured or silted area covers 30-50% of the evaluated stream reach. Scouring is evident below obstructions, at constrictions, and on steep grades. Deposits tend to fill and decrease the size of some pools. Riffle areas are not significantly silted.

   Poor: Scouring or deposition is common. More than 50% of evaluated stream reach is affected. Few deep pools are present due to siltation. Only the larger rocks in riffle areas remain exposed. Bottom silt may move with almost any flow above normal.

8. **Bottom Substrate** - This item refers to the availability of habitat for support of aquatic organisms. A variety of substrate material and habitat types is desirable. Different organisms are adapted to different habitats; thus, a variety of habitat is necessary for development of a diverse community. The presence of rock and gravel in flowing streams is generally considered more desirable habitat. However, other forms of habitat may provide the niches required for community support. For example, trees, tree roots, vegetation, undercut banks, etc., may provide excellent habitat for a variety of organisms. This item is evaluated and rated by observation. The evaluation should be conducted when stream flow is at a normal or lower stage to enhance observation.

   Excellent: Greater than 50% stable habitat. Rocks, logs, etc. provide shelter. Gravel, debris, riffle areas provide habitat for insects and feeding areas for fish.

   Good: Stable habitat in 30-50% of the stream reach evaluated. Habitat is adequate for development and maintenance of fish and insect communities.

   Fair: 10-30% stable habitat. Habitat is approaching a monotypic type and may have a limiting effect on fish and insect populations. Habitat is less than desirable.

Poor: Less than 10% stable habitat. Almost no habitat available for shelter or development of a desirable insect or fish community. Lack of habitat is obvious.

STREAM MORPHOLOGY AND FLOW - The rating items in this category include depth, flow, and run-to-riffle or pool-to-bend ratio. These stream characteristics are closely related to previous rating items. Stream depth, morphology and flow are a function of watershed characteristics and climate. They may be the most important evaluation parameters because they relate to the volume of water and habitat available to provide life support requirements, i.e., shelter, food and reproduction needs. Low stream flow and shallow depth can be major limiting factors preventing a certain use. Stream morphology relates to habitat and can also become a limiting factor.

In situations where effluent flow significantly adds to or subtracts from natural stream flow, the stream should be evaluated under both flow conditions. This procedure applies to the Average Depth and Stream Flow rating items.

9. **Average Depth at Representative Low Flow** - Average stream depth is estimated by measuring the maximum depth in riffles and pools, adding those depths, and dividing by the total number of riffles and pools. This rough estimate should be adequate because it relates to the ability of a stream to provide a medium for shelter and movement. It may not be practical to measure depth at a representative low flow. However, if a stream is evaluated at average or lower flow, a representative low flow depth can be reasonably estimated. The representative low flow depth is rated because it is a better expression of prevailing conditions and the uses possible in a stream most of the time. The following rating depths are based on depths of streams in southern Wisconsin known to support various communities. The rating depths are general guidelines only. For example, a cold water stream with an average depth less than 24 inches may deserve an excellent rating if otherwise excellent habitat is available.

   Excellent: Average depth greater than 24 inches. Riffle depths allow for free passage of fish and shelter when feeding. Pool depths provide security and ample space for several fish, even at very low flow.
   Good: Average depth 12-24 inches. Most riffles allow free passage and shelter at normal flow conditions. Most pools provide adequate shelter under all but very low flow conditions.
   Fair: Average depth 6-12 inches. Many riffles are too shallow for free passage of fish at normal flow. Some habitat is provided by pools but only at normal or higher flow. Depth may be sufficient to support forage species and macroinvertebrates.
   Poor: Average depth less than 6 inches. Riffles are shallow, even at normal flow. Pools and flat areas are shallow and uniform in depth. Little cover available for any fish species. Stream may cease to flow in very dry periods.

10. **Stream Flow, at a Representative Low Flow** - Stream flow relates to the ability of a stream to provide and maintain a stable aquatic environment. The rating flows are based on a review of publications on the surface water resources of Wisconsin counties by the Wisconsin Department of Natural Resources. Flows were compared to species of fish known to inhabit streams.

    Excellent: Stream flow greater than 5 cfs for warm water streams, and greater than 2 cfs for cold water streams. These values are based on the potential of a stream to support warm or cold water sport fish.
    Good: Stream flow 2 to 5 cfs for warm water streams, and 1 to 2 cfs for cold water streams. Surface water resources data for Wisconsin indicates many warm water streams, with good habitat, in this flow range support sport fish. Other streams, with good water quality, support diverse forage fish populations. Many cold water streams in this flow range will support trout, if habitat is good.
    Fair: Stream flow 0.5 to 2 cfs for warm water streams, and 0.5 to 1 cfs for cold water streams. These stream flows are sufficient to support forage species in warm water. Cold water streams in this flow range may support a few trout. Streams with exceptional habitat may support a fishable trout population. Many cold water streams in this range will support diverse forage fish and macroinvertebrate populations.
    Poor: Stream flow less than 0.5 cfs for both warm and cold water streams. Streams in this category may become intermittent in dry periods. Streams with exceptional water quality and habitat may support forage fish, or even serve as spawning or nursery areas for trout.

11. **Pool/Riffle or Run/Bend Ratio** - This rating item assumes a stream with a mixture of riffles or bends contains better habitat for community development than a straight (run) or uniform depth stream. "Bends" refer to a meandering stream. Bends are included because some low gradient streams may not have riffle areas, but excellent habitat can be provided by the cutting action of water at bends. The ratio is calculated by dividing the average distance between riffles or bends by the average stream width. If a stream contains both riffles and bends, the most dominant feature which provides the best habitat, should be used.

    Excellent: Pool-to-riffle or run-to-bend ratio of 5-7. Pools are deep and provide good habitat. Riffles are deep enough for free passage of fish.
    Good: Pool-to-riffle or run-to-bend ratio of 7-15. Adequate depth in pools and riffles.
    Fair: Pool-to-riffle or run-to-bend ratio of 15-25. Occasional riffle or bend. Variable bottom contours may provide some habitat.
    Poor: Pool-to-riffle or run-to-bend ratio greater than 25. Essentially a straight and uniform depth stream. Little habitat of any kind.

12. **Aesthetics** - This rating item does not necessarily relate to the ability of a stream to support aquatic life. However, people's perception of what constitutes a desirable surface water is important. Even though a stream may not be capable of supporting high use class organisms, it may have desirable aesthetic qualities which deserve protection. It is not possible to guide everyone to a uniform aesthetic rating decision. However, various studies have been conducted on what most people consider as aesthetics when viewing a setting. The various factors important in this evaluation include:

1. Visual pattern quality	5. Naturalness
2. Land husbandry	6. Geological values
3. Degree of change	7. Historical values
4. Recovery potential	8. Flora and fauna diversity

    Excellent: The stream or stream section has wilderness characteristics, outstanding natural beauty, or flows through a wooded or unpastured corridor.
    Good: High natural beauty — trees, historic site. Some watershed development may be visible, such as agricultural fields, pastures, some dwellings. Land in use is well managed.
    Fair: Common setting, but not offensive. May be a developed but uncluttered area.

Poor: Stream does not enhance aesthetics. Condition of stream is offensive, and recovery without extensive renovation of watershed and stream is unlikely.

HABITAT RATING PROCEDURE

The habitat characteristics described are rated from excellent to poor on the form provided in the Appendix. The habitat score obtained from the rating form is used in Table 4 to assist in determining attainable stream use. The rating numbers are relative to one another from excellent to poor, and number values are weighted to give the more important rating items (depth, flow, substrate) more significance in the total score. It is the proportion of the rating values to one another that is important, not the actual number value.

Complete the rating form using field measurements, observations, maps, aerial photos, etc. If a stream is divided into segments, complete a separate form for each one as follows:

1. Circle the number which best describes the condition of the rating item.
2. If you feel the actual condition falls somewhere between two descriptions cross out the number and write in an intermediate value which better describes the situation.
3. Complete all rating items on the form.
4. Add all scores in each column, then add the column totals to arrive at a final ranking score for the stream segment.
5. Use the final ranking score in Table 4.

The rating items are interrelated so do not dwell on any one item for long. Avoid keying in on a single indicator unless it has significant impact on the stream's potential to support aquatic life. The weight given to more important items is intended to account for this. In this system a stream with excellent characteristics will receive a lower number score than one with poor characteristics, i.e. the lower the score, the better the stream system habitat.

The rating form should be completed in the field to insure all items are rated at the site. The descriptions are intended to stimulate mental images of indicator conditions which lead to consistent, reproducible habitat ratings by different evaluators.

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APPENDIX: Stream System Habitat Rating Form

Stream ____________ Reach Location ______________________________________ Reach Score/Rating ________________

County ____________ Date ____________ Evaluator ______________________________ Classification ________________

Rating Item	Category							
	Excellent		Good		Fair		Poor	
Watershed Erosion	No evidence of significant erosion. Stable forest or grass land. Little potential for future erosion.	8	Some erosion evident. No significant "raw" areas. Good land mgmt. practices in area. Low potential for significant erosion.	10	Moderate erosion evident. Erosion from heavy storm events obvious. Some "raw" areas. Potential for significant erosion.	14	Heavy erosion evident. Probable erosion from any runoff.	16
Watershed Nonpoint Source	No evidence of significant source. Little potential for future problem.	4	Some potential sources. (roads, urban area, farm fields).	8	Moderate sources. (Small wetlands, tile fields, urban area, intense agriculture).	16	Obvious sources. (Major wetland drainage, high use urban or industrial area, feed lots, impoundment).	20
Bank Erosion, Failure	No evidence of significant erosion or bank failure. Little potential for future problem.	6	Infrequent, small areas, mostly healed over. Some potential in extreme floods.	9	Moderate frequency and size. Some "raw" spots. Erosion potential during high flow.	15	Many eroded areas. "Raw" areas frequent along straight sections and bends.	18
Bank Vegetative Protection	90% plant density. Diverse trees, shrubs, grass. Plants healthy with apparently good root system.	6	70-90% density. Fewer plant species. A few barren or thin areas. Vegetation appears generally healthy.	9	50-70% density. Dominated by grass, sparse trees and shrubs. Plant types and conditions suggest poorer soil binding.	15	<50% density. Many raw areas. Thin grass, few if any trees and shrubs.	18
Lower Bank Channel Capacity	Ample for present peak flow plus some increase. Peak flows contained. W/D ratio <7.	8	Adequate. Overbank flows rare. W/D ratio 8-15.	10	Barely contains present peaks. Occasional overbank flow. W/D ratio 15-25.	14	Inadequate, overbank flow common. W/D ratio >25.	16
Lower Bank Deposition	Little or no enlargement of channel or point bars.	6	Some new increase in bar formation, mostly from coarse gravel.	9	Moderate deposition of new gravel and coarse sand on old and some new bars.	15	Heavy deposits of fine material, increased bar development.	18
Bottom Scouring and Deposition	Less than 5% of the bottom affected by scouring and deposition.	4	5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools.	8	30-50% affected. Deposits and scour at obstructions, constrictions and bends. Some filling of pools.	16	More than 50% of the bottom changing nearly year long. Pools almost absent due to deposition.	20
Bottom Substrate	Greater than 50% rubble, gravel or other stable habitat.	2	30-50% rubble, gravel or other stable habitat. Adequate habitat.	7	10-30% rubble, gravel or other stable habitat. Habitat availability less than desirable.	17	Less than 10% rubble, gravel or other stable habitat. Lack of habitat is obvious.	22
Average Depth at Rep. Low Flow	Greater than 24 inches.	0	12 inches to 24 inches.	6	6 inches to 12 inches.	18	Less than 6 inches.	24
Flow, at Rep. Low Flow	Warm water >5 cfs. Cold water >2 cfs.	0	Warm water 2-5 cfs. Cold water 1-2 cfs.	6	Warm water 0.5-2 cfs. Cold water 0.5-1 cfs. Continuous blow.	18	Less than 0.5 cfs. Stream may cease to flow in very dry years.	24
Pool/Riffle, Run/ Bend Ratio	5-7. Variety of habitat. Deep riffles and pools.	4	7-15. Adequate depth in pools and riffles. Bends provide habitat.	8	15-25. Occassional riffle or bend. Bottom contours provide some habitat.	16	>25. Essentially a straight stream. Generally all flat water inches or shallow riffle. Poor habitat.	20
Aesthetics	Wilderness characteristics, outstanding natural beauty. Usually wooded or unpastured corridor.	8	High natural beauty. Trees, historic site. Some development may be visible.	10	Common setting, not offensive. Developed but uncluttered area.	14	Stream does not inhance aesthetics. Condition of stream is offensive.	16

Column Totals Without Effluent —
Column Totals With Effluent —

Add Column Scores Without Effluent, E______ +G______ +F______ +P______ = Reach Score
Add Column Scores With Effluent, E______ +G______ +F______ +P______ = Reach Score

0 = Excellent, 71-129 = Good, 130-200 = Fair, >200 = Poor