

Ecosystem Enhancement Program
Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation
November 7, 2011

The requirements provided in this document are intended to supplement the requirements found in the United States Army Corps of Engineers 2003 Stream Mitigation Guidelines document. (USACE 2003 SMGs). Where conflicts exist between the requirements of this document and previous documents, the requirements of this document shall supersede those of other documents.

I. General Stream and Wetland Monitoring Requirements

- A.** Site monitoring for all stream and/or wetland mitigation projects shall occur for seven full years (post construction) except in those circumstances provided for in this document where specific monitoring activities may be terminated as early as five years. If performance standards have not been met by year seven, additional monitoring may be required to ensure that a site is relatively stable with respect to anthropogenic or natural effects and that the target community is established on the site or the site (or portions of the site) may be deemed to be unacceptable for generation of compensatory mitigation credit.
- B.** Seven years of monitoring are not required for stream and/or wetland preservation reaches or areas which are subject to Monitoring Level 3 requirements of the USACE 2003 SMGs.
- C.** Success criteria as provided in the mitigation plan or in the permit conditions must be restated verbatim in the monitoring report.
- D.** Monitoring reports shall be completed for all seven years and provided to the Ecosystem Enhancement Program (EEP) for review by December 31 of each year that the site is required to be monitored. This is to ensure that any remedial action that may be necessary can be accomplished during the next planting season. Failure to provide monitoring reports by this deadline may result in additional monitoring.
- E.** Vegetation monitoring standards shall apply to all stream and/or wetland mitigation projects (other than preservation or other forms of mitigation that do not require vegetation planting).

II. Planted Vegetation Monitoring Requirements

The following requirements apply to all stream and/or wetland mitigation projects that include the planting of stream buffers and/or wetland mitigation areas. These requirements modify the vegetation monitoring requirements included in Monitoring Levels 1 & 2 in the USACE 2003 SMGs.

A. Vegetation Planting Monitoring Requirements

- 1. Permanent plots to sample vegetation shall be randomly located in each of the target communities. Plot sizes for the determination of stem density and vigor (height) shall be a minimum of 0.02 acre in size, and should typically be square or rectangular.
- 2. Vegetation monitoring plots shall make up a minimum of 2% of the planted portion of the site with a minimum of 4 plots.
- 3. Upon initial establishment of vegetation plots (baseline/year 0), the plot corners shall be identified in the field with markers, the plot shall be divided into a grid pattern and each

installed plant shall be identified for future monitoring according to its grid location within the plot.

4. Within each plot, vegetation data collected shall include:
 - species, height, date of planting, and grid location of each planted, living individual
 - species, height, and total number of individuals in the plot of volunteer woody vegetation
5. Vegetation plots shall be monitored for 7 years, with monitoring events occurring in years 1, 2, 3, 5, and 7. If supplemental monitoring occurs, results may be considered towards meeting performance standards.
6. At least 180 days, occurring between March 1 and November 30, must separate the completion of the initial vegetation planting and the initiation of the first year of monitoring (Year 1). If 180 days has not occurred since the completion of vegetation plantings, the first year of monitoring must occur during the following year.
7. Individual plot data for planted species must be provided. Plot data shall not be averaged over the entire site to obtain a single figure for stem density.
8. Enumeration of the density of planted species: density = number of living, planted stems per acre. "Stems are defined as individual plants, where plants with multiple shoots are treated as a single stem.
9. Live stakes planted on the stream banks shall not count toward meeting the stem density requirements.
10. Volunteer plants growing within plots may be considered on a case-by-case basis in determining whether a project has met the overall goal of reestablishing the vegetated buffer; however, volunteer plants shall be counted separately from planted vegetation in the monitoring reports.
11. Monitoring events should also be used to evaluate the site for the presence of invasive species, which should be noted in the monitoring report.

B. Planted Vegetation Performance Standards

1. At least 320 three year-old planted stems/acre must be present after year three. At year five, density must be no less than 260 five year-old planted stems/acre. At year 7, density must be no less than 210 seven year-old planted stems/acre.
2. Planted vegetation must average 10 feet in height in each plot at year 7 in sites located in the coastal and piedmont counties and 8 feet in height in each plot at year 7 in the mountain counties (as defined in the USACE 2003 SMGs). If this performance standard is met by year 5 and stem density is trending toward success (i.e., no less than 260 five year-old stems/acre) monitoring of vegetation on the site may be terminated provided written approval is provided by the USACE in consultation with the North Carolina Interagency Review Team (NCIRT).

III. Wetland Hydrology Monitoring Requirements

The following requirements apply to all mitigation projects that include wetland restoration and/or enhancement.

A. Groundwater Gauge Location and Data Collection Requirements

1. Due to the variability in the size, shape and distribution of areas proposed for wetland mitigation, the location and number of groundwater gauges that are required to document re-establishment of wetland hydrology will be determined on a project by project basis as part of the development of the site specific Mitigation Plan.
2. Projects that provide multiple, discrete (or isolated) wetland mitigation areas within the project area will be required to sufficiently document the re-establishment of wetland hydrology in each discrete wetland mitigation area.
3. Groundwater gauge data shall be collected and reported to EEP in each of the 7 years (post construction) of monitoring. At a minimum, data shall be collected (continuously) through the entirety of the growing season in the county(ies) the project is located.

B. Visual Monitoring Requirements for Wetlands

1. Visual monitoring of all wetland restoration and/or enhancement areas shall be conducted 2 times per year and a minimum of 5 months apart, in each of the required 7 years of post construction monitoring. Visual monitoring shall include walking throughout the entire site to identify and document areas of low stem density or poor plant vigor, invasive species, beaver activity, herbivory, encroachments, indicators of livestock access, or other areas of concern.
2. The results of the visual assessment shall be included in a plan view of the project identifying the location of each area of concern, along with a written assessment and photographic documentation of the area. Once an area of concern has been identified, that same feature shall be reassessed on all subsequent visual assessments. Photographs should be taken from the same location year-to-year to document progression of the problem. The monitoring reports shall identify all areas of concern and recommended courses of action, which may include continued monitoring, repair or other remedial action.

C. Wetland Hydrology Performance Standards

1. Due to the variability in wetland types (i.e. riverine, non-riverine, etc.) related to physiographic region, landscape position, soils, etc., specific performance standards (hydrologic success criteria) will be determined on a project by project basis as part of the development of the Mitigation Plan for the project. The hydrologic success criteria will typically be based on the range of soil wetness conditions that would be expected for the type of wetland targeted for mitigation.
2. Wetland hydrology data must consistently document an appropriate soil wetness condition (hydroperiod) has been re-established for all areas proposed for wetland mitigation. If the data fail to support this conclusion in any area(s) proposed for wetland mitigation after 7 years of monitoring, additional monitoring may be required, or the area(s) may be deemed to be unacceptable for generation of compensatory wetland mitigation credit.

IV. Stream Channel Stability

The following requirements apply to all stream mitigation projects that require monitoring of channel stability in accordance with the USACE 2003 SMGs, including both Monitoring Levels 1 & 2. These requirements apply to

all Restoration and Enhancement Level I projects, and also to Enhancement Level II where in-stream work is conducted that alters the bankfull channel.

A. Stream Channel Stability Monitoring Requirements

1. As-built surveys shall be conducted upon completion of channel construction to document baseline conditions. As-built surveys shall include all measurements typically documented during subsequent channel geomorphological surveys. A longitudinal profile of the thalweg, water surface, bankfull, and top of bank, shall also be collected during the as-built survey of the constructed channel to compare with future geomorphological data, if necessary. Longitudinal profiles shall not be required during routine channel stability monitoring (years 1 through 7) unless the monitoring efforts demonstrate channel bank or bed instability, in which case additional longitudinal profiles may be required by the USACE along channel reaches of concern to track changes in the channel and demonstrate stability.
2. Reference stakes, indicating the surveyed station and corresponding to the as-built survey, shall be installed in the riparian buffer near the stream bank every 100 feet along the length of the stream.
3. Channel cross-sections shall be monitored for 7 years, with monitoring events occurring in years 1, 2, 3, 5, and 7. If the Sponsor/Permittee chooses to conduct supplemental monitoring, results may be considered towards meeting performance standards.
4. Per the USACE 2003 SMGs, permanent, monumented cross-sections shall be installed at a rate of 1 cross-section per 20 bankfull channel widths, with approximately 50% of cross-sections occurring at pools and 50% at riffles/ripples. All channel cross-sections shall include measurements of Bank Height Ratio and Entrenchment Ratio, which shall be documented in monitoring reports.
5. At each monitored cross-section located on a stream bend (typically at pool locations), a bank pin array shall be installed along the outer bend of the stream. Bank pins may consist of chain, rebar, or wire driven horizontally into the bank face, and should be a minimum of 3 feet long. A minimum of one pin per 2 feet of bank height shall be installed vertically at each location, with the lowest pin installed just above the normal water line and additional pins installed at 2-foot intervals above the first. Vertical series of pins should be installed in at least three locations - at the monumented cross-section, the upstream third of the meander bend, and downstream third of the meander bend. The pins shall be installed flush to the face of the stream bank, and the length of exposed pin shall be measured and reported during each cross-section monitoring event. Once the exposure has been measured, the pin should be hammered flush with the face of the bank. Lateral movement of the stream banks as indicated by pin exposure shall be included in all monitoring reports. Additional bank pin arrays may be required by the USACE to document erosion along particular reaches of channel where concern over channel stability is identified during routine monitoring events. Bank pins are not required on channels with a bankfull width of less than 3 feet, unless indicated by the results of the monitoring or required by the USACE.

B. Visual Monitoring Requirements for Streams

1. Visual monitoring of all sections of the project shall be conducted in each of the required seven years of monitoring to identify areas of concern in both the vegetated buffer and restored stream channel. The following requirements apply to all stream mitigation projects that are required to

comply with Monitoring Levels 1 & 2 in the USACE 2003 SMGs, including all forms of Restoration and Enhancement (Level I and II).

2. Visual monitoring of all sections of the stream project shall be conducted twice per monitoring year. Generally, one visual monitoring event should be done in conjunction with other stream channel stability monitoring (e.g., cross-sections, bank pins, etc.). At least 5 months shall separate each visual monitoring event.
3. Within the stream channel, visual monitoring shall be conducted along the entire length of the channel to identify and document excessive lateral movement of the channel, bank instability, instability/failure of in-stream structures, structure piping, headcuts, beaver activity, excessive live stake mortality, invasive species, aggradation/excessive sediment deposition, or other potential problems with the channel. Visual monitoring of streams shall be conducted only by individuals that have been properly trained to assess the stability of streams and condition of in-stream structures.
4. Within the vegetated buffer, visual monitoring shall be conducted by walking throughout the entire site to identify and document areas of low stem density or poor plant vigor, invasive species, beaver activity, herbivory, encroachments, indicators of livestock access, or other areas of concern.
5. The results of the visual assessment shall be included in a plan view of the channel identifying the location of each feature of concern, along with a written assessment and photographic documentation of the feature. Once a feature of concern has been identified, that same feature shall be reassessed on all subsequent visual assessments. Photographs should be taken from the same location year-to-year to document progression of the problem. The monitoring reports shall identify all features of concern and recommended courses of action, which may include continued monitoring, repair or other remedial action.

C. Stream Channel Restoration Performance Standards

1. Bank Height Ratio (BHR) shall not exceed 1.2 within restored reaches of the stream channel. This standard only applies to restored reaches of the channel where BHR is corrected through design and construction.
2. Entrenchment Ratio (ER) shall be no less than 2.2 within restored reaches of the stream channel. This standard only applies to restored reaches of the channel where ER is corrected through design and construction.
3. The stream project shall remain stable and all other performance standards shall be met through two separate bankfull events, occurring in separate years, during the 7 year post construction monitoring period.

V. Early Closure Provision

If the monitoring of the site demonstrates that the site is successful by year 5 and no concerns have been identified (vegetation, stream stability, etc.), the Permittee/Sponsor may propose to terminate monitoring of the site and forego the monitoring requirements of years 6 and 7. This provision is only for sites that have consistently met all performance standards, and at year 5 meet the year 5 vegetation density standards (260 plants/acre) and the year 7

average height requirements (10 feet in height in each plot at year 7 in sites located in the coastal and piedmont counties and 8 feet in height in each plot at year 7 in the mountain counties). Early closure will only be provided through written approval from the USACE in consultation with the NCIRT.

VI. Remedial Actions

Mitigation plans are required to include an adaptive management plan, which should address how problems on sites are resolved. In addition, if monitoring results indicate that all or some portions of the site will fail to meet one or more of the required performance standards, the monitoring report must provide a remedial action plan to address the deficiency. The remedial action plan, at a minimum, must describe the failure, the source or reason for the failure, a concise description of the corrective measures that are proposed, and a time frame for the implementation of the corrective measures. Additional monitoring, as prescribed by this document may also be required.

A. Vegetation

If monitoring indicates that portions of the site are not going to meet required vegetation performance standards, replanting of all or part of the site may be required. If the total area that requires supplemental replanting exceeds 10% of the total planted area of the site, , additional monitoring shall be required within these areas to demonstrate success in accordance with the vegetation performance standards. The remedial action plan should take into account reasons for failure and provide for corrective measures if applicable. For instance, if inundation is determined to be a cause for poor vegetation performance, the replanted species composition may be adjusted (with approval from EEP) to include species more tolerant to inundation.

B. Stream Instability

Stream stability may be identified as a concern with stream mitigation projects even though all performance standards may be met. Visual monitoring of the channel is intended to identify potential problems and allow them to be tracked and addressed if necessary. In general, repairs shall be required when stream stability issues are identified that continue to worsen, pose a threat to other portions of the stream (headcuts), or are symptomatic of more serious issues with the design and/or construction of the project. If problems persist, continued repairs may be discontinued and mitigation credits adjusted accordingly. These decisions will be made on a case-by-case basis by the USACE, in consultation with the North Carolina Interagency Review Team (NC-IRT).

C. Invasive Species

As more restoration projects have been established, problems with invasive or otherwise undesirable plant species have become more prevalent. A list of these species is available as an appendix to the NC SAM Users Manual, which can be found on the Wilmington District page of the RIBITS website (<http://ribits.usace.army.mil>). No specific performance standards have been established in this guidance for invasive species, although sites should be routinely monitored for the presence of invasive species during both the visual assessments of the channel and vegetation plot monitoring events.

Although a site may rapidly be dominated by one or more of these invasive species, in many cases the desirable or planted materials have survived and exhibited adequate growth to ensure that they will, at least over the short term, continue to survive. Efforts should be taken immediately upon the identification of invasive species on the site to eradicate or at least control their recurrence, and may include chemical or physical methods. In either case, extreme care must be exercised such that the desirable species are not adversely impacted. Efforts taken to control invasive species should be noted in the monitoring reports.

D. Beaver

The presence of beaver on stream mitigation projects has become prevalent. Beaver management is a topic that should be addressed in the adaptive management plan portion of all mitigation plans. In general, it is understood that perpetual management of beaver on a stream mitigation site beyond the required monitoring period is not practicable; however, it is expected that beaver should be actively managed for the duration of the 7 year post construction monitoring period to ensure an initial period of growth for planted vegetation to get established is provided. It is also necessary to maintain channel flow and maintain conditions necessary for the proper evaluation of stream performance standards. Management entails trapping or otherwise removing beaver from mitigation sites and breaching any beaver dams. Generally, dams should be removed by hand whenever possible. Dam removal using explosives is considered a regulated discharge and should not be conducted without first obtaining a DA permit for the activity. Once beaver are noted on or adjacent to a site, management should be conducted as frequently as necessary to maintain the site in an unobstructed flow condition.

Beaver management activities associated with the project shall be tracked and included in the monitoring reports. This shall include dates of trapping, number of beaver removed, and the number and location of dams that are removed. Additionally, the locations of dams shall be shown on the plan view of the site.