North Carolina Department of Environmental Quality

Division of Mitigation Services

Stream and Wetland Mitigation Plan Template and Guidance

June 2017

Applicability

This Mitigation Plan Template is intended for use on all projects that provide stream and wetland mitigation credits for the NCDEQ Division of Mitigation Services (DMS). This template is intended to provide structure and standardization, but does not prevent the inclusion of additional information considered appropriate by the mitigation service provider. All stream and wetland mitigation projects are expected to conform to the guidelines of the USACE 2003 or the most recent Stream Mitigation Guidelines and the Compensatory Mitigation for Losses of Aquatic Resources; Final Rule (2008).

General Formatting

The report must be printed double sided on 8.5" x 11" paper.

Maps, tables and other graphics may be 11" x 17" and single sided.

Maps must always include title, scale, north arrow and legend.

Maps and tables related to discussions must be inserted into the narrative after and as close to the text that introduces them as is practical. Supplementary maps, tables and/or other material not directly relevant to the narrative should be included in the appendix.

Reports must have standard footers including the project name, DMS project number, submittal date and page number. All data must show units of measurement.

Generally, an 11 or 12 point font size is preferred for narratives; font sizes for tables, graphs and other figures should be no smaller than 9 pt.

Electronic files in Adobe PDF format must be submitted on compact disc [digital submission instructions]. Upon final approval of the project mitigation plan, submit a CD with final hardcopies that includes the following:

- PDFs of all applicable permits and related correspondence
- All required spreadsheets or files associated with physical, chemical or biological measurements or assessments (e.g. morphology, hydrology, substrate,) see formats here >> DMS Mitigation Plan Tables Excel workbook Mecklenburg Spreadsheet tool may be used for morphological data if preferable
- Any additional pre-monitoring data, e.g., water quality measurements or assessments
- Existing condition photos

Approach

The DMS approach to mitigation is intended to integrate sound science and engineering principles within a cost-effective project to optimize ecosystem uplift. The mitigation plan is intended to logically inform DMS and the Interagency Review Team (IRT) of the restoration process as it applies to all components in the waterfall model illustrated below. Each component of the waterfall model informs and describes subsequent levels to demonstrate restoration need, constraints, potential and success. These components are outlined in more detail in the Outline of Contents.

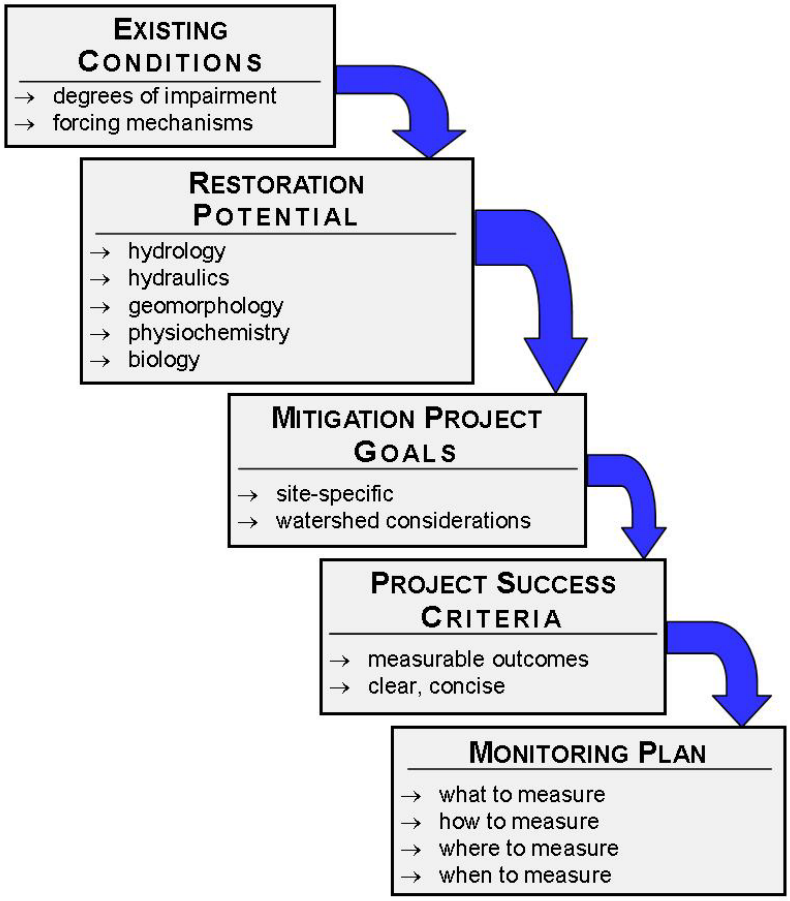

Figure 1: Waterfall Model for Stream and Wetland Mitigation. The waterfall represents the basic elements required for considering functional uplift potential and mitigation planning.

DMS requires structured analyses of functional uplift potential and anticipated outcomes. DMS recognizes the functional pyramid (Harman et al 2012) and functional objectives described by Fischenich (2006) as effective organizational tools for conducting analysis of stream and wetland systems; however, alternative approaches are encouraged. We encourage mitigation service providers (providers) to examine the processes and functions within a proposed project area to determine the maximum uplift potential given the specific conditions and constraints in the watershed and within the project boundaries. Additional resources can be found in the References Cited section.

Providers are responsible for addressing and integrating all of the waterfall concepts into the mitigation plan. As memorialized by contract, providers understand their responsibilities for producing mitigation plans that receive approval from the IRT. This document provides basic considerations for DMS projects. The intent is to allow experienced professionals to apply their judgment to develop and implement mitigation plans that will address identified goals and objectives and will demonstrate project results.

As with all other aspects of compensatory mitigation projects, DMS subscribes to two basic tenets for wetland and stream mitigation:

- The North Carolina Division of Mitigation Services (DMS) affirmatively supports innovation, sound science, and cost-efficient improvements to all aspects of mitigation;
- All work must be in accordance with applicable federal and state regulations.

As stated above, the applicable regulatory guidance for stream and wetland mitigation remains the 2003 (or most recent) USACE Stream Mitigation Guidelines. Mitigation must also comply with the 2008 Federal Mitigation Rule (33 CFR Parts 325 and 332). Should any apparent contradictions arise between this DMS document and/or the 2003 Stream Mitigation Guidelines and the 2008 rule, the USACE/federal documents shall prevail.

Required Documentation

Most of the information provided in a mitigation plan to justify and support the project is at the discretion of the provider and must reflect the complexity of the project. Providers should be aware that all mitigation plans should demonstrate an understanding of the project site, issues that need consideration, forcing mechanisms, and appropriate actions to reach the desired uplift. Mitigation plans that do not provide enough detail to demonstrate the rationale behind the design and/or support a successful project may be deemed incomplete and more information may be required by DMS before approval.

While the primary purpose of this document is to provide guidance for mitigation plans, some documentation is mandatory for every mitigation plan (Table 1).

Table 1: Mitigation Plan Mandatory Items

Cover Page Information
Project Introduction Information
Project Asset table
Project Asset Map
Project Attribute table
Essential Morphology Parameters table
Stream XS Data and plots
GW and Precipitation Data (wetland pre-construction hydroperiods)
Watershed Approach and Site Selection (referenced to watershed plans)
Stream Morphology Table (in Data Appendix 2)
If applicable, a map of all proposed stream and wetland impacts that will be part of the project and associated 404/401 permitting.
All appendix items (Appendices 1-12)

Outline of Contents

COVER PAGE

MITIGATION PLAN, Project Name, County, North Carolina
Draft or Final status
DMS Project Identification Number and Contract Number.
River Basin, Cataloging Unit
USACE Action ID Number
State Construction Project ID or RFP Number as applicable
Prepared for:
NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652
Month Year

Provide name (s) of contributing staff, and consultant statement below.

"This mitigation plan has been written in conformance with the requirements of the following:

- Federal rule for compensatory mitigation project sites as described in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.8 paragraphs (c)(2) through (c)(14).
- NCDEQ Division of Mitigation Services In-Lieu Fee Instrument signed and dated July 28, 2010

These documents govern NCDMS operations and procedures for the delivery of compensatory mitigation."

PROJECT INTRODUCTION

Broadly describe the project including name, location, latitude/longitude, existing linear footage and/or acreage, River Basin, HUC, and EPA level IV ecoregion and/or physiographic region.

Briefly state the anticipated outcomes of the project.

Provide the total amount of mitigation units expected from the project.

WATERSHED APPROACH AND SITE SELECTION

Describe connections to DMS River Basin Restoration Priorities, DMS Watershed Plans and/or other watershed evaluations. The goals of the project should be linked to the Compensation Planning Framework (CPF) at the highest resolution plan available and should advance the improvement of identified issues. Site selection is expected to support the watershed approach as outlined in the CPF and emphasized in the federal rule.

Provide a project watershed map with watershed planning priority boundaries (e.g., Local Watershed Plan, Targeted Local Watershed, Targeted Resource Area, Regional Watershed Plan) as applicable, and easement boundaries.

BASELINE AND EXISTING CONDITIONS

This section applies to regional, watershed and local conditions as they apply to the current condition of the site. DMS encourages providers to consider spatial and temporal variability of the hydrologic and geomorphic processes related to streams and wetlands. Consideration for the complexities of ecosystems and watershed processes should be incorporated into the analysis of current condition and then used to inform the structured analyses for restoration potential. *Analyses do not need to be exhaustive or comprehensive if extensive details are not needed. Analyses should be completed to the extent necessary to explain how and why the proposed project activities will result in meaningful and sustained ecosystem improvements.*

Watershed Processes and Resource Conditions

Describe/analyze watershed processes, land use and resource conditions. This section provides the opportunity to describe the linkages between landscape controls, land use activity, current condition and geomorphic processes. Use this section to scale from regional to site specific uses and conditions within the context described below. Methods of analysis should recognize natural landscape variability, scale and resolution. The order of the subtopics listed below does not necessarily represent the only approach for organizing descriptions of watershed process and condition, although each subtopic does represent components of process and current condition that may be critical to the project area.

Be attentive to sampling design in assessment of watershed process and current condition. Sampling design for understanding rates and magnitudes of processes should consider the application of the data in the assessment and monitoring phases of the project to best demonstrate success. Sampling design must capture the variability of the site.

Landscape Characteristics

Describe the temporal and spatial landscape variables that control past and present landscape processes. Specifically, describe the landscape setting in terms of geology, topography and landforms, vegetation, soils, hydrology and hydrologic connections. This section should address overall conditions as well as local conditions by answering the questions below as applicable. The level of detail and extent of information should be limited to that which is relevant to the project area and site activities.

How do geologic structure and lithology influence the landscape?

How does the hydrologic regime relate to stream condition and function, e.g., discharge and flow frequency?

For wetland sites, how does the landscape position relate to sources of hydrology?

Generally, what kind of vegetation and habitat would be expected to be present prior to disturbance?

Considerations for this section may include but are not limited to the list below.

Geology (local, regional)	Channel gradient
Bedrock structure	Channel substrate
Topography	Alluvial/colluvial material
Relief	Floodplain and/or terraces
Precipitation	Floodplain and bank materials
Drainage density and pattern	Wetland hydrology
Valley confinement	Vegetation
Valley slope	Sediment production and delivery to streams
Channel hydrology	Sediment routing
Contributing drainage area	Watershed and/or valley aspect
Habitat type	Surface water/groundwater interactions
Soils	

Use maps and/or tables with captions as appropriate to illustrate the major points [link to examples].

Land Use / Land Cover, Impacts, Historic, Current and Future

Describe current and historic land use as relevant to present and anticipated site conditions. Provide explanation of land use/land cover changes and expectations of future changes and if applicable, how these changes will influence project design.

Considerations for this section include but are not limited to the list below.

Wetland ditching and/or filling	Roads/Bridges/Culverts
Historic Wetlands	Drain tiles
Channel relocation	Field crowning
Channel straightening	Public water supply
Agriculture	Impoundments
Grazing	Impoundment removal
Development	Timber harvest
Legacy sediments	Zoning/population growth
	Utility Easements

Use maps, tables and/or narratives to illustrate the major points.

Watershed Disturbance and Response

This section serves as the baseline condition at the project and watershed scales and as an opportunity to link disturbance and response to functional loss. This section also provides the foundation for mitigation activities by providing quantitative and/or qualitative support for restoration potential, project goals and objectives, performance standards and monitoring protocols.

Describe the temporal and spatial watershed process changes that have occurred as a result of landscape changes and land use practices. Describe the temporal and spatial stream and/or wetland response to changes as they relate to physical and biological processes, and aquatic resources (Montgomery and Bolton 2003). Include all that apply relating to soils, hydrology, hydraulics, geomorphology, physicochemical and biology. Descriptions should reflect the intensity, duration and extent of disturbance and/or process changes.

Provide site/reach specific information regarding sediment and pollutant sources, sinks and forcing mechanisms. Provide data and analysis at the relevant scales to demonstrate the magnitude of impairments, process change and response when applicable. DMS strongly encourages direct measurement or at least cataloging of parameters, e.g., bank erosion, habitat features.

Demonstrate resource conditions with maps and tables, (e.g., channel classification map, channel slope maps, channel evolution map (Simon 1989), habitat maps, point and nonpoint erosion source and deposition maps, facies mapping, process links to functional loss (example in Skidmore et al. 2011). Some suggested exhibits can be found at this link [examples].

FUNCTIONAL UPLIFT POTENTIAL

Given the watershed current and projected future processes and conditions, provide a narrative with tables and figures to describe the uplift potential for the project area.

Describe the highest practical potential functional uplift based on the hydrology, hydraulics, geomorphology, physicochemical, and biological hierarchy (guidance found in Harman et al 2012). The determination of maximum, practical potential includes consideration of any constraints such as land use, watershed condition, landscape variables, infrastructure and/or cost that preclude reaching higher levels of functional uplift. Provide thorough and thoughtful discussion of on-site and off-site conditions that influence uplift opportunities.

Compare/contrast existing conditions to the target potential of higher function.

Conduct and describe alternatives analysis to support design treatments and the proposed level of treatment.

Reference and/or include available data and resources used to inform functional uplift opportunities, constraints and optimization, e.g., gauging stations, biological inventories, floodplain analysis.

This section should be linked to the above watershed assessment and should answer the following questions if applicable:

> What resources will be addressed, what resources will not be addressed and why?
>
> What are the natural and anthropogenic constraints within the project area and/or watershed that limit or maximize the uplift potential?
>
> What is the anticipated growth or build-out that may limit success?
>
> What is the maximum uplift that will be achieved given landscape, current conditions and constraints?

MITIGATION PROJECT GOALS AND OBJECTIVES

Goals and objectives arise from the analysis of restoration potential within the context of regulatory imperatives. Goals are broad statements of what is to be accomplished and should be consistent with identified watershed priorities as supported by DMS plans and/or other watershed evaluations. Objectives represent a step toward accomplishing a goal. In contrast to the goal, an objective is narrow, precise, tangible, concrete, and measureable. Mitigation project objectives determine performance standards and should represent measureable site level actions.

List and qualify the goals and objectives of the project. Goals and objectives must link to resource condition, functional uplift opportunities and optimization, performance standards and monitoring. Objectives must be clearly stated and must be measureable to show success. Project objectives are not to be confused with project benefits, and objectives should be specifically articulated to illustrate a measureable outcome. Each project objective should have a corresponding performance standard and monitoring parameter(s).

Benefits of the project can be included in the narrative to support the project goals, objectives and the uplift potential or may be included in the introduction section.

DESIGN APPROACH AND MITIGATION WORK PLAN

This section should be used to explain the mitigation approach, proposed uplift activities and rationale. Address the relevant issues specific to the project.

DMS recognizes three primary approaches to stream and wetland restoration including analytical, analog and empirical as described by Skidmore et al. (2001). Providers are not limited by these approaches. DMS supports combined, hybrid and/or alternative approaches, especially the use of analytical tools for refinement and verification when empirical generalizations are used. Providers are encouraged to use the best approach or combination of approaches as dictated by the project needs and restoration potential.

Provide project asset table (in workbook) and asset map (example map). NOTE: existing and proposed monitoring features may be included on the asset map for efficiency if preferable. Provide narrative of determination of credits if needed to justify or explain deviations from standard ratios and/or credits related to BMPs and other nontraditional mitigation strategies.

Describe approach and methods for determination of design criteria. State why specific models and/or methods were chosen for use.

Support approach by including design discharge and analyses, water budgets, sediment budgets (qualitative or quantitative), sediment transport and routing analysis, and morphologic parameters.

Describe rationale for proposed wetland hydroperiod, hydrologic budgets and model results for analytical tools utilized. Provide relevant information and input parameters to support methods and results.

If reference streams will be used, provide the location and qualifications for reference stream selection in terms of similarity in landscape controls, inputs and watershed

history. If reference wetlands are used, provide all applicable information relating to location, hydrology, hydroperiod, soils, landscape positions, and gauge locations.

All reference streams and wetlands must demonstrate similar landscape characteristics and processes as the project stream or wetland. In most cases, this means reference streams are within the same Level IV ecoregion, geology, landscape position as the project site.

Include design descriptions by reach and/or wetland area (narrative and/or a table). If using reference sites, provide a table comparing existing, reference and proposed parameters. If reference sites are not used, provide a table comparing existing and proposed parameters.

A morphological parameter table is useful for supporting approach and design concepts. DMS prefers a table illustrating the primary variables needed to demonstrate the design as shown here [link to workbook]. If the provider chooses to include the traditional "morph table", please provide a digital copy as part of the digital submission and include as an appendix.

Describe the use of BMPs, their purpose and need, locations and any mitigation credit strategy.

Describe or quantify expected short-term and long-term response (rates, duration and direction) to treatments for all that apply to the project (e.g., bank stability/erosion, wetland hydrology, habitat, riparian function, vegetative succession).

Work plans should detail the proposed construction methods including timing and sequence and will provide elevations of all pertinent features such as water bodies and conveyances, landforms (existing and proposed) and strata interfaces. The work plan will also include a site grading plan and details for sediment and erosion control measures.

Provide a statement identifying risks or uncertainties. Describe the range of uncertainty in terms of estimated magnitude and direction as needed. Examples include but are not limited to legacy sediment constraints, hydrologic trespass, land use/build out and/or easement restrictions.

Vegetation and Planting Plan: The planting plan for each mitigation project should advance project objectives and increase the likelihood that vegetation performance standards will be met.

Current USACE 2003 guidelines require levels of woody stem survival throughout the monitoring period with year 5 final survival rate of 260 stems/acres.

DMS encourages innovative planting plans and schedules that advance survival and structural success during and after the monitoring period.

DMS strongly recommends the use of early successional species.

DMS does not generally endorse attempts to eradicate invasive species and discourages eradication as a performance standard since it will likely fail.

Atypical planting schedules that promote the likelihood of success are encouraged. However, any schedule that may impact monitoring results must be explained in the mitigation plan

Describe the objectives of the vegetation plan and how the vegetation plan will support project success.

Describe vegetation planting plan to include species list, site preparation, planting density, planting method and material specifications. Vegetation design choices should be tied directly to objectives and expected outcomes.

Include all planting components listed below as applicable.

Objectives
Planting Zones
Planting Acres
Species List
Site Preparation
Materials and Methods
Management Plan
Competition Control (native and nonnative)
Stabilization Plan

PERFORMANCE STANDARDS

Clearly state each criterion and/or standard to be used to determine project success.

Describe methodology, data and/or other information to show how the performance standard will be used for analysis and interpretation to determine success.

Illustrate how each performance standard is measureable and linked to objectives.

Modifications to the approved performance standards may only be made in accordance with an implemented Adaptive Management Plan or in cases of natural disaster.

MONITORING PLAN

Illustrate the measurable connection between objectives, performance standards and monitoring. Use tables, figures, and narrative as needed (example Table 1).

Specifically include:

- what will be measured
- how will measurements be taken (methods)
- when will measurements be taken (schedule)
- where will measurements be taken
- map illustrating pre and post construction monitoring features (monitoring features may be added to the asset map).

Strong consideration should be given to measuring those parameters identified in the existing condition assessment to demonstrate specific functional uplift from the project activities. For example exhibits follow this link.

Table 1: Example of Linkage between treatment, goals, monitoring and outcome:

Goal	Treatment	Performance standards	Monitoring metric	Outcome	Likely Functional Uplift
Increase number and diversity of bedforms for instream habitat.	Installation of wood structures to force pools and riffles, and facilitate backwater areas.	Bedform diversity increase by x % over pre-restoration condition.	Inventory of pools, riffles and backwater areas (sample reaches) and % change from pre-construction.	Bedform number and diversity exceeded performance standards (x+n %).	Increased woody structure in stream, increased organic matter (biogeochemical cycling), increased refugia, benthic abundance and diversity, fish habitat.

ADAPTIVE MANANGEMENT PLAN

An adaptive management plan is a requirement for a complete mitigation plan (33 CFR 332.4(c) (1) (iii) (12)). A procedural statement will generally be sufficient in a mitigation plan:

"In the event the mitigation site or a specific component of the mitigation site fails to achieve the necessary performance standards as specified in the mitigation plan, the sponsor shall notify the members of the IRT and work with the IRT to develop contingency plans and remedial actions."

LONG-TERM MANAGEMENT PLAN

The following standard language may be used for the long-term management plan.

"The site will be transferred to the NCDEQ Stewardship Program *(or 3rd party if approved)*. This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the site to ensure that restrictions required in the conservation easement are upheld. Funding will be supplied by the responsible party on a yearly basis until such time an endowment is established. The NCDEQ Stewardship Program is developing an endowment system within the non-reverting, interest-bearing Conservation Lands Conservation Fund Account. The use of funds from the Endowment Account will be governed by North Carolina General Statue GS 113A-232(d)(3). Interest gained by the endowment fund may be used for the purpose of stewardship, monitoring, stewardship administration, and land transaction costs, if applicable.
The Stewardship Program will periodically install signage as needed to identify boundary markings as needed. Any livestock or associated fencing or permanent crossings will be the responsibility the owner of the underlying fee to maintain".

Include the site-protection instrument in an appendix.

Additional Easement Management: Early in the project development process (i.e., technical proposal process), providers should envision the highest and best use of the site that is fully consistent with the mitigation objectives. Consultation with the landowner and/or land managers should reveal long-term easement/buffer management options compatible with adjacent land uses and landowner preferences. These considerations will establish upfront buy-in and commitment from those individuals responsible for easement compliance and management of adjacent land. Increasing compatibility of the mitigation site with adjacent land uses will significantly increase compliance.

Mitigation objectives may be met while also utilizing other compatible land uses. Additional land uses for mitigation projects include but are not limited to hunting, fishing, wildlife viewing and wildlife management. Planting plans, species selection, planting areas and spacing, and vegetation maintenance may be adapted for the long-term management of the easement. Additional management strategies may include:

- Scheduled burning for long leaf pine management
- Limited vegetation management for fishing access
- Maintaining vegetation structure to promote edge habitat
- Maintaining vegetation for bog turtle habitat
- Locally increasing planting space for wildlife foraging
- Establishing and maintaining areas for hunting
- Management specific to parks and other recreational areas in urban settings.

If alternative management plans are proposed, clearly describe and/or explain the intent, management activity and the sustainable compatibility with the mitigation project easement. Specific implications to crediting should also be considered and documented in the mitigation plan.

REFERENCES

APPENDICES

1. Plan sheets

2. Data/analysis/supplementary information and maps

3. Site Protection Instrument

4. Credit Release Schedule

5. Financial Assurance

6. Maintenance Plan

7. DWR Stream Identification forms

   Include a summary table (example below) and/or map of DWR intermittent and perennial stream determinations. If applicable to main text, insert summary table after text, otherwise, include in appendix. Submit digital copies of the stream forms in a separate file with the digital submission.

Site number	Geomorphology Score	Hydrology Score	Biology Score	Total Score	Comments

8. USACE District assessment methods/forms (e.g., stream assessment if used) - Include a digital copy of the USACE methods/forms in a separate file the digital submission.

9. Wetland JD forms - Include the approved and signed USCAE determination pages, surveys and/or maps from the JD in the appendix. All other forms used must be submitted in a separate file with the digital submission.

10. Invasive Species (establish policy and apply to plan)

11. Approved FHWA Categorical Exclusion Form: The signed Categorical Exclusion checklist should include all of the supporting documentation that was provided to DMS to receive FHWA approval during Task I.

12. DMS Floodplain Requirements Checklist

References Cited

Beechie, T., and S. Bolton. 1999. An approach to restoring salmonid habitat-forming processes in Pacific Northwest watersheds. Fisheries 24(4):6-15.

Fischenich, J.C. (2006). Functional objectives for stream restoration. EMRRP Technical Notes Collection (ERDC TN-EMRRP-SR-52). Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Harman, W., R. Starr, M. Carter, K. Tweedy, M. Clemmons, K. Suggs, C. Miller. 2012. A function based framework for developing stream assessments, restoration goals, performance standards and standard operating procedures. U.S. Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Washington, D.C.

Montgomery D.R. and S. M. Bolton 2003. Hydrogeomorphic variability and river restoration, 39–80. © 2003 by the American Fisheries Society

Simon, Andrew 1989. A model of channel response in disturbed alluvial channels. Earth Surface Processes and Landforms. Volume 14, Issue 1, pages 11–26.

Skidmore, P.B, Shields, F., Doyle, M., and Miller, D. (2001) A Categorization of Approaches to Natural Channel Design. Wetlands Engineering & River Restoration 2001: pp. 1-12.

Skidmore, P.B., C.R. Thorne, B.L. Cluer, G.R. Pess, J.M. Castro, T.J. Beechie, and C.C. Shea. 2011. Science base and tools for evaluating stream engineering, management, and restoration proposals. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-112, 255 p.

Wohl, E., P. L. Angermeier, B. Bledsoe, G. M. Kondolf, L. MacDonnell, D. M. Merritt, M. A. Palmer, N. L. Poff, and D. Tarboton (2005), River restoration, Water Resour. Res., 41, W10301.