

Post-Construction Monitoring

Construction Performance Standards

Construction will follow the sequence as shown on the plans. In general, the major construction will be divided into two dry season phases that will allow construction ‘in-the-dry’ of the channel relocation in the first phase while the existing channel continues to convey flows. Access for construction of the channel will be isolated to a proposed entrance shown on the plans. Similarly, construction of the wetland detention ponds will proceed as shown on the plans.

Typical equipment to be used on-site will include medium-size track excavators, dump trucks, and handheld equipment and tools. Suitable soil, trees, and other materials existing on-site will be reused to the extent practicable to reduce hauling and use of off-site materials.

Naturally Sustainable Ecological Success Criteria

Success of the wetland detention ponds, channel relocation and riparian buffer revegetation will depend on channel bank and channel stability, channel biology, and channel anti-degradation. Re-vegetation success will also be dependent on adequate moisture during the first two establishment years, prevention of competition from invasive species/weeds and erosion control to prevent washout of plant material. The monitoring parameters described below will be used to evaluate whether the performance standards are being met.

Monitoring tasks and their associated performance standards are listed in Table 1. Should the channel relocation and riparian buffer not meet these criteria, remedial action will be taken pending USACE consultation and approval.

Table 1. Monitoring Parameters and Performance Standards		
Monitoring Task	Performance Standard	Location
Vegetation Assessment	<ul style="list-style-type: none"> • 80% survival of woody plants. Suitable natural recruitment will be counted to offset plant mortality provided cover and species richness are acceptable and are of species typically found native to the proposed habitats. • Annual increases in height and stem diameter (dbh) of planted trees to indicate positive growth gains. • A minimum of 100 trees per acre by the fifth year of monitoring. Naturally recruited trees counted toward the 100 trees per acre must have attained a size of at least 50 percent that of the planted trees. An increase in species richness of 1.5 times the number of species planted will be considered a successful re-vegetation structure. Only native or naturalized species would count toward reaching this performance standard . • Potential to achieve 75% cover of woody species (trees and shrubs) and a 75% cover of herbaceous species at maturity (qualitative estimate) 	<ul style="list-style-type: none"> • Riparian Buffer • Wetland Detention Ponds
Channel Bank and Channel Stability Assessment	<ul style="list-style-type: none"> • Low or moderate ranking for bank erosion potential on the Bank Erosion Hazard Index (BEHI) and Near Bank Stress (NBS) for the channel • Pools downstream of cross vanes; riffles in straight reaches; no substantial bank erosion • No mid-channel bars in riffles; minimal sedimentation in pools • Bankfull measurements comparable to design 	<ul style="list-style-type: none"> • Stream Channel

Table 1. Monitoring Parameters and Performance Standards		
Monitoring Task	Performance Standard	Location
	<ul style="list-style-type: none"> • Sinuosity comparable to design • Radius of curvature comparable to design • Channel alignment comparable to design • Stream type and valley unchanged • No head cut development • Riffle slopes comparable to design • Thalweg length comparable to design • Structures are stable • Good to excellent rating for bank stability (modified Pfankuch, Rosgen, 2001) 	

Adaptive Management

Data collected during annual monitoring will be analyzed to verify that expected stream, riparian buffer and wetland detention pond performance standards are being met. If the performance standards are not being met, the cause will be identified; however, natural and human-induced factors may occur beyond the control of the Government of Guam (Owner). If the cause of failure is within the control of Owner, a remedial action plan will be developed for submission to the United States Army Corps of Engineers (USACE) outlining corrective measures to be taken. The Owner will continue to evaluate and perform any necessary maintenance of restored streams and riparian buffers until the performance standards are met during the monitoring period. Maintenance activities will be conducted to meet or exceed the stream and riparian buffer performance standards for the first five years of the project until such time as they are met and the USACE releases the applicant for any further action. If performance standards are not met according to the year 5 monitoring results, then the applicant will meet with the USACE for guidance in resolving the impasse.

If adverse impacts occur to the Site (e.g., Acts of God, drought, flooding, acts of vandalism, or storm damage) that affect the performance standards throughout the monitoring period, the following procedure will be followed to implement a contingency plan.

1. The Owner will notify the USACE of the type and location of the adverse impact and the proposed contingency action(s) that would resolve the issue.
2. The USACE shall respond within 30 days of the Owner’s notification of its intent to make a site visit and/or approve the proposed contingency actions.
3. If the USACE elects to visit the site, a site visit shall be scheduled no later than 30 days after the Owner’s notification.
4. If a site visit is scheduled, a consensus will be reached between the USACE members and the Owner during the site visit regarding the method(s) required to resolve any issues. The Owner and USACE will develop a projected timeline for implementing the contingency actions and any needed revisions to establish objectives and performance standards. A consensus will also be reached during the site visit on any adjustments needed to the monitoring protocols to align with revised objectives and performance standards.
5. The Owner will prepare and submit meeting minutes based on discussions and decisions made during the site visit to the USACE. The meeting minutes, and photographs of the areas of concern before and after implementation of contingency actions, will be included in the annual monitoring report provided subsequent to implementation of the contingency actions. If necessary, the annual

monitoring report will also include revised performance standards and a description of revised methods to monitor the success of the contingency actions.

Monitoring Frequency, Duration, and Reporting

Monitoring Frequency

The Owner agrees to perform all necessary work to monitor the channel relocation and riparian buffer planting to demonstrate success as listed above. The purpose of the monitoring will be to assess whether the project is achieving its objectives and to remediate any problems identified. The monitoring will be conducted at Years 1, 3, and 5. Monitoring may be terminated or the extent of monitoring may be reduced over part or all of the site at the discretion of the USACE. The monitoring plan will include:

- Channel Bank and Channel Stability
- Vegetation Assessment

Channel Bank and Channel Stability

Three permanent riffle cross-sections will be established (with permanent markers established during the first monitoring interval) and evaluated for channel bank and channel stability. At each riffle cross-section, the channel dimensions will be surveyed and compared to data from previous years to monitor channel stability. In addition, the following parameters will be measured and evaluated at each cross-section:

- Ground level photographs will be provided for the purpose of documenting vegetation and channel stability. Photographs will be taken twice annually (Dry Season/Wet Season) and will clearly show the channel upstream and downstream, the riparian buffer area, and each channel bank
- Rosgen channel classification
- Bankfull dimensions
- Bank Erosion Hazard Index (BEHI)
- Width-to-depth ratio
- Entrenchment ratio
- Bank/height ratio
- Channel Stability Evaluation (Rosgen, 2001)

Vegetation Assessment

The monitoring program for riparian buffer restoration and wetland detention pond areas shall follow the following guidelines:

1. Visual Description: Visual descriptions shall be provided with each monitoring report by one of the following means: (i) ground level photographs, taken facing north, south, east and west, from stations located adjacent to each vegetation plot [permanent markers shall be established to ensure that the same locations (and view directions) are monitored in each monitoring period], or (ii) one color aerial photograph (8" x 10" or larger) depicting the entire site.
2. Vegetation: Three sample plots shall be located on a stratified random basis over the site in order to sample all habitat areas of upland buffer at locations adjacent to each photo location marker.

Each plot shall be of a size no less than 400 square feet (approximately 0.10 acre) for woody plants and 3'x3' for herbaceous plants (or circular with approximately the same surface area). Alternative sampling

methods may be submitted for USACE) review and approval. The vegetation data shall be collected during the same season each year during the monitoring survey period and shall include:

- Dominant vegetation species identification;
- Coverage assessment;
- Number of woody plant stems (total and #/acre);
- Percent survival of planted species;
- An invasive/noxious species assessment, including percent cover; and
- Average height of woody species (including volunteers) in each sample and percent change in height since the original planting. Reporting of this parameter may be discontinued if canopy coverage is $\geq 30\%$.

Monitor Reporting Protocols

The Owner will submit Monitoring Reports within 60 days of completion of each of the monitoring periods (after Years 1, 3, and 5). The monitoring reports will include as-built plans (Year 1 only), a summary of the field methods, a summary of the monitoring requirements and performance standards, and a determination on whether the channel and riparian buffer restoration is proceeding towards meeting, has met, or is failing to meet the performance standards and warrants a compliance visit. The Monitoring Reports and photographs may be submitted electronically if desired. The Monitoring Report will consist of the following information.

Monitoring Report Narrative

Project Overview (1 page)

1. Corps Permit Number and Name of the Project.
2. Name of party responsible for conducting the monitoring and the date(s) the survey was conducted.
3. A brief paragraph describing the purpose of the approved project.
4. Written description of the location, any identifiable landmarks of the project site including information to locate the site perimeter, and coordinates of the site (expressed as latitude, longitudes, UTMs, state plane coordinate system, etc.).
5. Dates the project commenced and/or was completed.
6. Short statement on whether the performance standards are being met.
7. Dates and a description of work for any recent corrective or maintenance activities conducted since the previous report submission.
8. Specific recommendations for any additional corrective or remedial actions and a timetable for completing such actions.

Requirements: List the monitoring requirements and performance standards and evaluate whether the project site is successfully achieving the approved performance standards or trending towards success. A table will be provided to compare the performance standards to the conditions and status of the project site.

Summary Data: Summary data will be provided to substantiate the success and/or potential challenges associated with the project. Photo documentation may be provided to support the findings and recommendations referenced in the monitoring report and to assist the USACE in assessing whether the project is meeting applicable performance standards for that monitoring period. If photos are submitted, they will be formatted to print on standard 8 ½ inches x 11 inches paper, dated, and clearly

labeled with the direction from which the photo was taken. The photo location points will also be identified on the appropriate maps.

Maps and Plans: Maps will be provided to show the location of the project site relative to other landscape features, habitat types, locations of photographic reference points, transects, sampling data points, and/or other features pertinent to the project. In addition, the submitted maps and plans will clearly delineate the project site perimeter to assist USACE in locating the project during subsequent site inspections. Each map or diagram will be formatted to print on standard 8 ½ inches x 11 inches paper and will include a legend and the location of any photos submitted for review. As-built plans may be included with the first monitoring report.

Conclusions (1 page): A general statement will be included which describes the conditions of the channel relocation project. If performance standards are not being met, a brief explanation of the difficulties and potential remedial actions proposed by the Owner, including a timetable, will be provided.