Level 1 - Stream Condition Assessment for All Ephemeral and Intermittent Streams and for Impacts Less Than 500 Linear Feet to Intermittent Streams with Perennial Pools, Perennial Streams and Wadeable Rivers

1.0 Introduction

Regulated impacts are proposed to various types and qualities of streams. Therefore, it is important to assess the functional condition of the stream being impacted and use this condition as a baseline when evaluating the proposed impacts and determining the appropriate mitigation. The Level 1 assessment is designed to assess the functional condition of ephemeral and intermittent streams. In addition, Level 1 may be used to assess the functional condition of intermittent streams with perennial pools, perennial streams, and wadeable rivers when the proposed impact less than 500 linear feet. Level 1 is not designed to assess the functional condition of large navigable rivers or rivers with tidal influence. This assessment process does not alter the circumstances under which compensatory mitigation is required or the definitions of “waters of the United States” or “navigable waters of the United States.”

This qualitative assessment is designed to evaluate relative potential of a stream to support and maintain a diverse community of organisms by visually assessing hydrogeomorphic and fluvial geomorphic characteristics such as active floodplain, width/depth ratios, bed elevation and floodplain storage and release. The visual parameters sampled under Level 1 include: 1) Visual Channel Assessment; 2) Desktop Riparian Buffer Assessment; 3) Desktop Aquatic Use Assessment; and 4) Visual Channel Alteration Assessment.

1.0.1 Stream Assessment Transect

The fundamental units for evaluating stream condition are the stream assessment transects (Transect). Application of the Transect is an important step in the assessment process and may affect the score. To simplify the process of establishing Transects, a fixed length Transect of 350 feet will be placed within set intervals commensurate with the project. The following guidelines will be applied for the placement and number of Transects to assure accuracy and precision of the assessment:

Projects proposing impacts to less than 500 linear feet of ephemeral, intermittent or perennial streams will be assessed using three, 350-linear-foot Transects placed no less than 125 feet apart and no greater than 200 feet apart.

Projects proposing impacts to 500 linear feet or greater to an ephemeral and/or intermittent stream will add one 350-linear-foot Transect for each additional 500 feet of impact. Transects must be placed no less than 125 feet apart and no greater than 200 feet apart.

Projects proposing impacts to intermittent streams with perennial pools, perennial streams, and wadeable rivers with proposed impacts of 500-linear feet or greater shall use the Level 2 Stream Condition Assessment Procedure.

1.1 Visual Channel Condition Parameter

Under most circumstances, channels respond to disturbances or changes in flow regime in a sequential, predictable manner. The way a stream responds to changes by degrading to a lower elevation and eventually re-stabilizing at that lower elevation is the basic premise behind the stream channel evolutionary process. The differing stages of this process can be directly correlated with the current state of stream stability. The purpose of evaluating channel condition is to determine the current condition of the channel cross-section, as it relates to this evolutionary process, and to make a correlation to the current state of stream stability. These evolutionary processes apply to the majority of stream systems since the majority of stream systems are degrading, aggrading, healing, or stable.

For a Level 1 Stream Condition Assessment, channel condition will be determined by visually assessing certain geomorphological indicators. These indicators include: channel incision; access to original or recently created floodplains; channel widening; channel depositional features; rooting depth compared to streambed elevation; streambank vegetative protection; and streambank erosion. Each of the categories describes a particular combination of the state of these geomorphological indicators which generally correspond to a stream channel stability condition at some stage in the evolution process.

1.1.1 Visual Channel Condition Variable

The Visual Channel Condition Variable assesses the channel condition by visually inspecting the cross-section of the stream along the Transect. The channel condition of each transect is categorized using the following five stream conditions: optimal; sub-optimal; marginal; poor; and severe. A score is given for each **Channel Condition Value (CV)**; however, there may be cases where the stream lies between the descriptions. In these cases, a score between those provided may be used. Scores for this category range from 1 for the most severe condition to 5 for the most optimal condition. The stream evaluator needs to identify the current channel condition by visually assessing the channel's geometry, the channel's stability and the channel's ability to connect to the active floodplain and document the basis for the findings; including providing photos, drawings or verbal description.

Channel Geometry:

The evaluator visually assesses the channel profile by assessing the degree of incision and/or widening. Channel incision is a common response of alluvial channels that have excess amounts of flow energy or stream power relative to the sediment load. This change in flow regime results in the stream eroding the streambed, causing steep, easily eroded banks. If the cohesiveness of the bank material is very low, such as loose sand, the channel will erode the banks and have a wide cross-section compare to its depth. This instability presents itself as an over-widened channel.

Channel Stability:

The evaluator assesses channel stability by looking for visual indicators of stability or instability. In a stable stream, the pattern of erosion and deposition occurs in an orderly and predictable fashion. One of the most common depositional features of stable streams in this region is the creation of point bars. A point bar is a crescent-shaped depositional feature located on the inside of a stream bend or meander. Point bars are composed of well-sorted sediment with a very gentle slope at an elevation below bankfull and very close to the baseflow water level. Since point bars are low-lying, they are often overtaken by streamflow and can accumulate driftwood and other debris during times of high water levels. Another common feature of a stable stream is a bankfull bench. A bankfull bench is a flat or shallowly sloped area above bankfull that slows high velocity flows during flows above bankfull. The bank of a stable stream will also be well vegetated with either herbaceous or woody species or may have a natural rock surface. These banks are stabilized by these surfaces, thereby reducing or preventing erosion. Finally, an indication of a stable stream may simply be an absence of indicators of an unstable stream channel.

Indicators of an unstable stream channel include depositional features such as mid-channel bars, transverse bars, and transient sediments, as well as erosion features such as erosion scars, denuded banks, and threaded channels. Mid-channel bars and transverse bars are landforms in a stream channel that begin to form when the discharge rate is low and the stream is forced to take the route of less resistance by flowing in locations of lowest elevation. Over time, the stream begins to erode the outer edges of the bar, causing it to remain at a higher elevation than the surrounding areas. The water level decreases even more as the river laterally erodes the less cohesive bank material, resulting in a widening of the river and a further exposure of the bar. As the discharge rate increases, material may deposit about the bar since it is an area in the stream of low velocity due to its higher elevation than the surrounding areas.

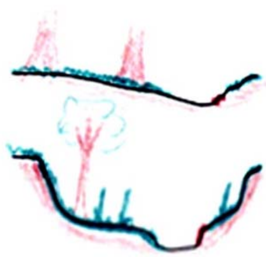
Active Floodplain Connection:

Active floodplain is the land between the active channel at the bankfull elevation and the terraces that are flooded by stream water on a periodic basis. Natural channels at or immediately below surrounding floodplain elevations will be connected to the active floodplain. Channels that are deeply incised or channelized will be below the elevation of the floodplain and will no longer be able to flood the floodplain during normal high-water events.

1.1.2 Identifying Visual Channel Condition Variable

Each transect is assessed for the condition of the channel by using the five categories described below.

Optimal-Score 5



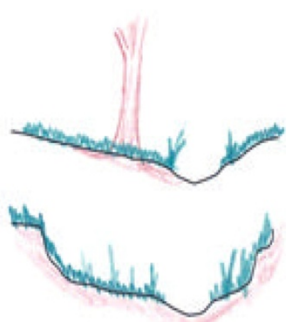
Channel Geometry: These channels show very little incision or widening and little or no evidence of active erosion or unprotected banks. Entrenchment ratio should be greater than 2.2.

Channel Stability: Visual indicators of this stability include: 1) vegetative surface protection or natural rock stability present along 80% or more of the banks; 2) stable point bars and bankfull benches may be present; and 3) mid-channel bars and transverse bars are rare and if transient sediment deposition is present, it covers less than 10% of the stream bottom.

Floodplain Connection: The channel has access to the active floodplain or has fully developed wide bankfull benches.

Additional Information: In addition, no bulkheading or riprap may be present along the Transect for an **Optimal** score, regardless of channel profile.

Suboptimal-Score 4



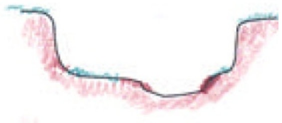
Channel Geometry: These channels are slightly incised and contain a few areas of active erosion or unprotected banks. Entrenchment ratio should be equal to or between 1.8 and 2.2.

Channel Stability: Visual indicators of this slight instability include: 1) vegetative surface protection or natural rock stability present along 60-79% of both banks; 2) depositional features such as point bars and bankfull benches are likely present; and 3) if transient sediment is present, it affects or buries 10-40% of the stream bottom.

Active Floodplain: The stream has access to bankfull benches, or newly developed floodplains along portions of the reach.

Additional Information: Suboptimal channels may show evidence of past channel alteration, but should exhibit notable recovery to a natural channel. In addition, a stream channel is visually characterized as **Suboptimal** if 1-25% of the Transect is bulkhead or riprap, regardless of channel profile.

Marginal-Score 3



Channel Geometry: These channels are often incised or their course has been widened, but to a lesser degree than the **Severe** and **Poor** channel conditions. Entrenchment ratio should be equal to or between 1.4 and 1.8.

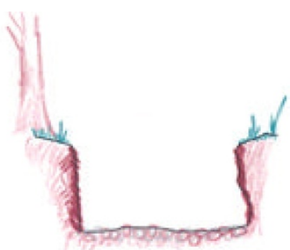
Channel Stability: Visual indicators of a marginal stream include: 1) erosional scars present on 40-59% of both banks; 2) vegetative surface protection may be present on 40-59% of the banks; 3) the streambanks may consist of some vertical or undercut banks or nickpoints associated with headcuts; 4) portions of the bankfull channel may still widen while some portions are beginning to narrow; and 5) temporary and transient sediment deposit covers 41-60% of the natural stream bed or bottom.

However, streams that have degraded channel profiles which are recovering will exhibit different characteristics, including: 1) presence of depositional features such as point bars, mid-channel bars, transverse bars, and bankfull benches may be forming or present; 2) channels have a V-shape; 3) vegetative surface protection is present on greater than 40% of the banks but evidence of instability can be observed in unvegetated areas.

Active Floodplain: Marginal streams have no connection to the active floodplain.

Additional Information: In addition, a stream channel is visually characterized as **Marginal** if 26-50% of the Transect is bulkhead or riprap, regardless of channel profile.

Poor-Score 2



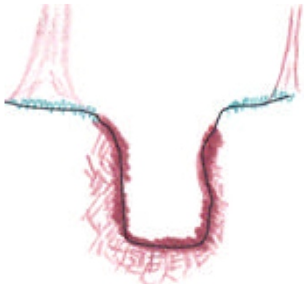
Channel Geometry: These channels are over-widened or are incised. These channels are vertically and/or laterally unstable and are more likely to widen rather than incise further. Entrenchment ratio should be equal to or between 1.2 and 1.4.

Channel Stability: Visual indicators of over-widening and incision include: 1) both banks are near vertical with shallow to moderate root depths; 2) erosional scars present on 60-80% of the banks; 3) vegetative surface protection present on 20-39% of both banks and is insufficient to prevent significant erosion from continuing; 4) between 61-80% of the natural stream bed or bottom (pools and riffles) is covered by substantial sediment deposition, often uniformed-sized materials; and 5) depositional features such as point bars and bankfull benches are absent.

Active Floodplain: **Poor** streams are not connected to the active floodplain.

Additional Information: In addition, a stream channel is visually characterized as **Poor** if 51-80% of the Transect is bulkhead or riprap, regardless of channel profile.

Severe-Score 1



Channel Geometry: Severe channels are deeply incised (or excavated) with vertical and/or lateral instability and may likely continue to incise or widen. Entrenchment ratio is less than 1.2. Channel Stability: Visual indications of a deeply incised stream include: 1) the streambed elevation is below the average rooting depth; 2) both banks are vertical or undercut; 3) vegetative surface protection present on less than 20% of the banks and is not preventing erosion from continuing; 4) bank sloughing present; 5) erosional scars or raw banks present on 81-100% of the banks; 6) 81% or more of the natural streambed or bottom (pools and riffles) is covered by substantial sediment deposition; and 7) Multiple thread channels and/or subterranean flow may be present in certain aggrading channels. Note: Stable multiple thread channels naturally occur in some low-gradient streams and should not be given a Severe Parameter Condition score.

Active Floodplain: **Severe** streams are not connected to the active floodplain.

Additional Information: In addition, a stream channel is visually characterized as **Severe** if the channels have been altered or channelized or the entire Transect is bulkhead or riprap, regardless of stream profile. An altered channel may be straight, with high banks, has dikes or berms, lack flow diversity, often has uniform-sized bed materials, and is missing or has non-native or invasive riparian vegetation along the bank.

1.2 Riparian Buffer Parameter

A Riparian buffer is defined as the zone of vegetation adjacent to streams, rivers, creeks or bayous. These vegetated zones are important in intercepting and controlling nutrients entering into the system. As such, it is considered a best management practice to include a riparian buffer in a compensatory mitigation plan as well as being an important consideration in the review of proposed impacts to the stream. Buffer width is positively related to nutrient removal effectiveness by influencing retention through plant sequestration or removal through microbial denitrification. This parameter is not intended to be a detailed vegetative cover survey, but instead, is a qualitative evaluation of the cover types that make up the riparian buffer. For the purpose of this assessment, the buffer is measured from the verified ordinary high water mark of the stream. The **Buffer Value (BV)** for this parameter is determined by evaluating the percentage of each cover type occupying the riparian buffer area for 100 feet on each side of the ordinary high water mark of the stream channel within the Transect. The left bank (LB) and right bank (RB) are determined by facing downstream.

The ideal riparian buffer would be 100% coverage of the assessment area by the native woody vegetation community with no additional land use. If the buffer is a mixed land use (example: 33% forested, 33% cropland, and 34% pavement), it is possible that the buffer could contain multiple condition categories. In that case, each condition category present within the buffer is scored and weighted by the percent it occupies within the buffer. An estimate of the percent area that each cover type occupies may be made from visual estimates made on-the-ground or by measuring each different area to obtain its dimensions. Multiple intrusions of roads, houses, developments, etc., into the 100-foot zone may require more detailed measurements to determine percentages. The observed cover types should be categorized and scored accordingly, based upon the parameter category description.

1.2.1 Riparian Buffer Condition Variable

The Transect is assessed for the condition of the Riparian Buffer to calculate the Riparian Buffer Variable (BV) using the five categories described below.

Optimal-Score 5

Native woody community species represent greater than 60% coverage with wetlands present within the Transect. No maintenance and/or grazing within the buffer.

Suboptimal:

High Suboptimal-Score 4.5: Native woody community species represent greater than 60% coverage *with no* wetlands present within the buffer and no maintenance or grazing within the buffer OR native community species represent between 30-60% aerial coverage *with* wetlands present and no maintenance or grazing within the buffer.

Low Suboptimal-Score 4: Native woody community species between 30-60% aerial coverage with no wetlands present and no maintenance or grazing activities present within the buffer.

Marginal-Score 3

Native woody community represents less than aerial 30% coverage with no maintenance or grazing activities present.

Poor-Score 2

The area is dominated by one or more of the following: lawns; mowed or maintained right-of-way; no-till cropland; actively grazed pasture; sparsely vegetated non-maintained area; recently seeded and stabilized; or other comparable condition**.**

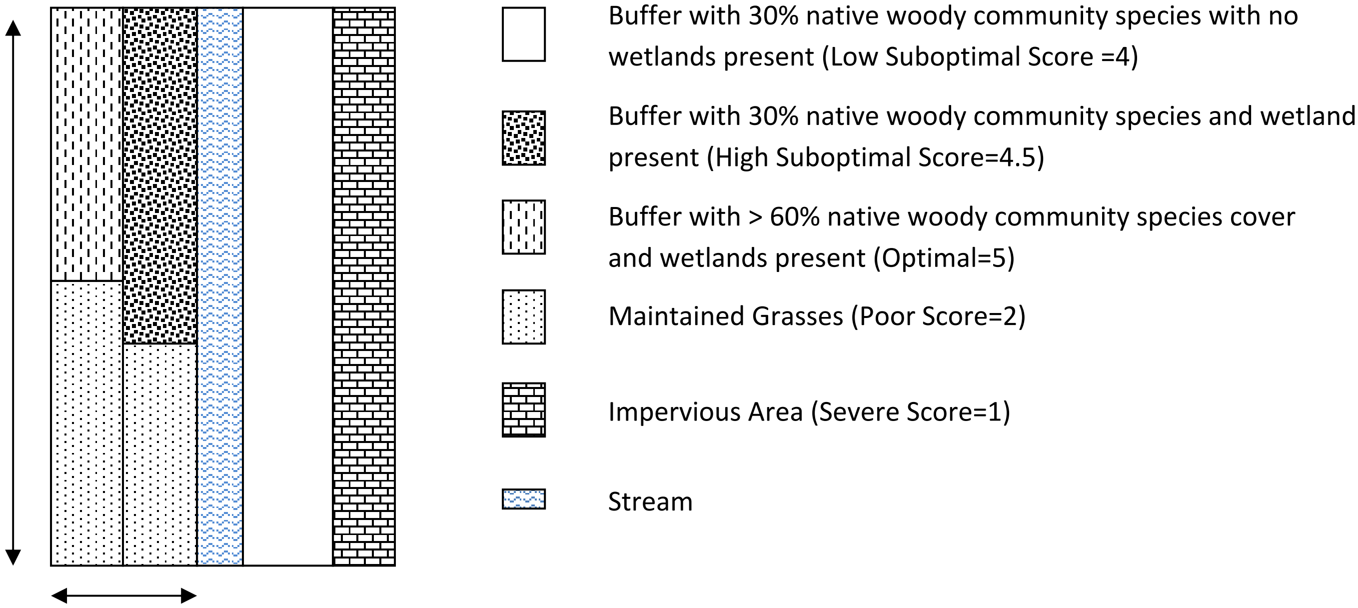
Severe-Score 1

The area is dominated by: impervious surfaces; mine spoil lands; denuded surfaces; conventional tillage; active feed lots; or other comparable conditions.

1.2.2 Identifying Riparian Buffer Condition

When a buffer is simply one vegetation community, determining the appropriate buffer condition variable is simple. However, often times the buffer in the Transect is a mixed community. Since a single variable is required for the calculations, an example of how to calculate a multiple condition buffer is included to explain the method.

EXAMPLE 1: Calculating Multiple Condition Riparian Buffer



<u>Right Buffer</u>

The buffer located on the right bank is comprised of:

1. A 60-foot by 1000-foot (or 60%) Low Suboptimal Score (or 4) area.
2. A 40-foot by 1000-foot (or 40%) Severe Score (or 1) area.

Therefore, the equation to calculate the Right Buffer is:

$$(0.60 * 4) + (0.40 * 1) = 2.8$$

<u>Left Buffer</u>

The buffer located on the left bank is comprised of:

1. A 50-foot by 500-foot (or 25%) Optimal Score (or 5) area.
2. A 50-foot by 750-foot (or 37.5%) High Suboptimal (or 4.5) area.
3. One 50-foot by 500-foot and one 50-foot by 250-foot (or a total of 37.5%) of Poor Score (or 2) area.

Therefore, the equation to calculate the Left Buffer is:

$$(0.25 * 5) + (0.375 * 4.5) + (0.375 * 2) = 3.68$$

The final variable for BV is calculated by averaging the two buffer scores.

$$(2.8 + 3.68)/2 = 3.24$$

1.3 Desktop Aquatic Use Parameter

The Texas Commission on Environmental Quality (TCEQ) and its cooperators, in compliance with 305(b) and 303(d) of the Clean Water Act, evaluate and monitor the state's surface waters and assess the health of surface waters of the state by comparing the data to the water quality standards. These standards are defined in the *Texas Surface Water Quality Standard (TSWQS).* Water quality standards are composed of designated uses and their associated criteria for instream conditions necessary to support those uses. Evaluation of state waters is conducted biennially and published as the *Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d).* The purpose of this report is to provide resource managers with a tool for making informed decisions. In developing this report, TCEQ considers all existing and readily available water quality related data and information. Data has been collected in the previous 7 years and is required to have been consistently sampled using scientifically rigorous water quality sampling methods. The TCEQ assess water quality based on the purposes designated for a water body, such as aquatic life use, providing water that is safe for swimming or other recreational purposes. The criteria may be expressed in terms of desirable conditions, or as numeric limits on certain pollutants. Specific criteria tested may include; water temperature, pH, chloride, sulfate, dissolved oxygen (DO), total dissolved solids (TDS) as well as fish and macroinvertebrate communities. Many stream segments have multiple parameters measured and examined in combination. Based on the TCEQ's assessment, each stream segment's Aquatic Life Use is designated into one of five categories. These categories indicate the suitability of stream segment to support an environment for fish and other aquatic life.

1.3.2 Aquatic Use Variable

The Transect is assessed based on the aquatic life use category score assigned to the stream segment by the TCEQ. Each classified segment in the TSWQS is assigned an aquatic life use, based on physical, chemical, and biological characteristics of the water body. The five aquatic life use categories are: *exceptional; high; intermediate; limited; and minimal* (no significant) *aquatic life use*. For streams not classified in the TSWQS, the aquatic life use is presumed based on the stream flow type. The Transect's Aquatic Use Variable (UV**)** is assessed based on the following five categories.

Optimal-Score 5

Aquatic Life Score of *Exceptional*.

Suboptimal-Score 4

Aquatic Life Score of *High*. Perennial streams that have not been assessed are also assumed to have an Aquatic Life Score of *High*.

Marginal-Score 3

Aquatic Life Score of *Intermediate.*

Poor-Score 2

Aquatic Life Score of *Limited*. Intermittent Streams with Perennial Pools that have not been assessed are also assumed to have an Aquatic Life Score of *Limited*.

Severe-Score 1

Aquatic Life Score of *Minimal*. Intermittent and ephemeral streams that have not been assessed are also assumed to have an Aquatic Life Score of *Minimal*.

1.4 Visual Channel Alteration Parameter

This parameter considers direct impacts to the stream channel from anthropogenic sources. The Transect may or may not have been altered throughout its entire length. Examples of channel alterations evaluated in this parameter that may disrupt the natural conditions of the stream include, but are not limited to, the following:

- Straightening of channel or other channelization
- Stream crossings (bridges and bottomless culverts)
- Riprap, articulated matting, concrete aprons, gabions, or concrete blocks along streambank or in streambed
- Manmade embankments on streambanks, including spoil piles
- Constrictions to stream channel or immediate flood prone area such as any culverts, levees, weirs, and impoundments
- Livestock impacted channels (i.e., hoof treads, livestock in stream, *etc*.)

It is important to note that this parameter evaluates the physical alteration, separate from the impact the alteration is having on the assessment reach. Any impact to the assessment reach resulting from the alteration (i.e. scouring, head cuts, vertical banks, etc.) is accounted for in the Visual Channel Condition Parameter. Any revegetation or natural re-stabilization of the channel is also accounted for in the Visual Channel Condition Parameter. For example, consider two Transects, each with similar bridges: the first reach shows no adverse effects to the stream channel or banks; the second shows significant scouring. The alteration is the bridge, not the effects of the bridge; therefore it is the length of bridge relative to the length of the assessment reach that is evaluated. The presence of a structure does not necessarily result in a reduced score. For instance, a bridge that completely spans the floodplain would not be considered an alteration. Also, the stream evaluator is cautioned not to make assumptions about past alterations. For example, incision can be mistaken for channelization. While the both result in an unstable width/depth ratio, only channelization would be accounted for in this parameter.

1.4.1 Channel Alteration Categories

The Transect is assessed for the extent of anthropogenic channel alterations to determine the appropriate Visual Channel Alteration Variable (AV) using the following four Categories. The evaluator selects the category most representative of the assessment Transect.

Optimal-Score 5:

Channelization, dredging, alteration, or hardening absent. Stream has unaltered pattern or has normalized. No dams, dikes, levees, culverts, riprap, bulkheads, armor, hoof tread, drop structures or withdrawal structures found on the Transect.

Suboptimal-Score 4:
Less than 100 feet of the Transect is adversely impacted by channelization, dams, dikes, levees, culverts, riprap, bulkheads, armor, hoof tread, drop structures or withdrawal structures. Evidence of past alteration may be present, but if the stream pattern and stability have recovered and no other recent alteration is present then it should not be counted as adverse impact.

Marginal-Score 3:
Between 101-200 feet of the Transect is adversely impacted by channelization, dams, dikes, levees, culverts, riprap, bulkheads, armor, hoof tread, drop structures or withdrawal structures. If the stream has been channelized, normal stable stream meander pattern has not recovered.

Poor-Score 2:
Between 201-300 feet of Transect is adversely impacted by channelization, dams, dikes, levees, culverts, riprap, bulkheads, armor, hoof tread, drop structures or withdrawal structures. If the stream has been channelized, normal stable stream meander pattern has not recovered.

Severe-Score 1:
Greater than 300 feet of the Transect is adversely impacted by channelization, dams, dikes, levees, culverts, riprap, bulkheads, armor, hoof tread, drop structures or withdrawal structures. The channel is deeply channelized or structures are present that prevent access to the floodplain or dam operations prevent flood flows.

1.5 Calculations

1.5.1 Assessing Transect Condition Index:
The first step is to assess the Condition Index (CI) for each Transect sampled. Each Transect is sampled for the following variables:

- Channel Condition Variable (CV) = Score 1-5
- Riparian Buffer Variable (BV) (see Example 1)= Score =1-5
- Aquatic Use Variable (UV)= 1-5
- Channel Alteration Variable (AV)= 1-5

The CI is calculated using an arithmetic mean, or average score. The CI shall be calculated for each Transect sample. The calculation for determining CI is:

$$CI = (CV+BV+UV+AV) \div 4$$

1.5.2 Assessing Reach Condition Index

Similar to the CI for each Transect, an arithmetic mean is used to calculate the Reach Condition Index (RCI). A single RCI is calculated for each stream segment, or reach, proposed for impact. The calculation for determining RCI is:

$$\mathrm{RCI}=\left(\sum_{n=1}^{Y}\mathrm{CIn}\right) \div Y$$

RCI = Reach Condition Index

CI = Condition Index for each Transect

Y= Number of Transects