U.S. ARMY CORPS OF ENGINEERS

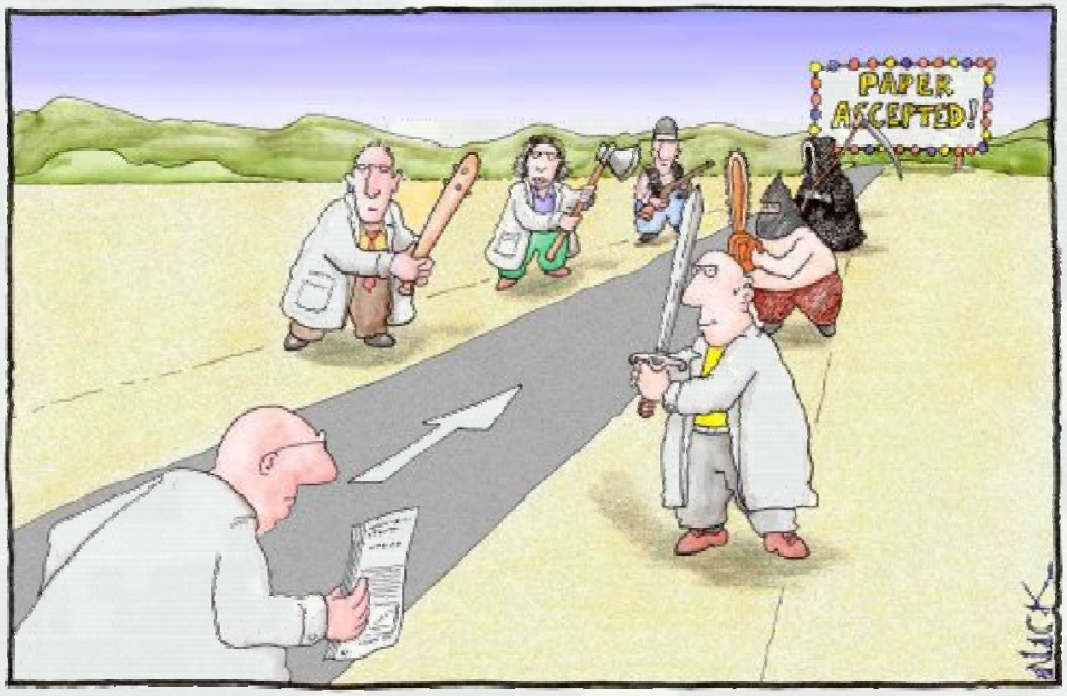
Galveston District
Stream Tool

2013

US Army Corps of Engineers
BUILDING STRONG®

Agenda

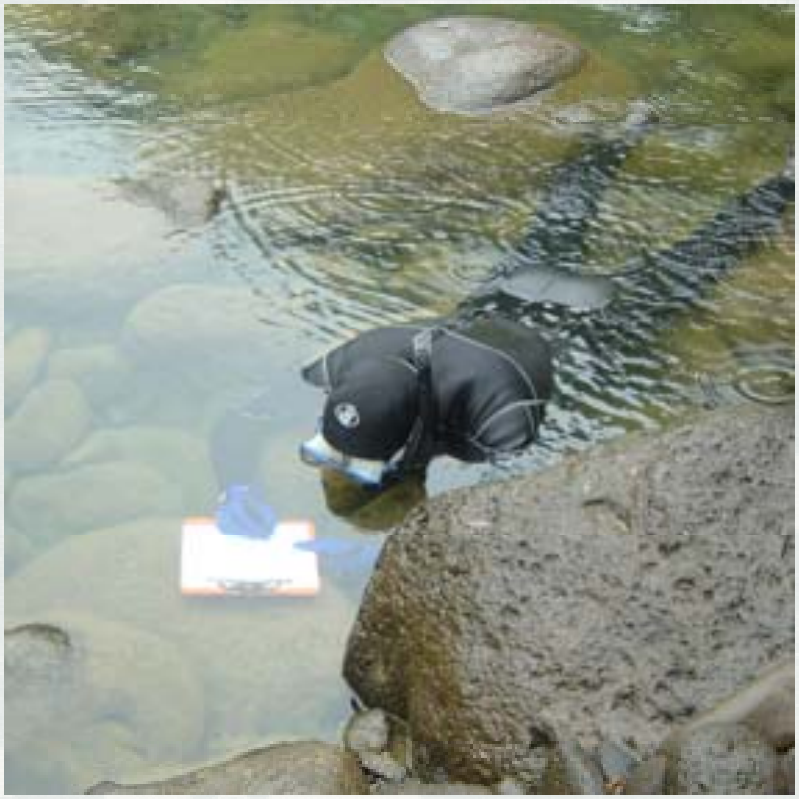
1. Level 1 Stream Condition Assessment
2. Stream Assessment Reach*
3. Visual Channel Condition
4. Riparian Buffer
5. Visual In-Stream Habitat*
6. Visual Channel Alteration
7. Determining Condition Index and Impact Factor
8. Calculating Debits
9. Assessing Mitigation Plans
10. Calculating Credits



Most scientists regarded the new streamlined peer-review process as 'quite an improvement.'

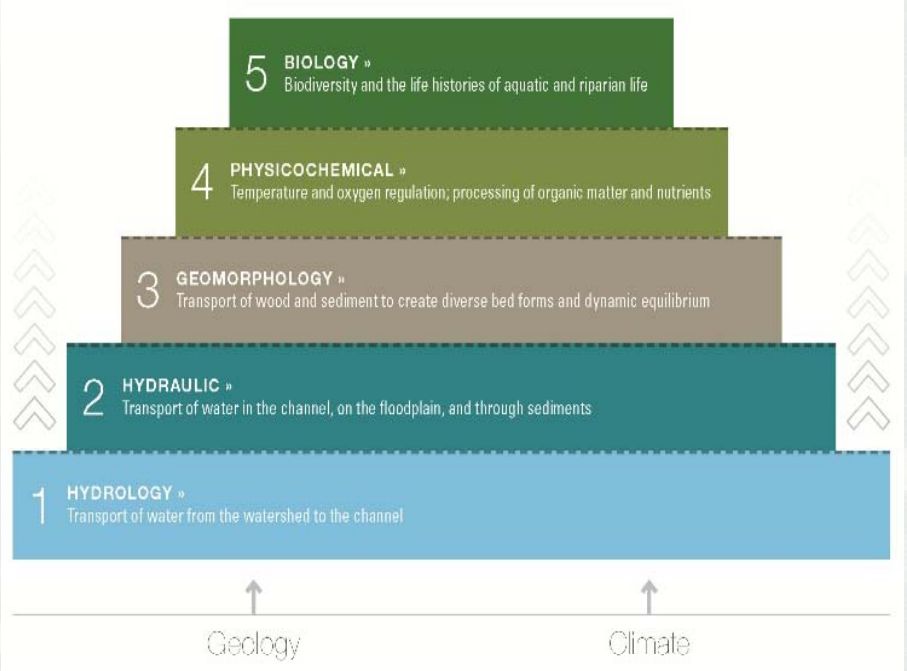
Level 1 Stream Condition Assessment

- Rapid Qualitative 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.
- Assesses condition of Physical, Chemical and Biological function.
- Assess past anthropogenics.



3 Functions in 4 Parameters

- Visual Channel Geometry
  - Physical
- Riparian Buffer
  - Chemical
  - Physical
- TCEQ Aquatic Life Use
  - Chemical
  - Biological
- Anthropogenics

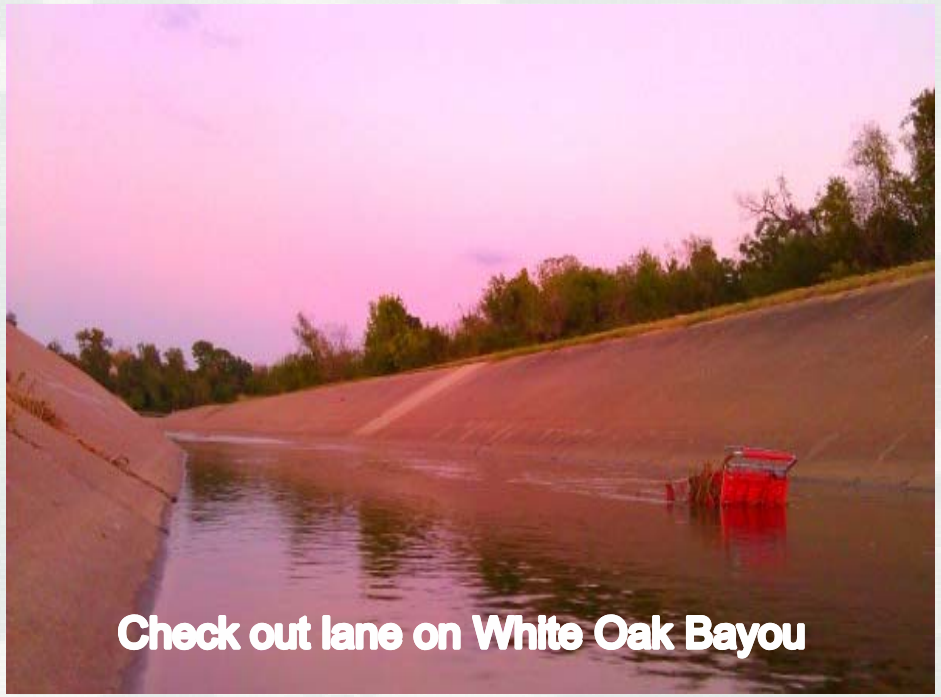


~~Stream Assessment Reach~~ Transect

- Transect is fixed length sampling unit of 350 feet placed within set intervals commensurate with the project.
- Projects proposing impacts to **less than 500** linear feet of ephemeral, intermittent or perennial streams will be assessed using **3 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 **1 Transect for each additional 500 feet** of impact.

Visual Channel Condition

- **Qualitative Measure of Physical Function designed to assess stream channel by assessing**
  - **Channel Geometry**
    - **Incision**
    - **Overwidening**
    - **Entrenchment**
  - **Channel Stability**
    - **Bank surface protection through vegetation**
    - **Bar deposition**
    - **Bank erosion**
  - **Connection to Active Floodplain.**
    - **Visual estimate of bankfull**



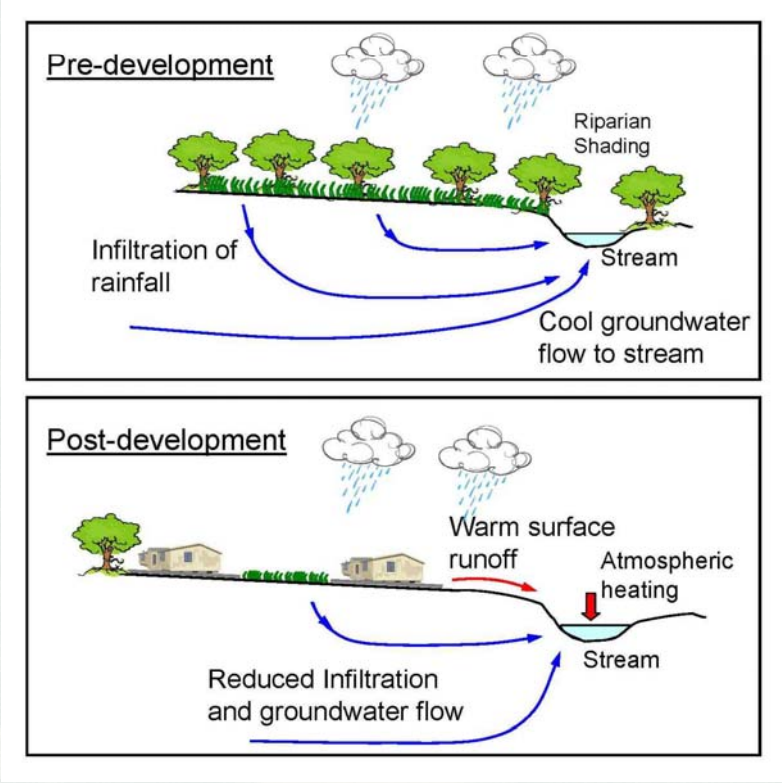
Scoring Visual Channel

Score	Geometry	Stability	Floodplain	Other
Optimal - 5	Very little incision or widening	≥80% vegetative cover, stable point bars	Access to active floodplain	No armor
Suboptimal - 4	Slightly Incised some erosion	60-70% vegetative cover, point bars present	Access to bankfull benches or new floodplain	1-25% armored
Marginal – 3	Incised and widened	40-59% vegetative cover, heavy transient sediments	No connection to floodplain	36-50% Armored
Poor - 2	Incised or overwidened and vertically/laterally unstable	Near vertical banks, substantial sedimentation, numerous erosion scars	No connection to floodplain	51% armored.
Severe - 1	Deeply incised (or excavated), Streambed elevation below average rooting	Many erosion scars,	No connection to floodplain	Channel altered or channelized or 100% armor

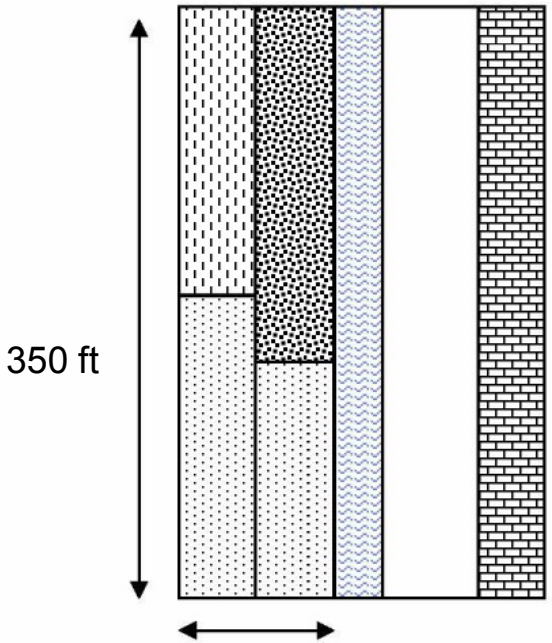
Channelized

Riparian Buffer

- A Riparian buffer is defined as the zone of vegetation adjacent to streams, rivers, creeks or bayous.
- The ideal riparian buffer would be 100% coverage of the assessment area by the native woody vegetation community with no additional land use.
- **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.**



Riparian Buffer Calculation



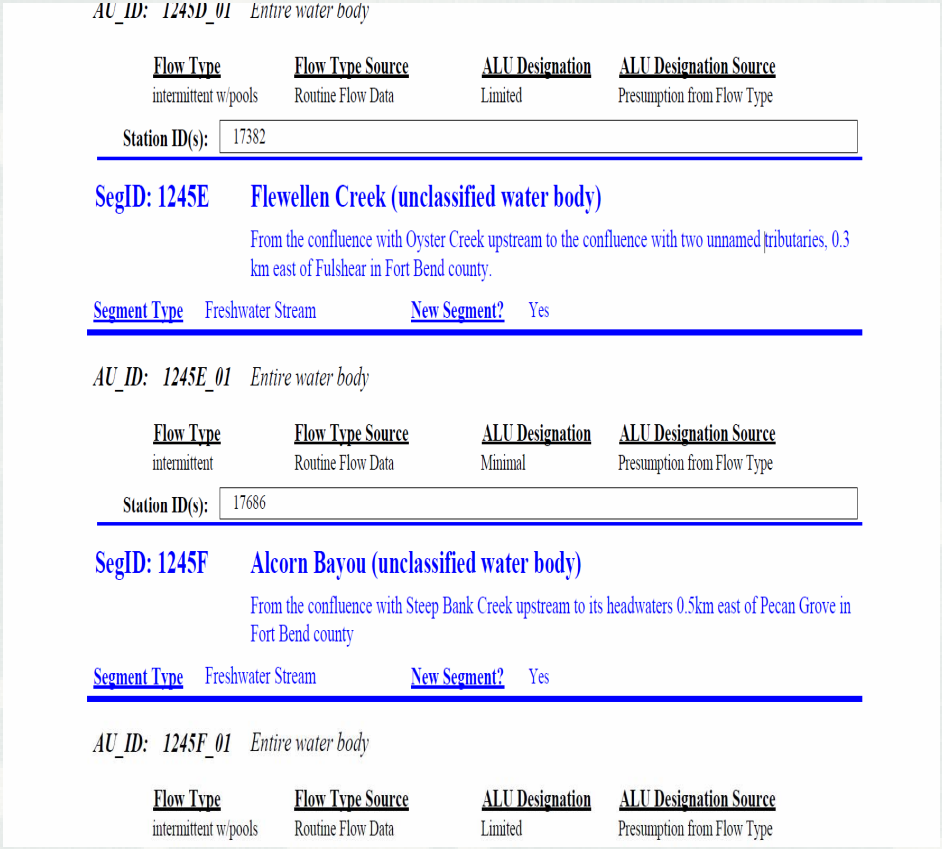
- Buffer with 30% native woody community species with no wetlands present (Low Suboptimal Score =4)
- Buffer with 30% native woody community species and wetland present (High Suboptimal Score=4.5)
- Buffer with > 60% native woody community species cover and wetlands present (Optimal=5)
- Maintained Grasses (Poor Score=2)
- Impervious Area (Severe Score=1)
- Stream

~~Visual In-Stream Habitat~~

- **Way too Subjective**

Aquatic Life Use

- Based on the aquatic life use category score assigned to the stream segment by the TCEQ published in the *Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d).*
- Specific criteria tested may include; water temperature, pH, chloride, sulfate, dissolved oxygen (DO), total dissolved solids (TDS) as well as fish and macroinvertebrate communities.



AU_ID: 1245D_01 Entire water body

Flow Type	Flow Type Source	ALU Designation	ALU Designation Source
intermittent w/pools	Routine Flow Data	Limited	Presumption from Flow Type

Station ID(s): 17382

SegID: 1245E Flewellen Creek (unclassified water body)

From the confluence with Oyster Creek upstream to the confluence with two unnamed tributaries, 0.3 km east of Fulshear in Fort Bend county.

Segment Type Freshwater Stream New Segment? Yes

AU_ID: 1245E_01 Entire water body

Flow Type	Flow Type Source	ALU Designation	ALU Designation Source
intermittent	Routine Flow Data	Minimal	Presumption from Flow Type

Station ID(s): 17686

SegID: 1245F Alcorn Bayou (unclassified water body)

From the confluence with Steep Bank Creek upstream to its headwaters 0.5km east of Pecan Grove in Fort Bend county

Segment Type Freshwater Stream New Segment? Yes

AU_ID: 1245F_01 Entire water body

Flow Type	Flow Type Source	ALU Designation	ALU Designation Source
intermittent w/pools	Routine Flow Data	Limited	Presumption from Flow Type

http://www.tceq.texas.gov/assets/public/compliance/monops/water/10twqi/2010_summary.pdf

UL Score

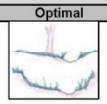
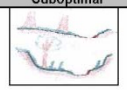
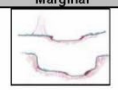
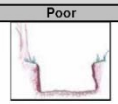
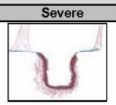
Optimal	Suboptimal	Marginal	Poor	Severe
Aquatic Life Score of *Exceptional*	Aquatic Life Score of *High*. Perennial streams that have not been assessed are also assumed to have an Aquatic Life Score of *High*.	Aquatic Life Score of *Intermediate*	Aquatic Life Score of *Limited*. Intermittent Streams with Perennial Pools that have not been assessed are also assumed to have an Aquatic Life Score of *Limited*.	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*.
Score – 5	Score – 4	Score – 3	Score – 2	Score – 1

Visual Channel Alteration

- **Accounts for previous anthropogenic modification to the stream.**
- **Easiest parameter to sample, requires least explanation.**
- **Generally accurate results.**

Transect Data Sheet

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

	Optimal	Suboptimal	Marginal	Poor	Severe
Visual Channel Condition Parameter	 Channel shows very little incision or widening and little or no evidency of erosion or unprotected banks. Indicators of stability inc lude greater than 80% vegetative cover on the banks, stable point bars and bankfull benches may be present, mid-channel and transverse bars are rare or transient. The stream has access to active floodplain or fully developed bankfull benches. No bulkheading or riprap may be present.	 Channel is slightly incised and contains a few areas of active erosion. Indicators of instability include vegetative cover or natural rock protection only present along 60-80% of the SAR, point bars and bankfull benches are likely present and transient sediment is present along 10-40% of the stream bottom. The stream has access to bankfull benches or developed floodplains along portions of the reach. Channel may show evidence of past channel alteration, but should be exhibiting notable recovery of a natural channel. Bulkhead and riprap are limited to 1-25% of the SAR.	 Channel is incised or has had its course widened. Indicators of instability include the presence of erosional scars on 40-60% of the SAR, vegetative cover or natural rock only found on 40-60% of the SAR, vertical or undercut banks, or nickpoints associated with headcuts may be present and portions of the channel may be widening while other portions of the channel are narrowing, and transient sediments are found in 40-80% of the natural stream bed or bottom. The stream does not have acces to the active floodplain. Bulkheading or riprap is found along 25-50% of the SAR.	 Channel is over-widened or are incised with vertically or laterally unstable banks. Visual indicators of over-widening and incision include near vertical banks with shallow root depths, erosional scars present along 60-80% of the SAR, vegetative cover or natural rock is limited to 20-40% of the SAR, substantial sediment deposition of uniformed-size material is present along 60-80% of the SAR and pint bars and/or bankfull benches are absent. The stream does not have access to an active floodplain . Bulkheading and riprap are present along 50-80% of the SAR.	 Channel is deeply incised or excavted with vertical or lateral instability in the stream bank. Indicators of instability includethe streambed elevation is located below the rooting depth, both banks are vertical or undercut, vegetative surface protection or natural rock is only found along 20% or less of the SAR, the bank is sloughing an erosional scars or raw banks present on 80-100% of the SAR and 80% or more of the natural streambed is covered by substantial sediment resulting in threaded channels. The stream does not have access to an active floodplain.
Score	5	4	3	2	

CV

Notes:

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR.

	Optimal	Suboptimal		Marginal	Poor	Severe
Riparian Buffers	Native woody species represent greater than 60% of the coverage and wetlands are present.	Native woody community species represent greater than 60% coverage with NO wetlands present within the buffer **OR** native woody community species represent 30-60% coverage with wetlands present. No maintenance or grazing activities.	Native woody community species represent between 30-60% coverage with NO wetlands present. No maintenance or grazing activities.	Native woody community represents less than 30% coverage with no maintenance or grazing activities.	The buffer 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.	The area is dominated by impervious surfaces, mine spoil lands, denued surfaces, conventional tillage row crops, active feed lots or comparable conditions.
Condition Scores	5	High = 4.5	Low = 4	3	2	1

Notes:

Right Bank	% Riparian Area>							0%		
	Score >									
									CI= (Sum % RA * Scores*0.01)/2	
Left Bank	% Riparian Area>							0%	Rt Bank CI >	0.00
	Score >								Lt Bank CI >	0.00

BV

0.00

3. AQUATIC USE: The Transect is assessed based on the aquatic life use category score assigned to the stream segment by the TCEQ.

	Optimal	Suboptimal	Marginal	Poor	Severe
AQUATIC USE	Aquatic Life Score of Exceptional.	Aquatic Life Score of High. Perennial streams that have not been assessed are also assumed to have an Aquatic Life Score of High	Aquatic Life Score of Intermediate.	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.	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.
Score	5	4	3	2	1

UV

Notes

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

	Optimal	Suboptimal	Marginal	Poor	Severe
Channel Alteration	Channelization, dredging, alteration or hardening absent. Stream has unaltered pattern or has normalize. No dams, dikes, levees, culverts, riprap, bulkheads, armor, drop structures or withdrawal structures within the SAR.	Less than 30% of the SAR is impacted by dredging, dams, dikes, levees, culverts, riprap, bulkheads, armor, drop structures or withdrawal structures. Evidence of past alteration may be present, but stream pattern and stability have recover. Withdrawals, if present, have no observable affect on flow	Between 30-60 % of the SAR is impacted by dredging, dams, dikes, levees, culverts, riprap, bulkheads, armor, drop structures or withdrawal structures. Evidence of past alteration may be present, but stream pattern and stability are beginning to recovered. Withdrawals, if present, have may have an observable affect on flow, but no observable affect on habitat or biota.	Between 60-90 % of the SAR is impacted by dredging, dams, dikes, levees, culverts, riprap, bulkheads, armor, drop structures or withdrawal structures. Evidence of past alteration is present, and stream pattern and stability are not recovering. Withdrawals, if present, may have an observable affect on both flow and habitat or biota.	Between 90-100% of the SAR is impacted by dredging, dams, dikes, levees, culverts, riprap, bulkheads, armor, drop structures or withdrawal structures. Withdrawals, if present, are large enough to have severe loss of flow and cause little to no habitat or biota.
SCORE	5	4	3	2	1

AV

Notes

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Calculating Condition

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) = 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:

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

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:

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

RCI = Reach Condition Index

CI = Condition Index for each Transect

Y= Number of Transects

Functional Delta

- 33 CFR 332.3(a)(1) requires the district engineer to determine the compensatory mitigation to be required in a DA permit…capable of compensating for the aquatic resource functions that will be lost as a result of the permitted activity.
- Since stream are rarely, if ever, completely destroyed during construction, the revision is designed to quantify functional loss resulting from the project.

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(Pre-construction RCI)- (Post-construction RCI) = Delta
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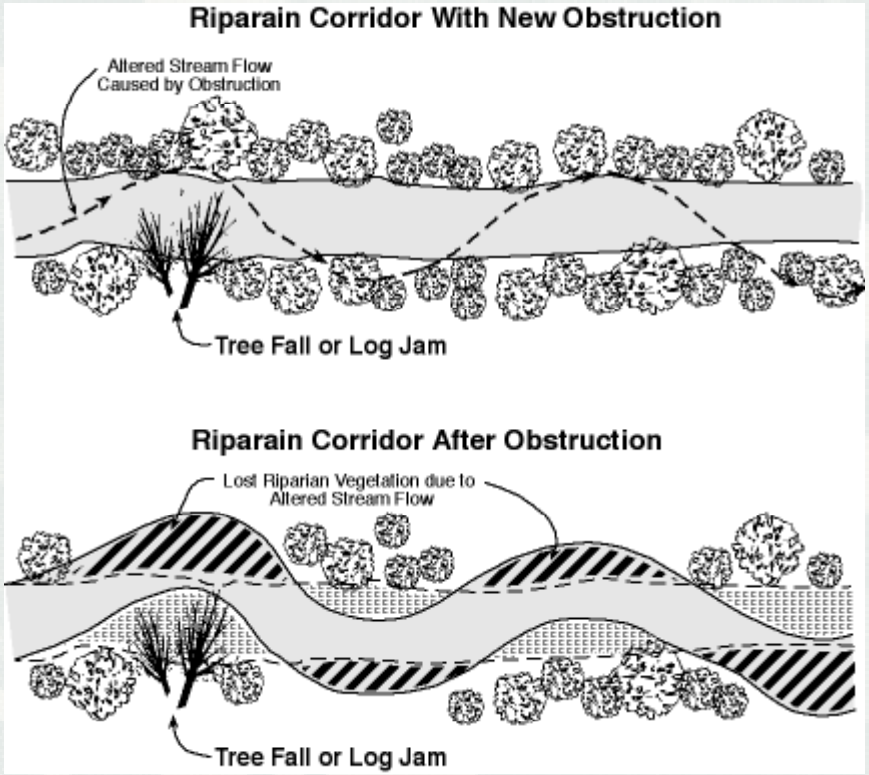
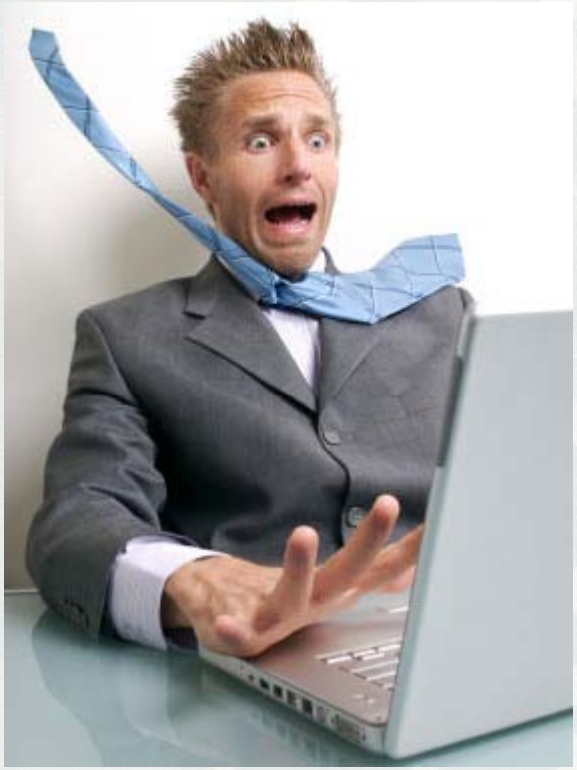
Determining Impact Factor

- **Severe-IF Score 5** The proposed project will eliminate a stream, or result in a loss function equivalent to a 4-point change in Reach Condition Index.
- **Major-IF Score 4** The proposed project will result in a loss of function equivalent to a 3-point change in Reach Condition Index.
- **Moderate-IF Score 3** The proposed project will result in a loss of function equivalent to a 2-point change in Reach Condition Index.
- **Minor –IF Score 2** The proposed project will result in a loss of function equivalent to or less than a 1-point change in Reach Condition Index.
- **Temporary- If Score 1** Impacts are temporary and the site will be returned to pre-construction contours and elevations with no permanent loss of aquatic function.



Calculating Debits

$$Reach\ Condition\ Index\ x\ Impact\ Factor\ x\ Linear\ Feet\ of\ Impact = Debit$$



Avoidance and Minimization

- **Avoidance:** In the context of a stream, a project that will not affect stream stability.
- **Minimization**: In the context of streams, a project that will affect stream stability but includes design features that will maintain stability after normalization.

Assessing Restoration and Re-establishment Mitigation Plans

- Demonstrating a stream's need for restoration/re-establishment is important; we should not assume a stream has impaired function based on a visual inspection that lacks the understanding of fluvial or hydrogeomorphology of the stream segment.
- There are two factors to evaluate on a proposed stream restoration/re-establishment project;
  - 1) the current condition of the stream's functions.
  - 2) the proposed restoration method.
- Design/build specifications need to be about 70%

Calculating Credits

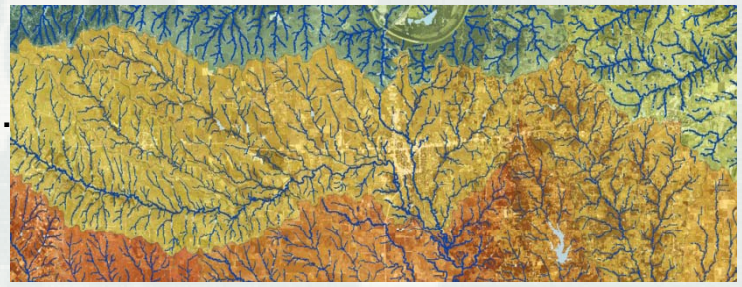
- Designed to account for all types of compensatory mitigation plans.
  - In-Kind/out of Kind
  - On-site/Off-site
  - PRM/Bank
- Re-Establishment
- Rehabilitation/Enhancement
- Preservation

Re-establishment

- Re-establishment means the manipulation of the physical, chemical, and biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource.
- Re-establishment activities may include:
  - 1) the re-establishment of a channel on the original floodplain, using a relic channel or constructing a new channel;
  - 2) re-establishment of a floodplain at the existing level or higher but not at the original level; or
  - 3) re-establishment of a channel with a flood prone area, but without an active floodplain.
- Generates 3 credits per foot, includes required buffer work.

Re-establishment Restrictions

- All three geomorphic characteristics (i.e., pattern, profile, and dimension) are required to be addressed, as well as a net gain in aquatic area, for a stream to receive re-establishment credit.
- No rehabilitation and/or enhancement activities can be coupled with re-establishment on the same linear foot of stream channel. Credit is limited to three credits per linear foot of in-channel and buffer work for the mandatory first 100-foot of buffer work. Additional Credit for additional buffer between 100-200 feet is calculated pursuant to Section 5.2.2.
- Re-establishment mitigation credits cannot be generated for stream channel or streambank restoration if the mitigation segment is within 500 feet of a dam or a channelized/piped stream reach.
- No artificial hydrology allowed.
- Water rights should be established.



Rehabilitation and Enhancement

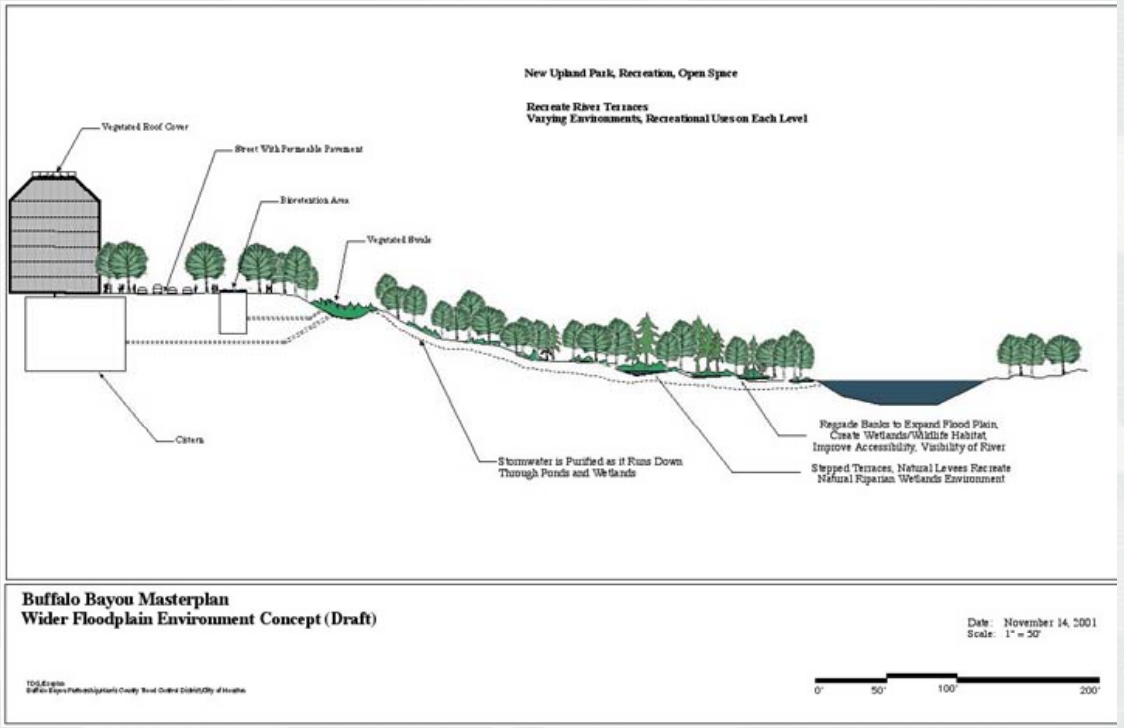
- **Rehabilitation** means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Results in a gain in aquatic resource function, but does not result in a gain in aquatic resource area.
- **Enhancement** means the manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Results in the gain of selected aquatic resource function(s), but may also lead to a decline in other aquatic resource function(s). Does not result in a gain in aquatic resource area.

Rehabilitation and Enhancement Guidelines

- In order for a site to be considered for **rehabilitation**, **pre-approved reference sites must be utilized** to establish the natural/historic function goals.
- However, **enhancement** process shall simply target the **Optimal and Suboptimal** standards set forth in the Conditional Assessment Procedure.

Rehabilitation and Enhancement

- Chemical
  - Riparian Buffer work
- Physical
  - Streambank and Streambed Improvements
- Biological
  - Habitat Improvements



Preservation

- Credit for this activity is given when no work to a riparian buffer area is proposed but that area will be placed under perpetual protection through an appropriate real estate instrument.
- Riparian buffer preservation must meet the requirements contained in 33 CFR Part 332.3(h) on preservation.
  - Resource provides important function
  - Resources contribute significantly to the ecological sustainability of the watershed.
  - Resources are under threat of destruction or adverse modifications.
- High Quality (RCI = ≥4) streams receive 0.1 credits per linear feet for the inner 100 feet.
- Low Quality (RCI = 3-3.9) streams receive 0.05 credits per linear foot for the inner 100 feet.
- For the outer 100-200 feet of buffer, all streams receive 0.05 credits per linear foot.
- Preservation will not be allowed for streams that score below an RCI of 3

Summary

- SARs are dead, now we have Transects
- Assessment of Biologic Function has changed
- We look at the Functional Delta on streams.
- Impact Factor is a multiplier based on functional Delta rather than project type.
- Clarified guidelines for stream restoration/re-establishment
- Assess chemical, physical and biological functional lift rather than specific work types.

Questions?