NORTH CAROLINA
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

Baseline Monitoring Document
Format, Data Requirements, and Content Guidance

The overall purpose of this document is to standardize the minimum content and format requirements of the Baseline Monitoring Document, which marks the completion of the construction phase for EEP projects and the transition to the monitoring phase. Some of the content herein will be carried forward from the Mitigation Plan, the name now standardized to describe the project design and permitting deliverable as part of the Federal Rule enacted July 28, 2010. The content that is carried forward may be modified based on unforeseen changes between the design phase and constructed state of the project. This format guidance document will be revised and redistributed as changes arise in order to provide clarity for performers and best meet EEP's data needs. Documents missing critical information or those that substantially diverge from the most current version of this document will not be approved. Lastly, while this document is intended to provide some level of standardization, it should not inhibit the inclusion of information that the consultant feels is essential given factors or occurrences unique to a given project.

1.0 Baseline Monitoring Document - Purpose and Function

The Baseline Monitoring Document is a key document and marks the technical transition from design/construction phase to the monitoring phase. This document along with the As-built record drawings provides a means to compare the as-built condition to the design specifications and along with the baseline monitoring data provides a means to assess change/trends during the monitoring period. Many of the tables and components that originate here in this document will be carried through the monitoring reports and further populated as the monitoring data is generated. The document generally serves several functions:

1.1 Restates the project goals and objectives for stream, vegetation and hydrology components
1.2 Details the project structure in terms of the restoration components/assets
1.3 Provides a synopsis of the project and site background
1.4 Finalizes the success criteria for stream, vegetation and hydrology components
1.5 Finalizes the monitoring plan for stream, vegetation and hydrology components
1.6 Compares the As-built baseline condition to the design specifications for stream, wetland and vegetation components and encompasses the following:
  -Sealed As-built plan sheets
  -Morph and vegetation data suitable to serve as a monitoring baseline (year-0).
1.7 Describes maintenance and repair contingencies

Although items 1, 2 and 3 may be refined somewhat between the Mitigation Plan and the Baseline Monitoring Document, in most cases they are simply carried through as they exist in the mitigation plan. Items 4, 5 and 7 will originate in the Mitigation Plan, but may undergo refinement between that point and the final Baseline Monitoring Document. Items 6 is truly unique to the Baseline Monitoring Document.

3.0 Baseline Monitoring Document Format/Template

3.1 General

The EEP Baseline Monitoring Document is a key document and marks the technical transition from the design/construction phase to the monitoring phase. It details the type and amount of restoration and relates that to a proposed amount of mitigation assets (Table 1). In addition to this and along with the above functions, the document includes the As-built drawings and monitoring baseline for the project. In conjunction with the As-built record drawings, the Baseline Monitoring Document provides a means to compare the as-built condition to the design specifications and along with the baseline monitoring data provides a means to assess change/trends during the monitoring period. Many of the tables and components that originate here in this document will be carried through the monitoring reports and further populated as the monitoring data is generated (Table 5). The following provides some general rules in terms of the report format.

3.1.1 Some of the tables in this template/guidance document are to be used in housing data in the actual plan document, while others are simply part of this guidance document. In the actual plan document, place tables and figures sequentially in separate tabs/appendices at the back of the report body.

3.1.2 Reports must have standard footers in the event pages are separated from the binder. The footer should indicate that it is the Baseline Monitoring Document for the subject project (name/number), pagination and whether the document is a draft.

3.1.3 All data must have units assigned whether in figures, tables or text, and should include complete date of survey (day/month/year) if not covered under the timeline data typically found in table 2.

3.1.4 The number of data points (n) must be specified where ranges or means are provided.

3.1.5 Times New Roman or Arial fonts must be used with a minimum point size of 11 and 10 respectively for narrative text with table bodies as low as 9 and 8, respectively.

3.1.6 All photos should be in color, of adequate quality, and arranged in sequence. Additionally, photos should include complete date information (day/month/year). Cameras used for photo monitoring/documentation should have the automatic date stamp set to this format.

3.1.7 The tables in this document were created in WORD, but Excel versions will be available on the EEP website soon for actual data submission.

3.2 Title Page

3.2.1 Document Title “Baseline Monitoring Document and As built Baseline Report”
3.2.2 Draft or Final
3.2.3 Descriptive site name and any EEP project or contract number
3.2.4 County
3.2.5 Data Collection Period, Submission Date
3.2.6 Project photo
3.2.7 Submitted to/prepared for: NCDENR-EEP address and logos
3.2.8 Monitoring performer company logo should not be included on the title page

3.3 Table of Contents – An organized and detailed report outline must be provided in the form of a Table of Contents.

3.4 Executive Summary/Project Abstract

The executive summary should distill the information in the body and that detailed in the appendices for vegetation, stream, and wetland hydrology components. A single concise paragraph describing the overall goals and objectives as developed in the restoration plan should be followed by a paragraph describing the project background and pre-construction condition. This should be followed by a description of the overall restoration approach for each of the three potential primary project elements (e.g. stream, vegetation and hydrology) and how these elements compare in the as-built state to the design and planting plans. For example, this would include whether there were any deviations of significance in terms of channel morphology or the as-built stem density and species distribution. A statement regarding the components and duration of the monitoring shall also be included. Include a concise statement regarding any issues or mitigating factors, which may have arisen in the period immediately after the completion of grading and planting (e.g. impoundment changes, extreme precipitation trends or events, or beaver activity etc.), which that may require consideration or attention.

3.5 Project Goals, Background and Attributes

This section is designed to provide a more detailed synopsis of the projects setting, goals/objectives, structure, and background.

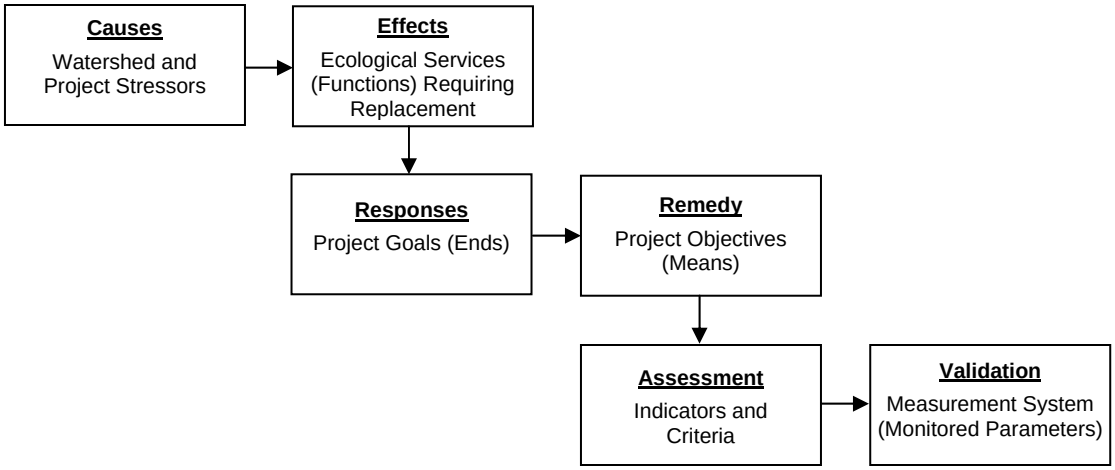
3.5.1 **Location and Setting**. Provide a concise paragraph regarding the project setting such as river basin, physiography, landscape position, adjacent landuse, etc. This is to be accompanied by a composite vicinity map that is to include a text box inset with detailed directions relaying how to get to the site that includes current local road names and/or route numbers. Road names/numbers and place-names should be clearly labeled on the vicinity map. The map is to include:

3.5.1.1 Figure number and title
3.5.1.2 North arrow
3.5.1.3 Scale
3.5.1.4 Appropriate plan footer info minimally including:
EEP logo
Project name/number
NC County
3.5.1.5 Labeled stream layer with the project extent overlain or bolded.
3.5.1.6 Approximation of the project boundary/easement.
3.5.1.7 This map can be a USGS Quadrangle map as a base if need be with current names or numbering for roads.
3.5.1.8 Unless the project access is surrounded by public property, the directions inset will include the following statement:
"The subject project site is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or

their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with EEP." This should be prominent, but should not interfere with the maps interpretation

3.5.1.9 Incorporate reference site(s) used (place within same map if the location permits the detail requested or a distinct map figure if not).

3.5.2 **Project Goals and Objectives** – Restate in a bulleted format the project goals and objectives that were developed during the design phase. Goals represent items such as reducing water quality stressors and improving instream or riparian habitat (ends), while objectives tend to represent the steps, actions, or methods to achieve them (means). Goals and objectives need to provide the linkage between the hydrologic, water quality and habitat functions that the proposed project expects to restore or enhance and the systems of measurement that will demonstrate attainment.



3.5.3 **Project Structure, Restoration Type and Approach**

3.5.3.1 **Project Structure**

The description and depiction of the project structure is accomplished with through a combination of a project asset map and asset table. This will be brought forward from its original form in the Mitigation Plan however, the following guidance is provided in the event design elements or components are altered between the design and As-built baseline phase. Delineating the project components/assets should include a properly segmented map (e.g. fig 1.) and corresponding table (Table 1). It is possible to delineate these pieces in the vicinity map (section 3.5.1), but if clarity is compromised it may require a distinct figure. See the appendix of this document for exhibit figure 1 that provides an example of the desired level of delineation.

For the purposes of associating monitoring data that might be affected by changes in the characteristics of various project components the following guidance is provided. Project structure is comprised of restoration components that are contiguous areas or reaches consistent in their restoration level (e.g.. P, C, EI, EII, R etc.), approach (e.g. PI, PII, for streams etc.) and target type (i.e. B, C, E for streams and community system types for wetlands). In the case of streams, a distinct piece of hydrology,

such as a tributary will always be treated as a distinct stream project component. For streams, there have been examples in the past where certain restoration reaches/components have demonstrated an intermingling of restoration approaches (e.g. PII/PIII). A distinct restoration component should be created for any continuous stream segment that demonstrates consistency in the above characteristics for 500 feet or more.

Inflections or changes in other characteristics, which may strongly influence the response or performance within a component delineated according to the above criteria may merit further segmentation. For example, in the case of a stream restoration segment with a consistent level, approach, and type (e.g. R, PI, E), but a distinct inflection in the valley type/characteristics occurs, it would be advisable to create a distinct component in the table given that the valley condition may be expected to yield performance differences. A large increase in the drainage on a project mainstem due to a tributary contribution would be another example. Typically a sustained shift in valley characteristics would often generate a distinct design stream type, negating the need for this additional consideration, but this is not always the case given that multiple valley types can include the same stream type. A distinct shift in soil type longitudinally over the valley may warrant the same kind of consideration or in the case of wetlands, a topographic feature that may isolate 2 BLH tracts from one another may warrant their distinction.

This component tabulation in table 1 has relevance and application beyond cataloging the project components/assets. The components delineated in table 1 define the segmentation of measurement and monitoring data, serving as the projects "analytical units". This means that data summary tables such as those outlined below for baseline morphology or those in monitoring reports that summarize wetland gauge performance are populated with data parsed according to the reaches or tracts listed in table 1. If the consultant intends to change the contents or distribution of table 1 between the Mitigation Plan and the Baseline Monitoring Document then the consultant needs to note this in the narrative and provide the rationale.

Upon verification at the point of Baseline Monitoring Document review, project components will only change in the event that maintenance or repair impacts the original type or approach and would occur through a decision process directed by EEP.

3.5.3.2 **Restoration Type and Approach**

Provide a concise paragraph regarding the historical condition (e.g. stream chanalized for agriculture; wetland ditched etc.) and a general description of the overall restoration strategy/approach.

3.5.4 **Project History, Contacts and Attribute Data** – This section is to provide a short narrative on the background of the project and a summary characterization of the project watershed(s). The data relevant to this section is housed in Tables (2-4). These exhibit tables are designed to provide a good representation of the type of information sought, but should not be limited to what is presented if the consultant can identify additional relevant information for EEP review. The first table, table 2 describes the reporting and milestone history for the project. The second identifies the project consultants, contractors and suppliers. (Table 3). Table 4 provides

relevant attributes/data at the project level and for the individual restoration components. The latter will more often relate to stream projects, but may apply to wetland projects as well. Aspects of Tables 2 and 3 will by default receive updates during the monitoring period and all tables will be carried through in the monitoring reports.

3.6 **Success Criteria** - Project success criteria will be brought forward from the Mitigation Plan with any adjustments that are dictated by unforeseen deviations between the design and As-built states and should be detailed in this section for each of the relevant project elements (i.e. stream, vegetation, hydrology). Although each project is unique, the following provides some content guidance and historical conventions.

3.6.1 Morphologic Parameters and Channel Stability - Stream restoration involves altering an impaired morphology to better approximate a stable stream type and reference and verifying the design form against process-based assessments. The morphologic contribution to uplift in hydrologic, water quality and habitat functions stem from two main morphologic objectives. The first being the maintenance of a restored or enhanced floodplain connection and associated dimension that facilitates the transport of in-stream sediment loads in equilibrium and dissipates energy associated with flood flows. The second is the maintenance of a longitudinal profile/gradient, which supports these same transport and energy management outcomes. In concert with adequate vegetation, these objectives promote the lateral and vertical stability that permits maintenance of in-stream habitat (bedform), reduces water quality stressors to the reach and watershed in the form of bank sediment export reductions and better manages storm flow energies.

Restored or enhanced streams should therefore demonstrate morphologic stability to be considered successful. Stability does not equate to an absence of change, but rather to sustainable rates of change or stable patterns of variation. Restored streams often demonstrate some level of initial adjustment in the period that follows construction and some change/variation subsequent to that is also to be expected. However, the observed change should not be unidirectional such that it represents a robust trend. If some trend is evident, it should be very modest or indicate migration to another stable form. Annual variation is to be expected, but over time this should demonstrate maintenance around some acceptable baseline with maintenance of or even a reduction in the amplitude of variation. Lastly, all of this must be evaluated in the context of hydrologic events to which the system is exposed.

3.6.1.1 Dimension – General maintenance of a stable cross-section and hydrologic access to the floodplain features over the course of the monitoring period will generally represent success in dimensional stability. However, some change is natural and expected and can even indicate that the design was successful and appropriate for the hydrologic and sediment regime. Examples include depositional processes resulting in the development of constructive features on the banks and floodplain, such as an inner berm, a slightly narrower channel, modest natural levees, and general floodplain deposition.

For stream dimension, cross-sectional overlays and key parameters such as cross-sectional area, and the channel's width to depth ratios should

demonstrate modest overall change and patterns of variation that are in keeping with the descriptions in section 3.6.1.

Significant widening of the channel cross-section or trends of increase in the cross-sectional area generally represent concern, although some adjustment in this direction is acceptable if the process is arrested after a period of modest adjustment. In the case of riffle cross sections, maintenance of depths that represent small changes to target competency (e,g, consistently low BHRs <1.2) would also reflect stability. Although a pool cross-section may experience periodic infilling due to watershed activity and the timing of events relative to monitoring, the majority of pools within a project stream reach/component should demonstrate maintenance of greater depths and low water surface slopes over time. The habitat aspect (depth) of the pool cross-sections need to be maintained over time and the rates of lateral migration need to be moderate.

3.6.1.2 Pattern and Profile – For the channels' profile, the reach under assessment should not demonstrate any trends in thalweg aggradation or degradation over any significant continuous portion of its length. Over the monitoring period, the profile should also demonstrate the maintenance or development of bedform (facets) more in keeping with reference level diversity and distributions for the stream type in question. It should also provide a meaningful contrast in terms of bedform diversity against the pre-existing condition. Bedform distributions, riffle/pool lengths and slopes will vary, but should do so with maintenance around design distributions. This requires that the majority of pools are maintained at greater depths with lower water surface slopes and riffles are shallow with greater water surface slopes. Pattern features should show little adjustment over the standard 5 year monitoring period and there measurement need not be part of annula monitoring unless issues in the profile and dimension indicate that pattern might be changing.

3.6.1.3 Substrate – Substrate measurements should indicate the progression towards, or the maintenance of the known distributions from the design phase.

3.6.1.4 Sediment Transport – The net effect of the state of the parameters in sections 3.6.1.2 – 3.6.1.4 should be the absence of any significant trend in the aggradational or depositional potential of the channel.

3.6.2 Vegetation – All applicable laws and regulations pertaining to vegetation establishment must be listed and referenced in this section, and the minimum standards for success required by each document must be outlined in text or table format. Applicable laws and guidelines typically include: USACOE (2003) Stream Mitigation Guidelines, Buffer Rules administered by the NC Division of Water Quality Nonpoint Source Management Program, and the NC Sedimentation Pollution Control Act of 1973 administered by the NC Division of Land Resources.

3.6.3 Hydrology

3.6.3.1 Streams - A minimum of two bankfull events must be documented within the standard 5-year monitoring period. In order for the monitoring to be considered complete, the 2 verification events must occur in separate monitoring years. Whether a crest gauge will suffice or a continuous recorder is advisable is something that should be discussed with EEP monitoring personnel.

3.6.3.2 Wetlands – Regulatory success criteria for wetlands can be found in the following 2 regulatory guidance documents.

USACOE (1987) *Corps of Engineers Wetlands Delineation Manual*. Tech report Y-87-1. AD/A176. - Hydrology success criteria for wetlands primarily involves achievement of groundwater levels within a certain distance of ground level for a set number of days (continuous) that represents an appropriate percentage of the growing season as determined by an appropriate reference.

3.6.4 Other Parameters - Provide success criteria as appropriate with those outlined in the Mitigation Plan accounting for any deviations between the design and As-built states.

3.7 **Monitoring Plan Guidelines** – Draft versions of the monitoring plan should assume annual data collection for the monitoring parameters below unless otherwise stated or directed as part of the review process.

3.7.1 Hydrology

3.7.1.1 Wetland – Measurement of wetland hydrology will be performed in accordance with traditional methods. Groundwater gauges will be installed at appropriate locations to characterize the degree of attainment of the reference hydrology.

3.7.1.2 Stream – Minimally, every stream project must include a crest gauge to verify the on-site occurrence of bankfull events. For select projects, new requirements in the design phase will call for the installation of 2 stream gauge transducers with data loggers on surveyed cross sections for the purpose of producing an on-site hydrograph. Projects with streams in rapidly developing watersheds where bankfull indicators may be very poor will include this more intensive data collection and continue through the monitoring phase. Therefore, if the project characteristics warrant this measure, this data collection would start early in the design process, providing an additional means of verification for bankfull design targets. This will continue in the monitoring phase and will aid in channel maintenance/repair determination should it become necessary. Observations of wrack and deposition may serve to augment gauge observations when necessary.

Each site visit by the monitoring performer must include documentation of the highest stage for the monitoring interval and a reset of the device or download of any data. The data related to bankfull verification will be summarized as described in the latest version of monitoring report format document.

3.7.2 Stream Channel Stability and Geomorphology: Exhibit Tables 5 and 6 are key tables designed to house the project's hydraulic and geomorphic data. These tables are initiated in the Baseline Monitoring Document/As-built report and are carried through the monitoring phase and updated each year as the relevant data is collected. A distinct pair of these tables will need to be produced for each distinct project stream segment, essentially structured in accordance with Table 1. These tables may assume new numbering when they are incorporated in the monitoring reports. Projects involving the restoration of a reference dimension, pattern, and profile will require some assessment of all three of these major geomorphic components during the monitoring phase. Visual based assessments may be solely relied on during the monitoring phase in lieu of rigorous measurement of pattern, profile and dimension if the level of enhancement resulted in minimal changes to these geomorphologic components (e.g. EII). However, the sections that follow provide general guidelines as to which monitoring features will typically be measured and their extent.

3.7.2.1 Dimension – As a general guideline the number of cross sections to be installed and measured in the As-built state should approximate an interval equal to the combined length of 20 bankfull widths. This distance interval applied to very narrow streams can make for a high number of cross sections. This criterion can be exceeded in such cases, but the designer or monitoring consultant should be confident that the extent of the variance in this parameter is being captured and the average distance interval shall not exceed 500 feet. In addition, because project bankfull design parameters are heavily weighted on the riffle cross sections, EEP seeks to have a distribution or minimally a range available for riffle cross sections. Given these various factors, the following tabulation provides a guideline for the number of cross sections that should cover most project reaches in a typical riffle-pool dominated system.

Segment/Reach			**Segment/Reach**		
Footage	**#Riffle**	**#Pool**	**Footage**	**#Riffle**	**#Pool**
500 or Less*	Vis	Vis	4001 to 4500	5	3
501 to 1000	3	1	4501 to 5000	5	4
1001 to 1500	3	2	5001 to 5500	6	4
1501 to 2000	3	2	5501 to 6000	7	4
2001 to 2500	3	2	6001 to 6500	8	4
2501 to 3000	4	2	6501 to 7000	9	5
3001 to 3500	4	2	7001 to 10000	10	5
3501 to 4000	4	3	10000 or >	14	6

* Very small reaches can be addressed through visual methods

Ultimately, the designer must install cross sections that will represent the stream type and capture the variability in the dimensional features. As an example, a step-pool system would require a different distribution and emphasis.

3.7.2.2 Profile – For restoration or enhancement I components, 3000 linear feet or less, the entire length is to be surveyed. For mitigation segments in excess of this footage, 30% of the length or 3000 feet are to be surveyed, whichever is greater. The reach/stream component structure to which this sampling criterion is applied should follow what exists in table 1 and the guidance in section 3.5.3.1. In choosing the placement of longitudinal profile endpoints one should keep in mind that areas with extensive bedrock controls are not ideal for expending available profile sample. Also, sections of a projects mainstem that include tributary confluences would be useful to capture.

3.7.2.3 Pattern – For those stream projects where pattern was restored, the parameters in Exhibit Table 5 and 6 should be collected and included. This need only be completed in year 5 and then only if there were any indications through profile and dimensional data that significant geo-morphological adjustments occurred.

3.7.2.4 Visual assessment – See the latest monitoring format document on the EEP website for the visual assessment data to be captured as a product of the morphometric channel survey.

3.7.2.5 Bank Stability Assessments – The bank stability summaries as part of the visual assessment cited in 3.7.2.4 catalog the amount of bank footage that has demonstrated some level of instability at some point within the monitoring phase. BEHI and NBS assessments should only be included if they exist for the entire project pre-construction as part of the existing conditions survey. In the event BEHI and NBS assessments are included in the monitoring plan they shall be performed in year 5, post-construction only. Coupled with an NBS assessment the intention is to produce project sediment export estimates (tonnage per annum) to compare to the pre-construction phase.

3.7.2.6 Vegetation - This section must contain a discussion of the general approach toward vegetation monitoring that is tempered with regard to the overall site potential and guided by the overarching goal of providing adequate data for supporting project success. Vegetation data collection must follow the CVS-EEP Protocol for Recording Vegetation (Lee et al. 2006). Information and materials related to the protocol are available at the following web site: (http://cvs.bio.unc.edu/methods.htm). The recommended approach for becoming familiar with the protocol is for users to first download the Work Flow documents, which outline the required schedules for collecting and delivering data. Then, the protocol and the corresponding datasheets should be reviewed with particular attention to levels 1, 2 and 3, which are the levels utilized for typical mitigation projects. The Data Entry Tool is an MS Access file and is the mechanism by which data must be entered and delivered to both the Carolina Vegetation Survey (CVS) and EEP. However, before attempting to use the data entry tool, users are strongly encouraged to download and review the series of power point presentations pertaining to the data entry tool features and helpful tips.

Within the synopsis, the following information pertaining to vegetation monitoring must be provided in table format (see Appendix C):

3.7.2.6.1 The number of plots to be installed. For stream projects, the number of required plots can be calculated using the Data Entry Tool. For wetland projects, a minimum of one vegetation plot for each hydrology gauge is required along with one vegetation plot for each vegetation community type, or zone, illustrated in the Restoration Plan document. For uncommon projects with channel(s) flowing through a relatively large wetland, the number of plots assigned to the stream can be derived from the Data Entry Tool based on an assumed buffer width of 50' while the plots assigned to the wetland are calculated separately using the criteria stated above.

3.7.2.6.2 The Level (1-5) of each plot for the Baseline data and five subsequent annual monitoring events. Refer to the following synopsis of each protocol Level to determine the appropriate approach for each project.

- Level 1: Inventory of Planted Stems The primary purpose being to determine whether prescribed plants are installed, species are distributed, individuals are spaced, and to estimate the average number of stems per acre. The baseline data containing planted trees for restoration projects containing forested community types is typically collected using protocol Level 1 because natural stems are not established immediately after construction.
- Level 2: Inventory of Planted and Natural Stems Applicable to all woody stems (planted and natural in separate categories) in the plot to assure an accurate assessment of woody-plant restoration on the site. Use of Level 2 is encouraged for projects containing forested community types that will rely on natural woody stems for development and success.
- Level 3: Stem Inventory and Dominant Cover Applicable to all woody vegetation, with no distinction between planted and natural stems. Cover estimated are required for all species with cover values above a set cut-off, perhaps 5%. The primary purpose of this protocol is to identify: degree of naturalization, spread of targeted species, and indication of direction and rate of succession change, and to monitor unforested community types lacking planted woody stems such as marsh and bog. These plots conform to the requirements for "occurrence plots" as defined by the ESA Guidelines. Optionally, cover in vertical strata can be sampled.

- Level 4: Full Floristics Identification of all species occurring on the plot, preferably with cover assigned to vertical strata. These plots conform to the requirements for "classification plots" as defined by the ESA Guidelines. The primary purpose of Level 4 is to facilitate more rigorous research and assessment, such as: trajectory analysis. Use of

Level 4 must be restricted to situations where trained botanists can be utilized.

- Level 5: Full Floristics in Spatial Scales Identification of all species, recording occurrence within nested subplots to provide data at spatial scales. Adequate descriptions of the plot environment must also be collected, including soil samples and notations of disturbances. The primary purpose of Level 5 is to sample vegetation to the fullest extent, providing data for many different applications. Use of Level 5 must be restricted to situations where trained botanists can be utilized.

3.7.2.6.3 The hydrology gauge and community type, or zone, corresponding with each vegetation plot.

3.7.2.7 Digital Photos

Photo stations should be established to capture the state of the channel and for vegetation plots. Stream photos from the established photo stations are preferably collected when the vegetation is minimal and within the same 2-month window between monitoring years. One representative digital photo of each vegetation plot must be taken on the same day vegetative cover estimates are conducted. The photo caption should include the plot number, and the date it was taken (day/month/year and monitoring year).

3.7.2.8 Other Parameters

Water quality and/or biological measurements represent other potential parameters to include in the monitoring plan. Outside of specific research efforts, an overarching guideline for the inclusion of such parameters is the likelihood that the system of measurement combined with the project characteristics provides a level of sensitivity sufficient to reliably detect change and that any observed change can be reliably assigned to the influence of the restoration effort. This is a question of signal to noise. For example, the size and landscape position of the project relative to its watershed could have significant impacts on the likelihood of reliably detecting change in chemical or biological parameters that can then be reliably attributed to the restoration effort. Therefore a project that is situated closer to the headwaters of a particular watershed would likely facilitate more sensitive and more reliable detection of any change attributable directly to the subject project. Another instance when such parameters should be considered is when the subject project includes some form of engineered stormwater controls.

3.7.2.8 The watershed – As part of the monitoring that follows construction, the influence of activities and changes in the project watershed should be considered. For example, where it can be observed that the introduction of fine sediments from activities in the contributing watershed are altering project features to the point of potentially impacting stability and success, this should be noted. Similar issues such as rare hydrologic events/conditions should be considered and language in this section of the

Baseline Monitoring Document should be included to emphasize the documentation of such factors for the benefit of future monitoring personnel.

3.7.2.9 Monitoring Plan View Prior to the As-built survey and collection of baseline monitoring data, the designer or monitoring firm (depending upon the party designated in project contracts) should render the intended monitoring features on the construction drawings and submit these electronically for EEP to examine prior to installation and collection of the data associated with the monitoring plan. EEP would like to examine the intended extent and distribution of monitoring features.

3.8 Maintenance and Contingency Plans

This section is to include details regarding corrective actions to be taken in the event that problems arise and will generally be carried forward from the Mitigation Plan with any adjustments/deviations that may have occurred between the design phase and the As-built Phase. This section is to include guidance, criteria or thresholds for remedial action and it should also include specifications for implementing remedial actions.

4.0 Documenting the As-built Condition (Baseline)

A major component of the Baseline Monitoring Document is the As-built report which is comprised of the As-Built Plan View and the Baseline Monitoring Data.

4.1 As-built/Record Drawings

4.1.1 It is EEPs intention that the designers submit a single drawing that will service SCO record drawing needs and EEP As-built needs.

4.1.2 As-built/record drawings are of particular importance in that they provide an opportunity to detail any plan view (pattern) and feature deviations from the construction drawings and to provide the baseline digital drawing file, which can be updated as needed throughout the monitoring phase. These drawings are a key addendum to the SCO Final Report and a key component to the Baseline Monitoring Document document.

4.1.3 In addition to the guidance below regarding the printed plan sheet deliverables and project baseline, a guidance document is now available for formatting of certain desired features in the underlying digital files that is critical to EEPs use of these deliverables. The PDF document entitled "Format, Data Requirements, and Content Guidance For Digital Drawings Submitted to EEP", can be found incorporated in the EEP Project Implementation Manual at the URL below. Submission of electronic drawings in compliance with these formatting specifications will be critical to the utility of these drawing files to EEP.

http://www.nceep.net/business/NCEEP_Project_Implementation_Manual_April%202009.pdf

Table 2 in the above referenced guidance document includes key features of interest for the digital files that comprise the As-built plans as well as feature/layer naming conventions and the organizational scheme. The main objective is that the features in Table 2 can be distinguished and readily extracted in Arc-GIS once converted from the CAD or Microstation format. Table 2 in the referenced guidance document does not specify symbology, just the features of interest, their preferred shape type (line, point or

polygon) and some coding in the underlying digital table. Therefore, in terms of drawing symbology all typical DOT standards and conventions can be utilized where they apply.

4.1.4 The as-built plan sheets must be the result of a re-survey of the projects limits of disturbance. Naturally many of the features will be carried forward or evolve from the construction drawings, but it is expected that the topography and baseline channel elements will be the result of actual resurvey with topographic contours attributed in the underlying table with elevations such that a 3D representation (terrain) can be generated by EEP.

4.1.5 If the designer wishes to distinguish the components of the As-built they will seal versus the general topographic survey performed by another party, extra sheets may be added to make this distinction.

4.1.6 Components of As-built/record drawings

4.1.6.1 Overall site plan cover sheet
4.1.6.2 Project Name and EEP project number
4.1.6.3 P.E. Sealed
4.1.6.4 Dated
4.1.6.5 Appropriately initialed (e.g. Designer, Checker, Drawer)
4.1.6.6 Plan Type: (As-built/record drawing - each sheet)
4.1.6.7 SCO ID#
4.1.6.8 Legends, scale and North arrow
4.1.6.9 Stationing and ID of project stream reaches
4.1.6.10 Wetland project tract numbers/ID.
4.1.6.11 Limits of disturbance if and where it differs from the construction drawings
4.1.6.12 Conservation Easement – The easement rendered in the As-built drawings must be SPO compliant, meaning that it represents the true recorded easement with proper extent, shape, orientation and geospatial referencing. See the guidance document specified in 4.1.3 above.
4.1.6.13 Contours at a maximum of 1 foot intervals
4.1.6.14 Tributaries within or immediately above the project extent that will influence the project reaches must be included in the drawing regardless of whether the tributaries are included in the restoration (assuming these were captured in design survey as well)
4.1.6.15 Pre-construction channel alignments
For stream projects, render the pre-restoration and design alignments under the As-built alignment. These would constitute a simple corridor feature that minimally includes the area between the top of bank features, which could be filled with differing levels of very light semitransparent shading. If this cannot be accomplished without making the presentation too visually complex or obscuring the as-built features/detail, then this aspect can be eliminated. If the difference in design and as-built plan views is so minimal that little of the design channel would be visible under the as-built alignment, then indicate through annotation or an inset note that the deviation from design plan view was negligible. Alternatively, simply depict or annotate where alignment deviations occurred as opposed to rendering the entire design alignment.
4.1.6.16 Longitudinal Profile plot of the entire As-built thalweg, overlaid on the design thalweg. Include Design and As-built TOB/Bankfull as well.
4.1.6.17 Plot cross-sections including station, (riffle/pool) with overly on typical cross-section.

4.1.6.18 A digital red line markup of the drawing providing callouts of any relevant changes or deviations to features.

4.1.6.19 The other objects features of interest including relevant digital formatting information can be found in Table 2 of the guidance document cited in section 4.1.3 above.

4.1.6.20 For the desired layout and plan sheet sequence as well as copies needed by EEP and SCO see appendix D.

4.2 Baseline Data Collection

4.2.1 **Installing and Marking Monitoring Features** Monitoring features will need to be installed and marked that support the following:

- Long-term measurement (permanence)
- Ease of relocation (marking)
- Ease of identification (labeling)
- Safety

No wooden material is to be used in the establishment of monitoring features. Rebar, or steel conduit will be cemented in place at the baseline phase. If this was not performed, the monitoring firm must minimally use rebar or steel conduit (2 foot lengths) driven into the ground with some means to provide ease of relocation (e.g. fiberglass flags, PVC Pipe etc.). The latter should only be excluded if risks of vandalism are high. Rebar or conduit should extend from the ground 4-6 inches and affixed with a cap for safety considerations and assisting in relocation. Burying a 2.5 or 3 inch diameter piece of PVC pipe with a threaded cap to surround the rebar/conduit is another mechanism to support all 4 of the bulleted elements above. The PVC will eventually get brittle over time, but it will provide the stated needs and added protections even over monitoring periods that extend well beyond the 5-year timeframe.

This is required for cross-sections, start and endpoints of longitudinal profile segments and vegetation plot corners (see specifics in CVS protocol). A scribed aluminum tag must be affixed to each of theses features for identification. Monitoring Reach ID, feature type (e.g. Riffle Cross-section) feature number (e.g. XS-2). GPS points will be collected for each pin as per standard practice from prior guidance. Cross-section pins should be placed far enough from the channel to capture floodplain topography (e.g.. terraces or berms etc.) and capture the top and ground level of the pin. Longitudinal profile monuments should be situated on stream left perpendicular to the centerline alignment approximately 10 feet from the top of bank.

4.2.2 The topographic survey and morphological measurements that constitute the As-built baseline should occur within 60 days of the completion of site grading.

4.2.3 Baseline vegetation data collection should occur within 21 days of completion of site planting.

4.2.4 This baseline measurement and the Year-1 measurement should never occur such that the interval between them is less than 6 months.

4.2.5 Morphological State of the Channel

The detailed measurement of dimension, pattern and profile features in the as-built state will provide the baseline to which future monitoring data can be compared and also permits an evaluation of any design deviations. Exhibit Tables 5 and 6 in the appendix are provided to capture this data and organize and display it in such a way as to facilitate future database incorporation and graphical display. These tables will be carried through and updated in the monitoring reports under different table numbering. The tables are designed to capture all data of relevance for morphometric and hydraulic assessment. Some of these parameters for certain baseline categories may not apply or may not be available. For example, a proximal, hydrologically connected USGS gage can provide a valuable verification of bankfull parameters and when available should always be included in the design process. Such an asset can also prove useful during the monitoring phase. However, the availability of this asset will obviously be the exception as opposed to the rule and therefore the associated cells will often remain empty in the table. The grayed-out areas of these tables represent data that will not apply given the parameter and field in question. The deviations in morphological parameters between the design and As-built state will be evaluated to determine if they represent any concern or warrant attention.

4.2.5.1 Profile – A geomorphologically relevant survey of the projects entire channel length is to be performed as part of the As-built baseline. A subset of the entire profile will be identified for annual re-survey as described in sections 3.7.2.2 and 3.7.2.9. This has been performed on some projects in the past without adequate resolution or without capture of certain features, diminishing the surveys utility as a monitoring baseline. The surveyor or survey oversight personnel must posses the knowledge necessary to conduct the survey to facilitate the extraction of meaningful distributions for the variables in table 5 in the appendix. A table in keeping with exhibit table 5 will have to be produced for each reach or project stream component as delineated in table 1. Ideally, the design firm and contractor can coordinate to provide both PLS credentials and a single survey that supports these data needs. Length and slopes of bedform features, bank height ratios etc. are examples of items that will have to be reliably extracted from this survey (see yellow highlighted items in exhibit table 5 below and see an example electronic spreadsheet submission that represents the data extraction necessary from the longitudinal profile for developing the distributions to support Table 5. Some variation of the example distribution table would be necessary for any performer to provide the bedform distribution summary in table 5. The example provided was found to be a useful part of the electronic submission for that project). This will require that the following is minimally surveyed as part of the baseline longitudinal profile at each bed feature head and grade control structure:

-Thalweg
-TOB
-Bankfull if different from TOB
-Water surface

This data will be plotted in Appendix B. Regardless of the data format (CAD, Microstation, River Morph) that the profile exist in for the plan sheets (4.1.6.16) it must be extracted into Excel for plotting in Appendix B. This is to make for easy overlay, ready examination and facilitate monitoring. The original format (CAD, Microstation, River Morph) will be submitted as well in the event the monitoring firm should choose to use these formats. The raw

data files will denote/code all longitudinal thalweg points (head of riffles, pool, pool max depth, glide, run. structures, crossings etc.)

4.2.5.2 Dimension – Cross-sections monumented for permanence in accordance with the approved monitoring plan (3.7.2.9) will be installed and surveyed. The shot resolution must be sufficient to serve as a monitoring baseline as opposed to the coarser shot densities of CAD alignment extracts. See table 5 and 6 for data summary expectations. This data will be plotted in Appendix B. Regardless of the data format (CAD, Microstation, River Morph) that the data existed in for the plan sheets (4.1.6.17) it must be extracted into Excel for plotting in Appendix B. The raw data files will denote/code all dimensional points of relevance, thalweg, water surface, bankfull, TOB, end pins, and any other deposition form of relevance.

4.2.5.3 Pattern – Pattern data for table 5 can be obtained from the As-built drawing files.

4.2.5.4 Substrate Data - Include a substrate sample only if the project includes constructed riffles. Just include one constructed riffle if they are a part of the project. EEP simply wishes to understand how the particle distributions in constructed riffles compare the riffle distributions collected for the system during the design phase.

4.2.5 Sediment Transport in the As-built State

An analysis of sediment transport in the As-built state is to be performed in order to determine the likelihood or risk of future aggradation or degradation. Utilizing the stream substrate data collected during the design phase and the morphometric parameters as measured in the As-built state, the designer will provide some net assessment of risk related to morphological deviations. This is to be a standard component of the Baseline Monitoring Document document primarily for streams with substrates in the range of sand to gravel, with the emphasis on capacity (stream power) for the former and competency on the latter (see blue fields in table 5). The designer is to provide a table comparing design and As-built competency and power as appropriate and a short narrative describing any implications of this analysis. If the results of this analysis indicate a significant increase in risk, this will prompt a conference between EEP, the designer and the contractor to determine a course of action. This requirement indicates that it is advisable to consider performing these analyses for project sections as they are completed during construction. It is understood that in most cases the morphological deviations will not result in a significant shift in design transport balance, but EEP seeks to have this confirmation in order to gauge whether a particular project might warrant greater than average attention/observation in the year(s) immediately following construction.

4.2.6 Verification of Plantings -

This section must provide a written summary of the overall vegetation condition within the project area immediately following construction and outline the data contained in the Excel Summary Tables (Appendix C) produced by the Data Entry Tool

4.2.7 Photo documentation

Digital photos will be collected from designated stations in accordance with the approved monitoring plan (3.7.2.9) to document the As-built/baseline state and included in an Appendix. These will be contrasted side by side with meaningful pre-construction photos for the area or reach in question.

4.2.8 Stream and Wetland gauge placement and condition will be verified once after baseline activities are complete.

5.0 **Report and Data Submission Format**

5.1 Submit 3 hardcopies of the report and plan sheets for review. Upon approval send 3 final copies and the electronic deliverables below.

5.2 Create a master folder to house all e-files using the following naming convention:

Project Name-Number-MitPlan (e.g. UT_Rocky_River-123456-MP) Project # supplied by EEP

5.3 Under a subfolder named "Report" include the following PDF components formatted to provide the best balance of quality and file size, sectioned as per the example below:

As an example: Jumping Run, Project number 29, Calendar year 2007, Mitigation Plan Submission

1JumpingRun_29_2007_MP_Main Body.pdf
2JumpingRun_29_2007_MP_AppA.pdf
3JumpingRun_29_2007_MP_AppB.pdf
4JumpingRun_29_2007_MP_AppX.pdf etc.

5.4 Under a second subfolder named "Support Files" create four subfolders (for projects that apply) named:

5.4.1 Vegetation
5.4.2 Stream
5.4.3 Wetland
5.4.4 Background_PlanViews_Figures
Include spreadsheet with tables 1 through 4.
As-built_Plan_Folder
(2 Subfolders: 1 for digital drawing files formatted as cited in section 4.1.3 and 1 for a PDF formatted version)
Figures Folder housing PDFs any other figures

5.5 Under subfolders 5.4.1-5.4.3 in item 5.4 create the following three subfolders and place the relevant files in them

5.5.1 Photo Folder (2 subfolders: 1 for problem photos, 1 for station photos)
5.5.2 Data

5.6 Under the Data folder in 5.5.2 under the Vegetation folder (5.4.1) place the following

5.6.1 Excel versions of all summary tables and CVS tables in Appendix C
5.6.2 PDFs of raw CVS data sheets

5.7 The stream (5.4.2) data (5.5.2) folder must include a folder to house each of the following:

5.7.1 Tables 5-6 (for all reaches)
5.7.2 Raw data tables and plots for cross sections and longitudinal profiles
5.7.3 Any River Morph Files with csv, txt, or EXCEL spreadsheet outputs
5.7.4 Any stream gauge hydrographs (USGS proxy or site transducer) and raw data files.
5.7.5 Any modeling files (e.g. HEC-RAS) not submitted with the restoration plan

5.8 The wetland data must include any raw precipitation and hydrology plots from the pre-construction phase not acquired during the restoration plan submittal.

5.9 Permits: PDFs of any permits acquired during design development and any associated correspondence.

6.0 References

USACOE (2003) *Stream Mitigation Guidelines*. USACOE, NCDENR-DWQ, USEPA, NCWRC,

USACOE (1987) *Corps of Engineers Wetlands Delineation Manual*. Tech report Y-87-1. AD/A176

Rosgen, D L. (1996) *Applied River Morphology*. Wildland Hydrology Books, Pagosa Springs, CO.

Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (http://cvs.bio.unc.edu/methods.htm).

APPENDIX A
General Tables and Figures

Vicinity Maps and General Site Maps
Project Component/Asset Maps (Exhibit Below)
Other Site Maps (e.g. Soil Map)
Tables 1 - 4

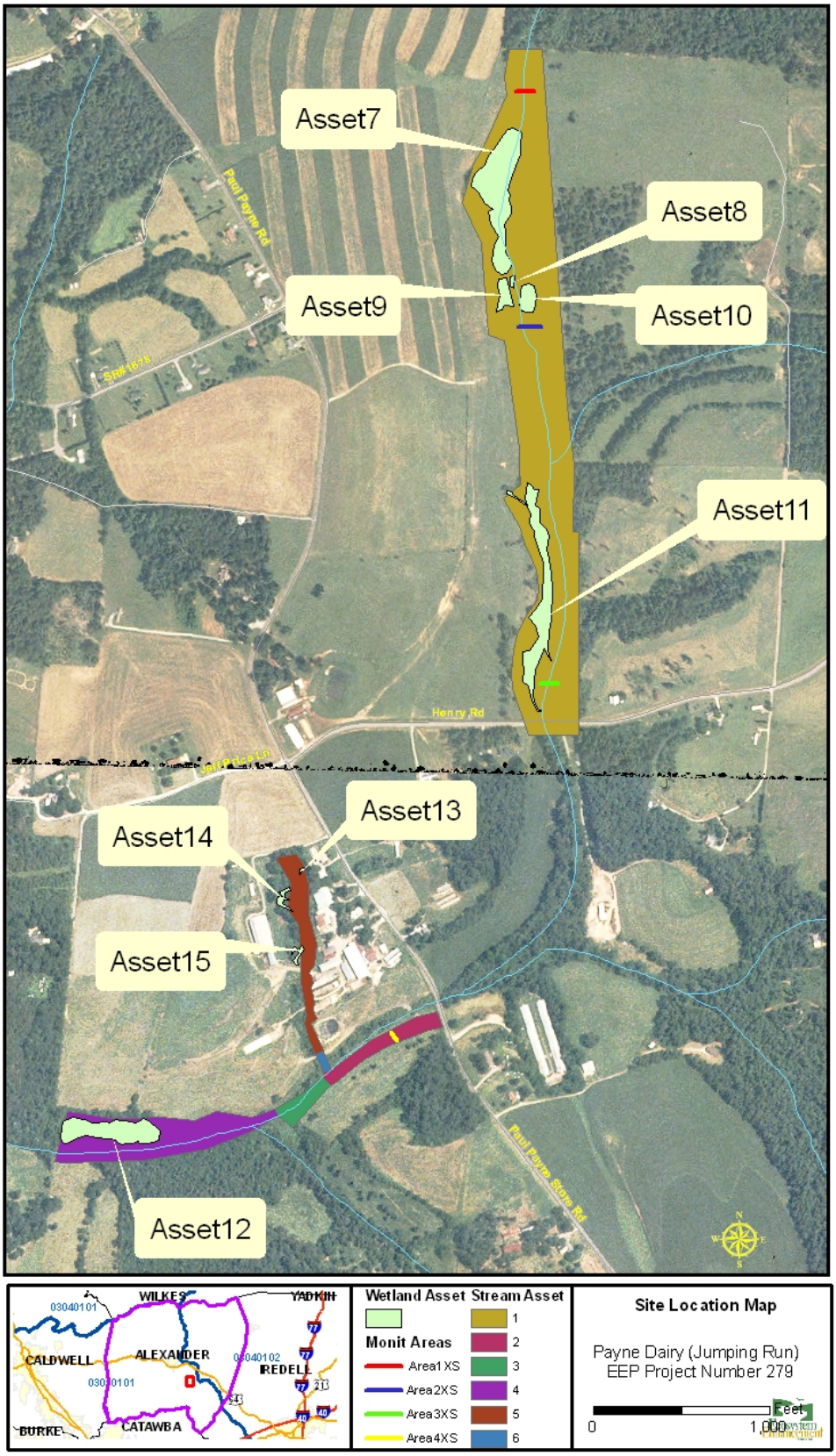


Exhibit Figure 1. Combination vicinity and restoration component/asset map. Just an example, a second figure at another scale may be needed/advisable.

Table 1. Project Components and Mitigation Credits
Project Name/Number

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals									

Project Components

Project Component -or- Reach ID	Stationing/Location	Existing Footage/Acreage	Approach (PI, PII etc.)	Restoration -or- Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration						
Enhancement						
Enhancement I						
Enhancement II						
Creation						
Preservation						
High Quality Preservation						

BMP Elements

Element	Location	Purpose/Function	Notes

BMP Elements
BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond; FS = Filter Strip; S = Grassed Swale; LS = Level Spreader; NI = Natural Infiltration Area; FB = Forested Buffer

Table 2. Project Activity and Reporting History Project Name/Number (XYZ)		
Activity or Report	**Data Collection Complete**	**Completion or Delivery**
Mitigation Plan	June 2001	Dec 2001
Final Design – Construction Plans	NA	May 2002
Construction	NA	July 2002
Temporary S&E mix applied to entire project area	NA	Aug 2002
Permanent seed mix applied to reach/segments 1& 2	NA	Aug 2002
Containerized and B&B plantings for reach/segments 1&2	NA	Sep 2002
Baseline Monitoring Document (Year 0 Monitoring – baseline)	Oct 2002	Dec 2002
Year 1 monitoring	Nov 2003	Jan 2004
Year 2 Monitoring	Sep 2004	Feb 2005
Structural maintenance (bench expansion, vane) Reach 1	NA	July 2005
Year 3 Monitoring	Dec 2005	March 2006
Supplemental planting of containerized material reach/segment 1	NA	
Year 4 Monitoring		
Etc.		

Bolded items represent those events or deliverables that are variable. Non-bolded items represent events that are standard components over the course of a typical project. Be advised that these are obviously not the extent of potential relevant project activities, but are just provided for example as part of this exhibit.

Table 3. Project Contact Table Project Name/Number (XYZ)	
Designer Primary project design POC	Firm Information / Address POC name and phone
Construction Contractor Construction contractor POC	Firm Information / Address POC name and phone
Planting Contractor Planting contractor POC	Firm Information / Address POC name and phone
Seeding Contractor Planting contractor point of contact	Company Information / Address POC name and phone
Seed Mix Sources	Company and Contact Phone
Nursery Stock Suppliers	Company and Contact Phone
Monitoring Performers	Firm Information / Address
Stream Monitoring POC	POC name and phone
Vegetation Monitoring POC	POC name and phone
Wetland Monitoring POC	POC name and phone

Table 4. Project Baseline Information and Attributes

Project Information			
Project Name			
County			
Project Area (acres)			
Project Coordinates (latitude and longitude)			
Project Watershed Summary Information			
Physiographic Province			
River Basin			
USGS Hydrologic Unit 8-digit		USGS Hydrologic Unit 14-digit	
DWQ Sub-basin			
Project Drainage Area (acres)			
Project Drainage Area Percentage of Impervious Area			
CGIA Land Use Classification			
Reach Summary Information			
Parameters	**Reach 1**	**Reach 2**	**Reach 3**
Length of reach (linear feet)			
Valley classification			
Drainage area (acres)			
NCDWQ stream identification score			
NCDWQ Water Quality Classification			
Morphological Description (stream type)			
Evolutionary trend			
Underlying mapped soils			
Drainage class			
Soil Hydric status			
Slope			
FEMA classification			
Native vegetation community			
Percent composition of exotic invasive vegetation			
Wetland Summary Information			
Parameters	**Wetland 1**	**Wetland 2**	**Wetland 3**
Size of Wetland (acres)			
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)			
Mapped Soil Series			
Drainage class			
Soil Hydric Status			
Source of Hydrology			
Hydrologic Impairment			
Native vegetation community			
Percent composition of exotic invasive vegetation			

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404			
Waters of the United States – Section 401			
Endangered Species Act			
Historic Preservation Act			
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)			
FEMA Floodplain Compliance			
Essential Fisheries Habitat			

APPENDIX B

Morphological Summary Data and Plots

Tables 5 - 6

Longitudinal Plots

XS-Plots

Exhibit Table 5. Baseline Stream Data Summary
Project Name/Number (XYZ) - Segment/Reach: XYZ (4500 feet)

Parameter	Gauge[3]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			As-built / Baseline					
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)																									
Floodprone Width (ft)																									
Bankfull Mean Depth (ft)																									
[1]Bankfull Max Depth (ft)																									
Bankfull Cross Sectional Area (ft^2)																									
Width/Depth Ratio																									
Entrenchment Ratio																									
[1]Bank Height Ratio																									
d50 (mm)																									
Profile																									
Riffle Length (ft)																									
Riffle Slope (ft/ft)																									
Pool Length (ft)																									
Pool Max depth (ft)																									
Pool Spacing (ft)																									
[2]Pool Volume (ft^3)																									
Pattern																									
Channel Beltwidth (ft)																									
Radius of Curvature (ft)																									
Rc:Bankfull width (ft/ft)																									
Meander Wavelength (ft)																									
Meander Width Ratio																									
Substrate, bed and transport parameters																									
[4]Ri% / Ru% / P% / G% / S%																									
[4]SC% / Sa% / G% / C% / B% / Be%																									
[4]d16 / d35 / d50 / d84 / d95 / di^p / di^{sp} (mm)																									
Reach Shear Stress (competency) lb/f^2																									
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Drainage Area (SM)																									
Impervious cover estimate (%)																									
Rosgen Classification																									
Bankfull Velocity (fps)																									
Bankfull Discharge (cfs)																									
Valley length (ft)																									
Channel Thalweg length (ft)																									
Sinuosity (ft)																									
Water Surface Slope (Channel) (ft/ft)																									
BF slope (ft/ft)																									
[5]Bankfull Floodplain Area (acres)																									
[6]Proportion over wide (%)																									
[7]Entrenchment Class (ER Range)																									
[8]Incision Class (BHR Range)																									
BEHI VL% / L% / M% / H% / VH% / E%																									
Channel Stability or Habitat Metric																									
Biological or Other																									

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = Methodology should be described/cited. 3 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).
4 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; di^p = max pave, di^{sp} = max subpave Shaded cells indicate that these will typically not be filled in. 5. Utilizing survey data produce and estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope. 6 = Proportion of reach determined to be over-wide based on the visual survey using the regional curve UL for width (see monitoring methodology document -pending); 7 = Entrenchment Class (ER ranges (see monitoring methodology document -pending). 8 = Incision Class (BHR ranges - see monitoring methodology document -pending) Footnotes 6, 7, 8 involve planned pre-construction monitoring for future projects. If the referenced monitoring methodology document is not available at the time of contracting or RFP review, the provider is not expected to address these parameters.

Exhibit Table 6. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters – Cross Section)
Project Name/Number (XYZ) Segment/Reach: XYZ (4500 feet)

	Cross Section 1 (Riffle)							Cross Section 2 (Riffle)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)							Cross Section 5 (Riffle)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation[1]																																				
Bankfull Width (ft)																																				
Floodprone Width (ft)																																				
Bankfull Mean Depth (ft)																																				
Bankfull Max Depth (ft)																																				
Bankfull Cross Sectional Area (ft^2)																																				
Bankfull Width/Depth Ratio																																				
Bankfull Entrenchment Ratio																																				
Bankfull Bank Height Ratio																																				
Based on current/developing bankfull feature[2]																																				
Bankfull Width (ft)																																				
Floodprone Width (ft)																																				
Bankfull Mean Depth (ft)																																				
Bankfull Max Depth (ft)																																				
Bankfull Cross Sectional Area (ft^2)																																				
Bankfull Width/Depth Ratio																																				
Bankfull Entrenchment Ratio																																				
Bankfull Bank Height Ratio																																				
Cross Sectional Area between end pins (ft^2)																																				
d50 (mm)																																				

These cells may or may not require population in any given year. See footnote 2 below

	Cross Section 6 (Riffle)							Cross Section 7 (Pool)							Cross Section 8 (Riffle)							Cross Section 9 (Riffle)							Cross Section 10 (Pool)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)																																				
Floodprone Width (ft)																																				
Bankfull Mean Depth (ft)																																				
Bankfull Max Depth (ft)																																				
Bankfull Cross Sectional Area (ft^2)																																				
Bankfull Width/Depth Ratio																																				
Bankfull Entrenchment Ratio																																				
Bankfull Bank Height Ratio																																				
Based on current/developing bankfull feature[2]																																				
Bankfull Width (ft)																																				
Floodprone Width (ft)																																				
Bankfull Mean Depth (ft)																																				
Bankfull Max Depth (ft)																																				
Bankfull Cross Sectional Area (ft^2)																																				
Bankfull Width/Depth Ratio																																				
Bankfull Entrenchment Ratio																																				
Bankfull Bank Height Ratio																																				
Cross Sectional Area between end pins (ft^2)																																				
d50 (mm)																																				

1 = Widths and depths for each resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development. 2 = Based on the elevation of any dominant depositional feature that develops and is observed at the time of survey. If the baseline datum remains the only significant depositional feature then these two sets of dimensional parameters will be equal, however, if another depositional feature of significance develops above or below the baseline, bankfull datum then this should be tracked and quantified in these cells.

0-YEAR, 2005 SURVEY DATA

FEATURE/FACET SLOPE LENGTH, AND SPACING AND LONGITUDINAL PROFILE DATA

TASK LONGITUDINAL PROFILE
REACH UPPER
DATE 5/9/2006 to 5/12/2006
CREW

Overall water surface slope =	0.2%
WS sta. start =	0.00 ft
WS sta. end =	1382.55 ft
ELEV. Start =	1035.97 ft msl
ELEV. End =	1032.63 ft msl

	DESIGN	MIN.	MAX.
Riffle	0.2%	0.4%
Run	---	---
p-p spacing	95	224

	n =	MIN.	MEDIAN.	AVG.	MAX.
Riffle slopes measured =	15	-0.1%	0.5%	1.4%	9.5%
Run slopes measured =	15	-0.3%	0.2%	0.5%	4.9%
Pools measured =	15	20	112	98	151

All data reported in units of **feet** unless otherwise specified. Elevation data is presented in feet mean sea level.

Feature	Start sta.	End sta.	Length	WS El. Start	WS El. End	Change	Slope
Riffle	0	12	12	1035.97	1035.81	0.16	1.4%
Riffle	76	118	42	1035.75	1035.65	0.10	0.2%
Riffle	180	211	31	1035.43	1035.29	0.14	0.5%
Riffle	294	315	21	1035.17	1035.04	0.13	0.6%
Riffle	392	410	17	1034.81	1034.79	0.02	0.1%
Riffle	521	552	31	1034.76	1034.72	0.04	0.1%
Riffle	599	635	36	1034.66	1034.17	0.49	1.3%
Riffle	733	760	27	1034.15	1034.18	-0.03	-0.1%
Riffle	833	850	17	1034.17	1033.97	0.20	1.2%
Riffle	875	879	4	1033.87	1033.65	0.22	5.1%
Riffle	957	979	21	1033.55	1033.15	0.40	1.9%
Riffle	1082	1115	33	1032.76	1032.74	0.02	0.1%
Riffle	1180	1194	14	1032.64	1032.65	-0.01	-0.1%
Riffle	1285	1309	24	1032.66	1032.68	-0.02	-0.1%
Riffle	1378	1383	5	1032.63	1032.17	0.46	9.5%

n =	15	
MIN =	-0.1%	Water surface flat, difference in shot was 0.03 feet.
MEDIAN =	0.5%	
AVG. =	1.4%	
MAX =	9.5%	Structure

Feature	Start sta.	End sta.	Length	WS El. Start	WS El. End	Change	Slope
Run	12	24	12	1035.81	1035.79	0.02	0.2%
Run	118	133	16	1035.65	1035.60	0.05	0.3%
Run	211	247	36	1035.29	1035.21	0.08	0.2%
Run	315	379	64	1035.04	1034.85	0.19	0.3%
Run	410	415	5	1034.79	1034.76	0.03	0.5%
Run	552	566	14	1034.72	1034.69	0.03	0.2%
Run	635	687	52	1034.17	1034.15	0.02	0.0%
Run	760	791	31	1034.18	1034.16	0.02	0.1%
Run	850	863	14	1033.97	1033.92	0.05	0.4%
Run	879	884	5	1033.65	1033.66	-0.01	-0.3%

Example of electronic submission that was useful in providing the profile distributions. The summation of this material was then used to populate summary table 5 above

APPENDIX C

Vegetation Data
Table 7
CVS Output Tables

Table 7 Planted and Total Stem Counts (Species by Plot with Annual Means)

			Current Data (MY3 2009)								Annual Means							
	Common Name	Type	Plot 1		Plot 2		Plot 3		Plot 4		Current Mean		MY2 (2008)		MY1 (2007)		AB (2006)	
			P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T
Alnus serrulata																		
Aronia arbutifolia																		
Baccharis halimifolia																		
Betula nigra																		
Cornus amomum																		
Diospyros virginiana																		
Nyssa sylvatica																		
Pinus taeda																		
Quercus laurifolia																		
Quercus michauxii																		
Quercus phellos																		
Salix nigra																		
Sambucus canadensis																		
Morella cerifera																		
Hamamelis virginiana																		
Liriodendron tulipifera																		
Unknown																		
		Plot area (acres)																
		Species count																
		Stem Count																
		Stems per Acre																

Type = Shrub or Tree
P = Planted
T = Total
L = Livestake

APPENDIX D

As-Built Plan Sheets

As-built/Record Drawings Template for EEP Projects

The as-built/record drawings are now considered as one submittal that combines the relevant design construction sheets, as-builts survey and mark-ups. The as-builts survey, which is submitted by the primary contractor to the designer must bear a PLS seal. The mark-up drawings, which are synthesized by the designer after importing the as-builts layers on top of the design layers, must bear the designer's P.E. seal.

The as-built/record drawings are submitted to satisfy the following requirements:

1. State Construction Office: SCO requires that 2 hard copies and 1 electronic copy of record drawings/as-builts be submitted as part of project completion. Please refer to General Conditions for more information.
2. EEP Design and Construction Unit: Design Construction Unit assessment and verification that the project was built according to grade within the specified tolerances.
3. EEP Monitoring Unit: Monitoring Unit will consider this submittal as baseline monitoring for the ensuing 5-year monitoring period. See the As-built Section of the most recent As-built/Mitigation template.

Number of Draft Copies:

Three hard copies of the as-built/record drawings must be submitted for review.

Number of Final Copies:

Format	SCO	EEP	Total
Hard Copy	2	1	3
Electronic (PDF)	1	1	2
Hard Copy with Baseline Monitoring Documents		3	3
CAD/Microstation/GIS		1	1

NOTE: Designer must submit final copies to SCO directly upon EEP approving the record drawings.

Time of Submittal:

Data collected for as-built survey must be prepared within 60 days after project completion or project. The SCO deliverable must be submitted within the 60-day period after project completion. See transition document

Format:

For electronic drawing formatting, please refer to *Format, Data Requirements, and Content Guidance for Electronic Drawings Submitted to EEP, March, 2008* on the EEP website.

For feature details, please refer to As-built Section of the most recent Baseline Monitoring Document template. The as-built/record drawings must consist of the following sheets:

Sheet 1 or Title Sheet:

A. Name of project and county
B. EEP agency
C. EEP Project's name
D. Review coordinator's name
E. Latitude and Longitude at upstream start of the project (STA 0+00)
F. Vicinity location map
G. Index of sheets
H. Firm name and project manager contact information
I. P.E. seal on title page and every page, except the surveyed as-builts (Sheets 5A, 5B, etc.), which are submitted by the contractor. The as-builts sheets submitted by the contractor must bear his PLS seal.

Sheet 2:

A. Legend and Symbols
B. Abbreviations
C. Any special notes on changes (e.g., dropping reaches, rock encounters, etc.)

Sheet 3, "Key sheet":

Sheet 4A, 4B, etc.:

A. Plan view construction sheets from the final construction sheets including addendum changes at the time of bid opening.
B. Profiles and cross sections of plan corresponding to plan sheets above.

Sheet 5A, 5B, etc.:

A. As-builts plan view survey results for features surveyed in accordance with the Special Provisions in the Project Manual. The contractor's PLS seal must be included on this sheet.
B. As-builts cross-sections and profile views. The contractor's PLS seal must be included on this sheet

Sheets 6A, 6B, etc:

A. Plan View showing both the design layer (Sheet 4) and as-built later (Sheet 5). Both layers must be distinguished by making the design layer a background feature and as-builts as foreground features. Changes must be marked and annotated in red.
B. Profile view and cross-sections of both design and as-built layers.

Other sheets: As necessary