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Department of the Army
Little Rock District, Corps of Engineers

Little Rock District Stream Method

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COMPENSATORY STREAM MITIGATION

A. GENERAL INFORMATION:
Compensatory mitigation means the restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts. The purpose of this document is to quantify compensation for unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization have been achieved. Compensatory mitigation may be required for impacts to perennial, intermittent, and ephemeral streams and should be designed to restore, enhance, and maintain stream uses that are adversely impacted by authorized activities. Compensatory stream mitigation using this functional assessment method will be required for Standard Permits and Letters of Permission. Standard Permits specific to Section 10 activities, such as associated with dredging, will typically not require the use of this functional assessment method. The decision to use this method for General Permits, including Nationwide Permits, will be assessed on a case-by-case basis. In some cases, the evaluation of the permit application may reveal that the stream compensation measures are not practicable, constructible, or ecologically successful.

Activities that constitute restoration/enhancement/preservation/establishment include, but are not limited to: stream channel restoration; bank stabilization; in-stream habitat enhancement; impoundment removal; livestock exclusion devices; road crossing improvements; stream relocation; and natural buffer establishment.

Mitigation for streams will be implemented using this assessment method on a case-by-case basis. Mitigation will be evaluated using current regulatory guidance, this functional assessment method, and best professional judgment. Final compensatory mitigation requirements for Department of the Army permits will be commensurate with the type and amount of impact associated with the permitted activity. For the majority of the aquatic resources to be considered for preservation, the site must provide a significant contribution to the ecological sustainability of the watershed based on case specific factors. The Regulatory Project Manager will determine the impacts of a project and will assess mitigation requirements in linear feet or acreage.

Stream mitigation generally means the manipulation of the physical, chemical, and/or biological characteristics of a stream with the goal of repairing or replacing its natural functions. When evaluating compensatory mitigation options, the district engineer will consider what would be environmentally preferable. In making this determination, the district engineer must assess the likelihood for ecological success and sustainability, the location of the compensation site relative to the impact site and their significance within the watershed, and the costs of the compensatory mitigation project.

The district engineer shall consider the type and location of mitigation based on the preferred hierarchy as follows: mitigation banks, in-lieu fee programs, permittee-responsible mitigation under a watershed approach, permittee-responsible mitigation through on-site and in-kind mitigation, and permittee-responsible mitigation through off-site and/or out-of-kind mitigation.

Regulatory Authorities & Guidelines

Section 10 of the Rivers and Harbors Act of 1899. In accordance with Section 10 of the Rivers and Harbors Act of 1899, the Corps of Engineers is responsible for regulating all work in navigable waters of the United States.

Section 404 of the Clean Water Act. In accordance with Section 404 of the Clean Water Act as amended in 1977, the Corps of Engineers is responsible for regulating the discharge of dredged or fill material in waters of the United States, including wetlands. The purpose of the Clean Water Act is to restore and maintain the physical, chemical, and biological integrity of the nation's waters**.**

Compensatory Mitigation for Losses of Aquatic Resources; Final Rule, dated 10 April 2008, (The Mitigation Rule) are the regulations governing compensatory mitigation for activities authorized by permits issued by the Department of the Army. The regulations establish performance standards and the use of permittee-responsible compensatory mitigation, mitigation banks, and in-lieu fee programs to improve the quality and success of compensatory mitigation projects. The Final Rule can be found at 33 CFR Parts 325 and 332.

Section 230.10 (d) of the Section 404 (b)(1) Guidelines. This states that "... no discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem." The Section 404 (b)(1) Guidelines require application of a sequence of mitigation -- avoidance, minimization and compensation. In other words, mitigation consists of the set of modifications necessary to avoid adverse impacts altogether, minimize the adverse impacts that are unavoidable and compensate for the unavoidable adverse impacts. Compensatory mitigation is required for unavoidable adverse impacts, which remain after all appropriate and practicable avoidance and minimization has been achieved.

Regulatory Guidance Letter (RGL) 05-05 – Ordinary High Water Mark Identification. This document provides guidance for identifying the ordinary high water mark. RGL 05-05 applies to jurisdictional determinations for non-tidal waters under Section 404 of the Clean Water Act and under Sections 9 and 10 of the Rivers and Harbors Act of 1899.

Regulatory Guidance Letter (RGL) 08-03 – Minimum Monitoring Requirements for Compensatory Mitigation Projects Involving the Creation, Restoration, and/or Enhancement of Aquatic Resources. This guidance provides the Districts and regulated public guidance on minimum monitoring requirements for compensatory mitigation projects including the required content for monitoring reports.

B. ADVERSE IMPACT FACTORS:

Adverse impacts determine the amount of mitigation required to offset stream losses within the permit area (debits). Application of this method will result in two numbers (debits and credits), debits being the adverse impacts of your project and credits being the mitigation. The mitigation credits must equal or exceed the adverse impact debits resulting from your project.

Streams are complex ecosystems with morphological characteristics that are dependent on appropriate geomorphic dimension, pattern, and profile as well as biological and chemical integrity. The mitigation credits must equal or exceed the adverse impact debits from a project. The following factors will determine the amount of mitigation credits required:

1. Stream Types:

Ephemeral Streams have flowing water only during and for a short duration after precipitation events in a typical year. Ephemeral streambeds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from precipitation is the primary source of water for stream flow. Ephemeral streams typically support few aquatic organisms. When aquatic organisms are found they typically have a very short aquatic life stage.

Intermittent Streams have flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from precipitation is a supplemental source of water for stream flow. The biological community of intermittent streams is composed of species that are aquatic during a part of their life history or move to perennial water sources.

Perennial Streams have flowing water year-round during a typical year. The water table is located above the streambed for most of the year. Groundwater is the primary source of water for stream flow. Runoff from precipitation is a supplemental source of water for stream flow. Perennial streams support a diverse aquatic community of organisms year-round and are typically the streams that support major fisheries.

2. Priority Area: Priority area is a factor used to determine the importance of the stream that would be impacted or used for mitigation. Priority areas are influenced by the quality of the aquatic habitat potentially subject to be impacted or used for mitigation. The priority area factor will influence the amount of stream credits generated. As new technology is available, a stream may increase to a higher category on a case-by-case basis. The priority areas are divided into three categories:

Primary: These streams provide important contributions to biodiversity on an ecosystem scale or high levels of function contributing to landscape or human values. Impacts to these streams should be rigorously avoided or minimized. Designated primary priority areas include:

Waters with listed Federal Endangered and Threatened Species
National Wild and Scenic Rivers/Study Rivers
Outstanding National Resource Waters
Outstanding State Waters
Extraordinary Resource Waters
Ecologically Sensitive Waters
12-Digit hydrologic unit code (HUC) of the Upper Little Red River Watershed
State Natural and Scenic Waters
Approved greenway corridors

Secondary: Compensation for impacts typically should emphasize replacement in the same watershed or an adjacent watershed. Secondary priority areas include:

Waters on the 303(d) list that are impaired by sediments or nutrients
Designated Fish Spawning Habitat
Stream and river reaches within 0.5 mile upstream or downstream of primary priority reaches
Stream or river reaches within highly developed areas that are not ranked as primary priority systems
Adjacent to an approved mitigation bank, in-lieu fee, or mitigation site
Waters with Federal Candidate Threatened and Endangered Species
Fayetteville Shale Play area

Tertiary: These areas include all other freshwater systems not ranked as primary or secondary priority.

3. Existing Condition: The state of the physical, chemical, and biological health of a stream at the time of the functional assessment, as compared to the least disturbed condition of similar streams in the ecoregion. This is a measure of the stability and functional state of a stream and the stability of the riparian buffer before project impacts. In after-the-fact situations, the state of the stream may be determined before the impacts by reviewing the state of similar streams in the proximity of the impacted stream.

Fully functional stream means that the physical geomorphology of the reach is stable and is representative of an appropriate stream hydrograph for the topographical setting. The biological community of a stream that is fully functional is diverse and unimpaired by excessive anthropogenic inputs. Streams with listed Federal species and streams identified as highly diverse could be considered fully functional.

For purposes of this methodology, a stream generally will be considered fully functional if it shows **no evidence of human-induced sedimentation** and meets three or more of the following criteria:

1. The stream is one that has not been channelized and levee protected.
2. The stream reach has no more than one stream impact within 0.5 mile upstream or downstream of the proposed stream impact, including culverts, pipes, or other manmade modifications (less than 30 feet of impacted section).
3. The stream does not exhibit channel incision and head cutting. If necessary, this may be quantified through the determination of an appropriate entrenchment ratio and width/depth ratio at bankfull discharge relative to the unimpaired stream condition.
4. The stream has at least a minimum width riparian buffer (minimum of at least 50 feet on both sides of the stream) of deep-rooted native vegetation. The deep-rooted vegetation must comprise 90% of the riparian buffer. Higher order streams are expected to have wider riparian zones.

The Corps, at its discretion, may designate the largest streams within an 8-digit HUC as fully functional, regardless of whether they meet the criteria above, based on the streams' recreational, commercial, or water supply values.

Moderately Functional stream means that the stability and resilience of the stream or river reach has been compromised, to a limited degree, through partial loss of one or more of the integrity functions (chemical, physical, biological). System recovery has a moderate probability of occurring naturally.

For purposes of this methodology, a stream generally will be considered somewhat impaired if the stream meets one or more of the following criteria:

1. The stream segment is considered somewhat impaired if the entrenchment ratio and width/depth ratio at bankfull discharge is inappropriate relative to the unimpaired stream conditions.
2. The stream shows that human-induced sedimentation and erosion is moderate.
3. The stream has a moderate riparian buffer of deep-rooted vegetation present (minimum of at least 10 feet on both sides of the stream).

4. The stream has no more than three stream impacts within 0.5 mile upstream of the proposed stream impact, including culverts, pipes, or other manmade modifications (with less than 100 feet of impacted section).

Functionally Impaired stream means that there is a very high loss of system stability and resilience characterized by loss of one or more integrity functions. Recovery is unlikely to occur naturally, and further damage is likely, unless restoration is undertaken.

For purposes of this methodology, a stream generally will be considered impaired if one or more of the following criteria is met.

1. The stream is considered impaired if the reach has been channelized.
2. The entrenchment ratio and width/depth ratio at bankfull discharge is inappropriate relative to the unimpaired stream condition.
3. The stream has extensive human-induced sedimentation.
4. The stream has little or no riparian buffer with deep-rooted vegetation on one or both sides of the stream due to human-induced activity.
5. The stream has banks that are extensively eroded or unstable.
6. The stream has five or greater stream impacts within 0.5 mile upstream of the proposed stream impact, including culverts, pipes, or other manmade modifications.

4. Duration: Duration is the amount of time adverse impacts are expected to last.

Temporary means impacts will occur within a period of less than 6 months and recovery of system integrity will follow cessation of the permitted activity.

Recurrent means repeated impacts of short duration (such as with in-channel 24-hour stormwater detention).

Permanent means project impacts will be permanent.

5. Activity:

Armor means to stabilize and control erosion by either riprap, bulkhead, or use of other rigid methods to contain stream channels.

Below Grade (embedded) Culvert means to route a stream through pipes, box culverts, or other enclosed structures (<= 100 Linear Feet (LF) of stream to be impacted per crossing). The *Little Rock District US Army Corps of Engineers, Regulatory Division, Guidelines for Non-Bridged Stream Crossings* should be referenced. Culverts should be designed to allow fish and other aquatic organism passage and allow other natural stream processes to occur unimpeded.

Clearing means the removal of streambank vegetation or other activities associated with a regulated activity that reduces or eliminates the quality and functions of vegetation within the riparian habitat without disturbing the existing topography or soil.

Detention means to temporarily slow flows in a channel. Areas that are temporarily flooded due to detention structures must be designed to pass flows.

Fill means the permanent fill of a stream channel including the relocation of a stream channel (even if a new stream channel is constructed), or other fill activities such as concrete lining the stream channel.

Impound means to convert a stream to a lentic (open water) state with a dam or other detention/control structure that is not designed to pass normal flows. Impacts to the stream channel where the structure is located are considered fill, as defined above.

Morphologic change means to channelize, dredge, or otherwise alter the established or natural dimensions, depths, or limits of a stream corridor.

Pipe means to route a stream for more than 100 feet through pipes, box culverts, or other enclosed structures.

Utility crossings mean pipeline/utility line installation methods that require temporary disturbance of the streambed. **Bridge footings** requiring fill in waters of the United States are also considered in this activity factor.

6. <u>Cumulative Linear Impact</u>: Linear impact means the entire length of stream, in feet, that will be impacted by a project, as authorized under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act of 1899, and for which mitigation will be required. This factor reflects the quantifiable cumulative impacts. If multiple streams are impacted, all stream lengths shall be summed to reflect cumulative impacts.

C. <u>MITIGATION CREDITS</u>:
All proposed stream mitigation actions should include design criteria and explain why/how the project will benefit water quality and/or habitat. The Mitigation Rule, 33 CFR Parts 322 and 325 should be referenced in the development of a mitigation plan.

<u>Net Benefit</u>: Net benefit is an evaluation of the proposed mitigation action relative to the restoration, enhancement, creation, and preservation of the chemical, biological, and physical integrity of waters of the United States. Five stream mitigation methods are covered under these guidelines – 1) stream channel restoration / stream enhancement, 2) stream relocation,

3) riparian establishment, 4) riparian enhancement / restoration, and 5) stream channel / riparian preservation. ***The Corps will determine, on a case-by-case basis*****,** the net benefit of mitigation actions.

1. In-Stream Work (Measured at OHWM)

- **Stream Channel Preservation** without any in-stream work/activity. This net benefit can only be used when the stream is either fully functional or moderately functional. Generally, this net benefit will be granted in combination with riparian preservation. The stream reach to be preserved must be at a minimum of 300 linear feet. Refer to the criteria for preservation as described in the Mitigation Rule, 33 CFR 332.3(h).

- **Stream Channel Restoration / Stream Enhancement:** All restored channels will generally be protected by a buffer of native vegetation. In addition, all stabilized streambanks should be protected by a buffer. This buffer will also generate riparian preservation, enhancement, restoration, or establishment mitigation credit. Credit for removal of structures described below under the **Excellent** and **Good** restoration actions will be based on the documented length of reach that the structure impacts under current flow conditions. If the reach is not defined, a reach will be considered 300 feet.

Excellent stream channel restoration actions include:

-Establishing floodplains of appropriate dimensions adjacent to streams with inappropriately low width/depth ratios at bankfull discharge.

-Restoring appropriate bankfull discharge width, stream sinuosity, entrenchment ratio, and width/depth ratio in degraded streams to referenced morphologic patterns.

-Removing dams and large weirs, pipes, culverts and other manmade in-stream structures with >50 linear feet of direct fill/impact, then restoring the stream channel to referenced, stable morphologic patterns (i.e., replace culverts with span bridges).

-Stream channel restoration that involves the re-establishment of a channel on the original floodplain, using a relic channel or constructing a new channel. The new channel is designed and constructed with the proper dimension, pattern and profile characteristics for a stable stream.

Good stream channel restoration / stream enhancement actions include:

-Converting stream type by shaping upper slopes and stabilizing both bed and banks.

-Restoring streambank stability in highly eroded areas.

-Restoring in-stream channel features (i.e., riffle/run/pool/glide habitat) using methodology appropriate to stream type. Adding structures that are specifically designed and result in grade control. (cross vanes, j-hook vanes, native material revetments, rock weirs, rock vortex weirs, log vanes, constructed riffles)

-Culverting existing road crossings in existing floodplains and replacing inappropriately sized/designed culverts to allow more natural flood flows.

-Removing weirs, pipes, culverts and other manmade in-stream structures.

-Restoring streambank stability in highly eroded areas. Bioremediation techniques such as live fascines, branch packing, brush mattresses, live cribwalls, tree revetments, or natural fiber logs, supplemented with the use of erosion control matting and live staking for long-term stability may qualify for excellent restoration enhancement depending on the extent of the work.

-In-stream habitat enhancement such as root mats, root wads, medium to large boulders, aquatic macrophyte plantings or other in-stream features may be designed as habitat for aquatic organisms and used as good stream channel enhancement.

Moderate stream channel restoration / stream enhancement actions include:

-Development of a minimum flow release on existing structures to improve downstream habitat and hydrology.

-Stabilizing stream channel in place**.**

-Restoring streambank stability in moderately eroded areas.

-Routing a stream around an existing impoundment by creating a morphologically stable and appropriate stream channel.

-Replacing inappropriately sized/designed culverts.

-Constructing fish ladders or adding woody debris to create fish habitat.

-Removing check dams, weirs, and other manmade in-stream structures with < 50 linear feet of direct fill/impact where these structures are contributing to bank erosion or scour or blocking stream processes and aquatic organism movements.

- **Stream Relocation:** Movement/creation of a stream at a new location to allow an authorized project to be constructed in the stream's former location. In general, relocated streams must reflect the dimension, pattern, and profile indicated by a natural reference reach/condition in order to be adequate compensation for the authorized stream impact. Relocated streams will generally require vegetative protected buffers of sufficient width. This buffer will also generate riparian preservation, enhancement, restoration, or establishment mitigation credit. Relocations resulting in a reduced channel length will generally require additional mitigation to replace stream functions. Relocated mitigation activities include, but are not limited to, open channel sections and in-stream features, including restoration of stream morphology.

2. Riparian Buffer Establishment, Enhancement, Restoration, and Preservation: For mitigation banks, no more than 50% of the bank credits can be generated by riparian buffers.

- **Riparian Buffer Establishment** means the manipulation of the physical, chemical, and/or biological characteristics present to develop a buffer on an upland where a buffer did not previously exist. Riparian wetland establishment, enhancement or restoration must be conducted within the designated riparian buffer and will be for stream credit purposes only. Wetlands in the riparian buffer can be considered for purposes of improving water quality, flood storage, and increasing biodiversity in the mitigation area.

- **Riparian Buffer Restoration / Enhancement** means implementing rehabilitation practices within a stream riparian buffer zone to improve water quality and/or ecological success. Buffer enhancement may include increasing or improving upland and/or wetland habitat or the removal of undesirable vegetation within or adjacent to riverine systems. Restoration programs should strive to mimic the composition, density, and structure of a reference reach habitat. For the purposes of these guidelines, an area will be considered as riparian buffer restoration if 51 to 100% of the area would require planting of vegetation to restore streambank stability and improve wildlife habitat. For the purposes of these guidelines, an area will be considered as riparian buffer enhancement if 10 to 50% of the area would require planting of vegetation to restore streambank stability and improve wildlife habitat.

- **Riparian Buffer Preservation** means the conservation, in its naturally occurring or present condition, of a riparian buffer to prevent its destruction, degradation, or alteration in any manner not authorized by the governing authority. For the purposes of these guidelines, an area will be considered as riparian buffer preservation if less than 10% of the area would require planting of vegetation to maintain streambank stability and improve wildlife habitat.

Table 1 below provides appropriate Net Benefit values for the riparian establishment, restoration, enhancement, and preservation mitigation worksheet. Note that on the worksheet, buffers on each bank of a given reach generate mitigation credit separately (Stream Side A and Stream Side B).

	Percent Buffer that Needs Vegetation Planted	*Buffer Establishment and Restoration Exotic Removal and (51-100%) Planting	Buffer Enhancement Exotic Removal and (10-50%) Planting	Buffer Preservation (<10%) Planting
Buffer Width (on one side of the stream)	100 feet	1.6	0.8	0.4
	75 feet	1.2	0.6	0.3
	50 feet	0.8	0.4	0.2
	25 feet** (Minimum width)	0.4	0.2	0.1

Table 1. Riparian Buffer Establishment, Restoration, Enhancement, and Preservation

* A minimum of Level I Monitoring is required.
** Smaller buffer widths may be allowed on a case-by-case basis for small streams and consideration for a reduced buffer width will be based on issues related to construction constraints, land ownership, and land use activities (i.e., farming). This is appropriate for limited use.
*** Buffers exceeding 100 feet will be considered on a case-by-case basis.
**** Buffers are required on both sides of the stream unless extenuating circumstances exist.

Requirements for Minimum Buffer Width: The minimum buffer width (MBW) for which mitigation credit will be earned is 25 feet on one side of the stream, measured from the top of the streambank, perpendicular to the channel. Smaller buffer widths may be allowed on a case-by-case basis for small streams and consideration for a reduced buffer width will be based on issues related to construction constraints, land ownership, and land use activities (i.e., farming). If topography within a proposed stream buffer has more than a 2% slope, two additional feet of buffer are required for every additional percent of slope (e.g., minimum buffer width with a +10% slope is 41 feet). Buffer slope will be determined in 50-foot increments beginning at the streambank. For the reach being buffered, degree of slope will be determined at 100-foot intervals and averaged to obtain a mean degree of slope for calculating minimum buffer width. This mean degree of slope will be used to calculate the minimum buffer width for the entire segment of stream being buffered.

Typically, riparian buffers along stream orders of two or smaller will range between 25 to 50 feet from the top of bank. Wider buffers may be accepted when the calculation for the minimum buffer width above requires additional buffering which is commonly found where steep slopes descend directly to the edge of the streambank. Wider buffers may also be considered where the stream channel frequently interacts with its overbank floodplain or where a relatively narrow corridor along a small stream can be widened and connect with large tracts of forest.

3. Riparian Buffer Restoration and Fencing in Livestock Pastures: Means restoring vegetation and fencing livestock from pastures, where active livestock grazing activities are impacting water quality and/or stream ecological function, thereby minimizing or avoiding streambank degradation, sedimentation, and water quality problems. Livestock exclusion is normally accomplished by fencing stream corridors and can include the construction of stream crossings with controlled access and with stable and protected streambanks.

Use a 1.2 multiplier with Table 1 to calculate mitigation credits generated for activities that demonstrate an additional benefit to the aquatic environment. I.e., if fencing livestock from a riparian buffer with no more than one livestock crossing planned per 1,000 linear feet of stream mitigation, the width of the livestock crossing will be deducted from the total length of the stream mitigation segment. After cattle have been removed, impacted riparian buffers will have to be restored or enhanced; preservation credit is not applicable.

4. Monitoring and Adaptive Management:
The final Mitigation Rule states that the submission of monitoring reports to assess the development and condition of mitigation projects is required, but the content and level of detail for those reports must be commensurate with the scale and scope of the compensatory mitigation project as well as the compensatory mitigation project type (33 CFR Part 332.6(a)(1)). All proposed mitigation monitoring must be in compliance with the final Mitigation Rule, special permit conditions, and shall be consistent with Regulatory Guidance Letter 08-03.

This stream assessment method allows for differing levels of monitoring credit associated with approved mitigation projects. Monitoring requirements are typically based on performance standards and may vary from one project to another. A more comprehensive monitoring protocol may be required for mitigation involving extensive stream restoration, in sensitive watersheds or critical habitat, in significant state waters, or if the permit action involves a threatened or endangered species. Likewise, the level of monitoring needed may depend on site selection or local conditions within a watershed. A more in-depth monitoring protocol may be needed for mitigation projects located in highly developing watersheds or in watersheds strongly influenced by intensive agriculture or animal farming practices.

The as-built survey described below will generally be required only for Excellent Restoration, Good Restoration / Enhancement, and major Stream Relocation projects. Upon completion of the project, an as-built channel survey shall be conducted and permanent photo reference points established. The survey should document the dimension, pattern, and profile of the restored channel and reference reach. Permanent cross-sections should be established at an approximate frequency of one per 20 (bankfull-width) lengths. In general, the locations should be selected to represent approximately 50 percent pools and 50 percent riffle areas. Flexibility in the location and frequency will be allowed for cross-sections and should be based on best professional judgment. The selection of locations should always include areas that may be predisposed for potential problems. In the case of very narrow streams, two cross-sections per 1,000 linear feet will generally be sufficient. The as-built survey should also include photo documentation at all cross-sections and structures, a plan view diagram, a longitudinal profile, vegetation information and a pebble count for at least six cross-sections (or all cross-sections if less than six required for project). If the restored stream section is less than 3,000 linear feet, the longitudinal profile should include the entire 3,000 linear feet; if the stream section is greater than 3,000 linear feet, the profile should be conducted for either 30 percent of the restored stream or 3,000 linear feet (whichever is greater).

Monitoring requirements associated with preservation will be determined on a case-by-case basis.

• **Level I Monitoring** (**Physical Monitoring):**
-- Riparian buffer: Collection of basic information on vegetation in the buffer to be restored (if any) before mitigation is implemented and after five years. Minimal information to be collected should include vegetation present and percent species composition. In addition, success of planted vegetation should be monitored at least annually, for five years, to determine if success criteria are met. Vegetation monitoring should include measurement of vegetation survival and growth.

This level will be required when mitigation consists of riparian buffer mitigation only.

• **Level II Monitoring (Physical / Biological Monitoring):** Conducting all features listed under Level I monitoring, plus
-- Stream channel restoration / enhancement and minor stream relocation: Initial baseline data on physical parameters in streams before mitigation is implemented and monitoring of these physical parameters at least annually, for five years, after mitigation is completed. Physical parameters to be measured include substrate characteristics, streambank erosion patterns, and cross-sectional profiles at sites within the restored reach.

This level will be required for minor Stream Relocation and Moderate Restoration / Enhancement.

• **Level III Monitoring (Physical / Biological / Reference Reach Comparison)**: Conducting all features listed under Level I and II monitoring, plus simultaneous collection and statistical comparison of as-built data and the suitable reference site annually for five years.

This level will be required for Stream Relocation, Excellent Restoration and Good Restoration / Enhancement.

Because each restoration project will have its own critical values, the values that determine the geomorphic threshold for a particular stream must be determined on a case-by-case basis. Adjustments that do not exceed the critical values may be attributed to changes within or along the channel that signal increased stability, such as added vegetation on the banks.

5. <u>Site Protection</u>:

A **Conservation easement (Third Party easement)** is a legally binding recorded instrument approved by the Little Rock District to protect and preserve mitigation sites.

A **Deed restriction** is a provision in a deed limiting the use of the property and prohibiting certain uses. The Little Rock District approves mitigation areas and requires deed restrictions to protect and preserve mitigation sites. If the applicant can demonstrate that the mitigation activity will occur within a right-of-way easement and if the easement will offer protection and preservation of the site, such as associated with highway projects, the credit will be considered the same as that for deed restriction of the mitigation site.

A **Restrictive covenant** is a legal document whereby an owner of real property imposes perpetual limitations or affirmative obligations on the real property.

6. <u>Timing</u>: No credits are generated for this factor if the mitigation action in a reach is primarily riparian buffer preservation (<10% of buffer area would require planting of vegetation; see Table 1).

***Schedule 1*:** All mitigation is completed before the impacts occur. This is generally the schedule that is used for mitigation banks.
***Schedule 2*:** A majority of the mitigation is completed concurrent with the impacts
***Schedule 3*:** A majority of the mitigation will be completed after the impacts occur.

7. <u>Temporal Lag</u>: A factor to compensate for temporal loss of stream functions, including buffers, due to a time lag in the ability of the enhanced, restored, or established mitigation area to fully replace functions lost at the impact site. Different systems will require different time to reach levels of functional capacity level with the impact site. Example: If a deep-rooted buffer is impacted, it may take over 20 years to replace all functions including structural habitat complexity. However, replacement of functions associated with an herbaceous buffer may take much less time.

8. **Mitigation Factor:**

For Permittee-Responsible mitigation, use a mitigation factor of **0.5** for all out-of-kind aquatic resource or buffer replacements and for mitigation located outside of the immediate 8-digit hydrologic unit code (HUC) watershed.

Out-of-kind replacements replace aquatic resources or buffers of a different physical and functional type. This is appropriate when it provides more environmental benefit and is more practical by providing more ecological or watershed benefit than in-kind.

Use a mitigation factor of **1.0** for all in-kind aquatic resource or buffer replacements or for mitigation located within the immediate 8-digit hydrologic unit code watershed or for defined mitigation bank service areas.

In-kind replacements are stream losses or buffer losses, which are replaced by a stream/buffer that is established, restored, enhanced, or protected of the same physical and functional type. This is required when the impacted resource is locally important.

Mitigation Banks will be authorized for primary and secondary service areas. Primary service areas can encompass a maximum of two 8-digit hydrologic unit codes. The determination of secondary service areas should be adjacent to the primary area and should be evaluated for authorization beginning with the adjacent 8-digit hydrologic unit codes. The inclusion of additional hydrologic unit codes in the secondary service area must be based on the best available ecological rationale.

The initial evaluation of the service areas for mitigation banks should begin with the 8-digit hydrologic unit code location. The initial review should also include an evaluation of the ecological value of the bank's location in the ecobasin and ecoregion. Mitigation Banks will continue to be evaluated by Regulatory Project Managers on a case-by-case basis to determine the adequacy of the initial and final Prospectus. Factors to be considered in the development of enhancement, restoration, preservation, and establishment are gradient, viability of the bank, distance from the impact site, the preservation of unusual flora and fauna and Interagency Review Team (IRT) reviews.

Mitigation banks may not include more than 50 percent of the total bank credits for preservation, unless this requirement is waived by the District Engineer. Mitigation proposed in the secondary service area of a mitigation bank will have a proximity factor of 1.5 applied to the calculation of adequate compensatory mitigation credits.

D. DEFINITIONS:

Bankfull Stage is the point at which water begins to overflow onto its floodplain. This may or may not be at the top of the streambank on entrenched streams. Typically, the bankfull discharge recurrence interval is between one and two years. It is this discharge that is most effective at moving sediment, forming and removing bars, shaping meanders and generally doing work that results in the morphological characteristics of channels. Bankfull stage is not considered the Ordinary High Water Mark (OHWM) by the Corps.

Bankfull width is the width of the stream channel at bankfull discharge, as measured in a riffle section.

Channel Dimension is the two-dimensional, cross-sectional profile of a channel taken at selected points on a reach, usually taken at riffle locations. Variables that are commonly measured include width, depth, cross-sectional area, floodprone area and entrenchment ratio. These variables are usually measured relative to the bankfull stage.

Channel Features: Natural streams have sequences of riffles and pools or steps and pools that maintain channel slope and stability and provide diverse aquatic habitat. A **riffle** is a bed feature where the water depth is relatively shallow and the slope is steeper than the average slope of the channel. At low flows, water moves faster over riffles, which provides oxygen to the stream. Riffles are found entering and exiting meanders and control the streambed elevation. **Pools** are located on the outside bends of meanders between riffles. The pool has a flat slope and is much deeper than the average channel depth. Step/pool sequences are found in high gradient streams. **Steps** are vertical drops often formed by large boulders or downed trees. Deep pools are found at the bottom of each step.

Channel Pattern is the sinuosity or meander geometry of a stream. Variables commonly measured include sinuosity, meander wavelength, belt width, meander width ratio and radius of curvature.

Channel Profile is the longitudinal slope of a channel. Variables commonly measured include water surface slope, pool-to-pool spacing, pool slope and riffle slope.

Channelized Stream is a stream that has been degraded (straightened) by human activities. A channelized stream will generally have increased depth, increased width, and a steeper profile, be disconnected from its floodplain and have a decreased pattern or sinuosity.

Entrenchment Ratio is an index value that describes the degree of vertical containment of a river channel. It is calculated as the width of the flood-prone area divided by bankfull width.

Flood-Prone Area is the floodplain width measured at an elevation corresponding to twice the maximum bankfull depth. The area often correlates to an approximate 50-year flood or less.

Mean Depth at Bankfull is the mean depth of the stream channel cross-section at bankfull stage as measured in a riffle section.

Ordinary High Water Mark (OHWM) is the line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding area.

Reference Reach/Condition: A stable stream reach generally located in the same physiographic ecoregion, climatic region, and valley type as the project that serves as the blueprint for the dimension, pattern, and profile of the channel to be restored.

Service Area is the geographic area within which impacts can be mitigated at a specific mitigation bank or an in-lieu fee program, as designated in its instrument.

Sinuosity and Stream Pattern: Stream pattern describes the view of a stream channel as seen from above. Streams are rarely straight; they tend to follow a sinuous path across a floodplain. Sinuosity of a stream is defined as the ratio of channel length/valley length. In addition to slope, the degree of sinuosity is related to channel dimensions, sediment load, stream flow, and the bed and bank materials.

Stable Stream: A naturally stable stream channel is one that maintains its dimension, pattern, and profile over time such that the stream does not degrade or aggrade. Naturally stable streams must be able to transport the sediment load supplied by the watershed. Instability occurs when scouring causes the channel to incise (degrade) or when excessive deposition causes the channel bed to rise (aggrade). (Rosgen, 1996)

Stream Enhancement: Stream rehabilitation activities undertaken to improve water quality or ecological function of a fluvial system. Enhancement activities generally will include some activities that would be required for restoration. These activities may include in-stream or streambank activities, but in total fall short of restoring one or more of the geomorphic variables: dimension, pattern and profile. Any proposed stream enhancement activity must demonstrate long-term stability.

Stream Profile: The profile of a stream refers to its longitudinal slope. At the watershed scale, channel slope generally decreases in the downstream direction with commensurate increases in stream flow and decreases in sediment size. Channel slope is inversely related to sinuosity, so steep streams have low sinuosities and flat streams have high sinuosities.

Stream Preservation is the protection of ecologically important streams, generally, in perpetuity through the implementation of appropriate legal and physical mechanisms. Preservation may include the protection of upland buffer areas adjacent to streams as necessary to ensure protection or enhancement of the overall stream. Generally, stream preservation should be in combination with restoration or enhancement activities. Under exceptional circumstances, preservation may stand alone where high value waters will be protected or ecologically important waters may be subject to developmental pressure.

Stream Reach is the length of a stream section containing a complete riffle and pool complex. If none noted, a suitable length is usually no less than 300 feet long.

Stream Restoration or Rehabilitation is the process of converting an unstable, altered, or degraded stream corridor, including adjacent riparian zone (buffers) and flood-prone areas, to its natural stable condition considering recent and future watershed conditions. This process should be based on a reference condition/reach for the valley type and includes restoring the appropriate geomorphic dimension (cross-section), pattern (sinuosity), and profile (channel slopes), as well as reestablishing the biological and chemical integrity, including transport of the water and sediment produced by the stream's watershed in order to achieve dynamic equilibrium.

Stream Riparian Zone is the area of vegetated land along each side of a stream or river that includes, but is not limited to, the floodplain. The quality of this terrestrial or wetland habitat varies depending on width and vegetation growing there. As with vegetated buffer, functions of the riparian zone include reducing floodwater velocity, filtering pollutants such as sediment, providing wildlife cover and food, and shading the stream. The ability of the riparian zones to filter pollutants that move to the stream from higher elevations results in this area being referred to as the buffer zone. The riparian zone is measured landward from the OHWM on each side of a stream or river.

Thalweg is the line within the stream channel that marks the deepest portion of the stream channel.

Stream Stabilization is the in-place stabilization of an eroding streambank. Stabilization techniques, which include primarily natural materials, like root wads and log crib structures, as well as sloping streambanks and revegetating the riparian zone, may be considered for mitigation. When streambank stabilization is proposed for mitigation, the completed condition should be based on a reference condition or by methods appropriate to the stream reach.

Watershed is a land area that drains to a common waterway, such as a stream, lake, estuary, wetland, or ultimately the ocean.

Watershed Approach is an analytical process for making compensatory mitigation decisions that support the sustainability or improvement of aquatic resources in a watershed.

Width/Depth Ratio is an index value that indicates the shape of the channel cross-section. It is the ratio of the bankfull width divided by the mean depth at bankfull.

APPENDIX A
Data Forms
A-1: Adverse Impact Factors Worksheet
A-2: In-Stream Work Worksheet
A-3: Riparian Buffer Worksheet

ADVERSE IMPACT
FACTORS FOR RIVERINE SYSTEMS WORKSHEET

Stream Type Impacted	Ephemeral 0.1			Intermittent 0.4			Perennial-OHWM width		
							<15’ 0.4	15’-30’ 0.6	>30’ 0.8
Priority Area	Tertiary 0.1			Secondary 0.4			Primary 0.8		
Existing Condition	Functionally Impaired 0.1			Moderately Functional 0.8			Fully Functional 1.6		
Duration	Temporary 0.05			Recurrent 0.1			Permanent 0.3		
Activity	Clearing 0.05	Utility Crossing/Bridge Footing 0.15	Below Grade Culvert 0.3	Armor 0.5	Detention 0.75	Morpho-logic Change 1.5	Impound-ment (dam) 2.0	Pipe >100’ 2.2	Fill 2.5
Cumulative Linear Impact	<100’ 0	100’-200’ 0.05	201-500’ 0.1	501-1000’ 0.2	>1000 linear feet (LF) 0.1 reach 500 LF of impact (example: scaling factor for 5,280 LF of impacts = 1.1)				

Factor	Dominant Impact Type 1	Dominant Impact Type 2	Dominant Impact Type 3	Dominant Impact Type 4	Dominant Impact Type 5
Stream Type Impacted					
Priority Area					
Existing Condition					
Duration					
Activity					
Cumulative Linear Impact					
Sum of Factors	M =				
Linear Feet of Stream Impacted in Reach	LF=				
M X LF					

Total Mitigation Credits Required = (M X LF) = ________________

IN-STREAM WORK
STREAM CHANNEL / STREAM RESTORATION or ENHANCEMENT AND RELOCATION WORKSHEET

Stream Type	Ephemeral 0.05	Intermittent 0.4	Perennial Stream (OHWM Width) <15’ 0.4	15’-30’ 0.6	30’-50’ 0.8	>50’ 1.0	
Priority Area	Tertiary 0.05	Secondary 0.2	Primary 0.4				
Existing Condition	Not Applicable 0	Functionally Impaired 0.4	Moderately Impaired 0.05				
Net Benefit	Stream Relocation 0.1	Stream Preservation: Moderately Functional 0.5	Stream Preservation: Fully Functional 1.0	Stream Channel Restoration / Stream Enhancement: Relocated Stream w/ In-Stream features 0.5	Moderate 1.5	Good 2.5	Excellent 4.0
Monitoring/ Contingency	Level I 0.05	Level II 0.3	Level III 0.5				
Site Protection	Deed Restriction/Restrictive Covenant 0.1	Third Party Easement and Monitoring 0.4					
Timing	Schedule 1 0.3	Schedule 2 0.1	Schedule 3 0				

Factors	Net Benefit 1	Net Benefit 2	Net Benefit 3	Net Benefit 4	Net Benefit 5	Net Benefit 6
Stream Type						
Priority Area						
Existing Condition						
Net Benefit						
Monitoring/Contingency						
Site Protection						
Timing						
Sum Factors (M)=						
Stream length in Reach (do not count each bank separately) (LF)=						
Credits (C) = M X LF						
Mitigation Factor Use (MF) = 0.5 or 1.0						
Total Credits Generated C X MF =						

Total Channel Restoration/Relocation Credits Generated = _____________

RIPARIAN BUFFER ESTABLISHMENT, ENHANCEMENT, RESTORATION AND PRESERVATION WORKSHEET

Stream Type	Ephemeral 0.05		Intermittent 0.2	Perennial 0.4	
Priority Area	Tertiary 0.05		Secondary 0.2	Primary 0.4	
Net Benefit (for each side of stream	Livestock (select values from Table 1 times 1.2 multiplier)		Riparian Creation, Enhancement, Restoration, and Preservation Factors (select values from Table 1) (MBW = Minimum Buffer Width = 25' + 2' / 1% slope)		
Monitoring/ Contingency (for each side of stream)	Level I 0.05		Level II 0.15	Level III 0.25	
Site Protection	Deed Restriction / Restrictive Covenant 0.05			Third Party Easement and Monitoring 0.2	
Timing (for each side of stream)	Schedule 1 0.15			Schedule 2 0.05	Schedule 3 0
Temporal Lag (Years)	Over 20 -0.3	10 to 20 -0.2		5 to 10 -0.1	0 to 5 0

Factors		Net Benefit 1	Net Benefit 2	Net Benefit 3	Net Benefit 4	Net Benefit 5	Net Benefit 6
Stream Type							
Priority Area							
Net Benefit	Stream Side A						
	Stream Side B						
Monitoring/ Contingency	Stream Side A						
	Stream Side B						
Site Protection							
Timing (none for primarily riparian preservation) < 10% requires planting)	Stream Side A						
	Stream Side B						
Temporal Lag							
Sum Factors (M)=							
Linear Feet of Stream Buffer (LF)= (don't count each bank separately)							
Credits (C) =M X LF							
Mitigation Factor Use (MF) = 0.5 or 1.0							
Total Credits Generated C X MF =							

Total Riparian Restoration Credits Generated = ____________________

Appendix B
B-1: References

References:

Clean Water Act, Section 404

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