US Army Corps
Of Engineers ®
Nashville and Memphis Districts

Permittee-Responsible Mitigation Guidance
May 26, 2016 (Draft)

This Permittee-Responsible Mitigation (PRM) document has been developed to provide guidance on the required elements of a compensatory mitigation (CM) plan that is compliant with 33 CFR 332. This guidance document is applicable to all type of permittee-responsible compensatory mitigation, including on-site and off-site mitigation. As stated in 33 CFR 332.3(c)(3)(iii) and 230.93(c)(3)(iii), the level of information and analysis contained in a mitigation plan must be commensurate with the scope and scale of the authorized impacts and functions lost. Please provide the following information with the submittal of a permittee-responsible mitigation plan:

A. Basic Information

1. DA Permit Number: Provide the DA permit number for which PRM is proposed as well as other past or current permits from state or federal agencies.

2. Applicant. Provide contact information for the applicant, landowner(s), and agent(s).

3. Agent. Identify consultants or experts to be involved in design of the compensation site, and list their qualifications and experience in designing and implementing mitigation projects.

4. Impact Site. Identify the resource type(s) and amount(s) of waters of the U.S. to be impacted by the project for which PRM is proposed. Please specify whether impacts will be temporary or permanent. For temporary impacts, please include an estimated schedule outlining when restoration of the temporary impacts would occur.

a. List the impact site(s) location from the nearest intersection of roads. List the nearest town, county, state, HUC-8 watershed, HUC-12 watershed, EPA ecoregion (Level III) and provide the impact site(s) coordinates in decimal degrees (NAD 83) and any associated available shapefiles relating to the proposed impact site.

b. Describe and quantify the aquatic resource type and functions that will be lost at the proposed impact site (e.g. RBP score, TRAM, etc.). Please fill out applicable items 6(a), (b), (c), (d)(ii), (iv)-(vi) in the "Baseline Information" section for proposed stream relocations.

c. Describe existing aquatic resource concerns in the watershed (e.g. flood storage, water quality, habitat, etc.) and how the impact site currently contributes to overall watershed/regional functions.

B. Components of a Compensation Mitigation (CM) Plan

1. Executive Summary. Provide a brief, narrative overview of the mitigation plan (approximately one page). The narrative should summarize the amount, aquatic resource type (e.g. Cowardin, HGM, ecological, and/or Rosgen stream classification), and functional capacity of both the aquatic resources proposed for impact and those proposed to be established, restored, enhanced, or preserved in the CM plan. The narrative should also explain how the CM work would replace aquatic resource functions that would be lost as a result of the proposed project.

2. Project Goals. Describe the purpose and goals of the project. Provide a description of any physical, chemical, and/or biological degradation occurring within the proposed CM site. The purpose and goals should address improving specific physical, chemical, and/or biological functions at the proposed CM site.

3. Objectives. A description of the resource type(s) and amount(s) that will be provided, the method of compensation (*i.e.*, restoration, establishment, enhancement, and/or preservation (33 CFR 332.2)), and the manner in which the resource functions of the CM project will address the needs of the watershed, ecoregion, physiographic province, or other geographic area of interest. (33 CFR 332.4(c)(2))

a. Identify the 8-digit HUC and ecoregion (Level III) for the mitigation site. Describe how the regional proximity (8-digit HUC) and ecological similarity (ecoregion and classification) relate to the impact site.

b. Describe the objectives of the project. The objectives will be specific and quantitative.

4. Site Selection. A description of the factors considered during the site selection process. This should include consideration of watershed needs, on-site alternatives where applicable, and practicability of accomplishing ecologically self-sustaining aquatic resource restoration, establishment, enhancement, and/or preservation at the mitigation project site. (CFR 332.4(c)(3))

a. *Watershed Overview*. This section should include a description of watershed size, historic and existing land uses, sources of impairment, development trends, percent impervious surfaces, etc.

b. *Site Constraints*. Describe constraints that would limit the restoration potential of the project. This should include a description of any watershed, physical, chemical, or biological constraints that would limit upland buffer width, construction methodology, site protection, wetland function, etc. Examples of constraints include, but are not limited to: adjacent landuse, roadways, utility lines, stormwater outfalls, liens, easements, or encumbrances on the property, inability to acquire property and/or long-term protection, presence of threaten or endangered species (state and federal), and historic properties. Identify any portion of the project that would occur on public lands and the public entity that owns the land.

c. *Additional Site Selection Criteria*. List any other site selection criteria that were used to identify the proposed project. Site selection criteria could include watershed plans, State Wildlife Action Plans prepared for the watershed, plans under Section 319 Clean Water Act grants, and any other watershed scale assessments.

5. Site protection instrument. A description of the legal arrangements (e.g. conservation easement, restrictive covenant, deed restriction, etc.) and instrument including site ownership that will be used to ensure the long-term protection of the CM project site. (CFR 332.4(c)(4))

a. *Site Protection*. Provide proposed legal arrangements and instrument, including site ownership that will be used to ensure the long-term protection of the compensatory mitigation project site. The site protection mechanism must provide long-term protection of the compensatory mitigation site

and to the extent appropriate and practicable, prohibit incompatible uses that might otherwise jeopardize the objectives of the compensatory mitigation project. Prohibited uses may include but are not limited to:

- Clearing, cutting, and mowing of native vegetation;
- Earthmoving, grading, filling, topography change;
- Construction of permanent or temporary structures;
- Mining, drilling;
- Draining, diking;
- Diverting or affecting the flow of surface or subsurface waters;
- Spraying with herbicides or pesticides for reasons other than controlling invasive species;
- Grazing or use by domesticated animals;
- Use of off-road vehicles and motor vehicles; and
- Utility lines.

6. <u>Baseline information</u>. A description of the ecological characteristics of the proposed CM project site. This should include descriptions of historic and existing plant communities, historic and existing hydrology, soil conditions, a map showing the locations of the impact and mitigation site(s), the geographic coordinates for those site(s), and other characteristics appropriate to the type of resource proposed as compensation. The baseline information should include a delineation of waters of the United States on the proposed CM project site. (CFR 332.4(c)(5))

a. *Location Description*. List the project area in acres and linear feet (streams) and location from the nearest intersection of roads. List the nearest town, county, state, HUC-8 watershed, HUC-12 watershed, ecoregion (Level III) and provide project coordinates in decimal degrees (NAD 83).

b. *Maps*.

i. Provide a plat or land ownership map and digital shapefile or KMZ file.

ii. Provide a map showing the boundaries of all existing aquatic resources on the CM project site and digital shapefile or KMZ file.

iii. Provide a NRCS soil map with the boundary of the proposed CM project site.
- Include a table identifying the soil taxonomy for each soil type where proposed the CM activities will occur.

iv. Provide a National Wetlands Inventory (NWI) map with the site boundary clearly identified. See www.nwi.fws.gov for available maps.

v. Provide a USGS topographic map and a map with recent aerial imagery with the following information/layers included on each:
- Boundaries of the proposed CM site;
- Clearly identified stream reaches or wetland areas labeled by proposed mitigation approach (e.g. restoration, enhancement, establishment, preservation, etc.)
- Transportation Layer; and
-Maintained easement locations (e.g. powerline ROW, sewerline easements, pipeline easements).

c. Provide historical aerial imagery overlain with proposed CM project boundaries with at least one image per decade throughout the available period of record.

d. *Baseline Stream Assessment.*

i. *Catchment Assessment Form*. Provide a completed *Catchment Assessment Form* (Appendix A).

ii. *Existing and Proposed Reach-Level Stream Function-Based Rapid Assessment Field Data Form.* Provide at least one complete *Rapid Assessment Data Form* for each unique stream reach within the project area (Appendix B). The *Hydraulic and Geomorphic Assessment Data Form* shall be completed with each *Rapid Assessment Field Data Form* submitted (Appendix C). To delineate the unique stream reaches consider changes in gradient, Rosgen classification stream type, floodplain connectivity, lateral stability, riparian vegetation, and bedform diversity. More than one data form will often be necessary to adequately characterize the variable conditions among reaches. Complete additional forms as necessary. Refer to *A Function-Based Framework for Stream Assessments and Restoration Projects*[1] document for supporting information to completing the form.

iii. *Biological Data*. Provide information on the biological scores for the waterbodies within the project boundaries. Contact TDEC[2] to obtain any pre-existing biological scores for the waterbody at or near the proposed project reach. If this information does not exist or is determined to no longer be valid, the state may elect to evaluate the site to establish existing biological conditions. In consultation with the TDEC, the applicant may provide biological scores following the standardized protocols found in TDEC's *Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys*[3]. Depending on site conditions and proposed treatments, biological scores may be requested for each unique stream reach within the project area.

iv. *Visual Habitat Assessment*. Provide habitat assessment data sheets for each unique stream reach within the project area. These field sheets are modified from the *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers* (Barbour et. al., 1999). Choice of field data sheets (high gradient vs. low gradient) is dependent on the Level IV ecoregion and/or stream type at the sampling location. The assessor should use standardized protocols found in TDEC's *Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys*[3] to enable comparison to ecoregional reference streams that have been assessed following the same standardized procedure. (Appendix D)

v. *Site Photos*. Provide photographs of the stream reaches within the proposed project area. Provide a photograph location map that clearly identifies the location and orientation of the photographs.

vi. *Adjacent land uses surrounding the project site*. Discuss reasonable expected development for the site (if CM activities were not implemented) and the surrounding area.

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[1] Harman, W., R. Starr, M. Carter, K. Tweedy, M. Clemmons, K. Suggs, C. Miller. 2012. A Function-Based Framework for Stream Assessment and Restoration Projects. US Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Washington, DC EPA 843-K-12-006. https://streammechanics.egnyte.com/h-s/20120914/cde14b2bb9f2456d

[2] TDEC's email contact information - water.permits@tn.gov

[3] TDEC's Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys - https://www.tn.gov/assets/entities/environment/attachments/bugsop11.pdf

e. *Baseline Wetland Assessment*

i. *Wetland Size*. Acreage for the entire CM project site and the acres of existing wetlands within the project site.

ii. *Existing Hydrology*

1. Provide water budget. Include source(s) of hydrology (e.g. groundwater, overbank flooding, surface runoff) and losses(s) and/or existing hydrologic impairments (e.g. ditching, drains, levees, culverts) that contribute to the current baseline conditions. Provide water budgets for both wet and dry years.
2. Hydroperiod (seasonal depth, duration, and timing of inundation and/or saturation), percent open water.
3. Historical hydrology of mitigation site.
4. Contributing drainage area.

iii. *Existing Vegetation*

1. Map the Cowardin class of existing wetlands on the CM site.
2. Approximate percent vegetative cover, and describe the vertical structure, and dominant taxa as documented on the appropriate regional supplement[4] data sheets.
3. List any invasive plant species and absolute percent cover within each community type.

iv. *Existing Soils*

1. List Soil Mapping Units, soil profile description, including soil color, textures, and redoximorphic features (if applicable) for each proposed mitigation project area. Identify whether the soil is appropriate for the proposed CM wetland and provide a rationale.
2. If CM site is located within existing or historic farmland, describe how plow pans, field crowns, tile drainage system, etc. affect the site.

v. *Habitat Description*. Current wetland habitat Cowardin classification types (with approximate acreages) within the project site and a brief discussion of the current land use, HGM classification, and dominant plant species (by vegetative stratum) identified throughout the site.

vi. *Adjacent land uses surrounding the project site*. Discuss reasonable expected development for the site (if CM activities were not implemented) and the surrounding area.

vii. *Site Photos*. Provide photographs of the proposed project area. Provide a map that clearly identifies the location and orientation of the photographs.

viii. *Wetland Assessment.* Provide a wetland assessment that will accurately document the baseline condition and/or function of any existing wetlands on the project site and summarize the data in a table. Preferred assessment methodologies include Tennessee Rapid Assessment Methodology (TRAM), applicable Hydrogeomorphic (HGM) assessment methodology, Tennessee Valley Authority-Rapid Assessment Methodology (TVA-RAM), Floristic Quality

[4] Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region, Version 2.0 (April 2012), or Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region, Version 2.0 (November 2010).

Index, or other IRT approved assessment method. If existing conditions vary within the project area, then an assessment needs to be completed for each physiognomically or structurally differing wetland area within the project site to accurately document baseline conditions. If the TRAM is used, please contact TDEC[5] for the latest version.

f. *Additional factors to consider during baseline data collection*

i. Include relevant discussion on the presence of special biological resources and how these were evaluated (e.g., endangered species/critical habitat, special aquatic sites, etc.).

ii. Include relevant discussion on the presence of any Historic/Cultural Resources which may occur within the project site and/or within one-half mile.

iii. Include relevant discussion on the presence of on any Hazardous/Toxic Waste issues that may exist on the site.

7. <u>Determination of credits</u>. A description of the number of credits to be provided including a brief explanation of the rationale for this determination. (CFR 332.4(c)(6))

a. This should include an explanation of how the mitigation project will provide the required compensation for unavoidable impacts to aquatic resources resulting from the permitted activity.

b. Stream Mitigation

i. *Mitigation Approach*. Provide a list of stream reaches that will receive mitigation treatments (establishment, restoration, enhancement, preservation – list separately). This description should be accompanied by a list presented in a table and organized by stream reach, length, proposed mitigation approach, and proposed mitigation ratio.

ii. *Functional Lift*. How the proposed project will increase specific stream functions above the pre-project levels. Use the information collected in the Rapid Stream Assessment Data Form to describe how the proposed project will improve stream functions within each reach. Identify stream reference reach(es) and provide a brief description of the reach(es).

c. Wetland Mitigation

i. *Mitigation Approach*. Describe the proposed mitigation approach for each area within the project site that will be considered in the mitigation plan (establishment, restoration, enhancement, preservation – list separately). This description should be accompanied by a list presented in a table and organized by proposed mitigation approach, type, and area.

ii. *Functional Lift*. Identify the projected increase in specific wetland functions above the baseline levels. Use the information collected during the baseline assessment to describe how the proposed project will improve wetland functions within each area. Provide the projected assessment scores in a table. Describe the target wetland Cowardin, HGM, and ecological classification[6]. Describe slope, size, and physiognomy of the upland buffer within the project site.

[5] TDEC's email contact information - water.permits@tn.gov

[6] NatureServe and Tennessee Department of Environment and Conservation. 2016. Tennessee Wetlands: Ecological Reference Wetland Classification and Associated Hydrogeomorphology. Manuscript in preparation.

Natureserve. 2016. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.0. NatureServe, Arlington, VA. U.S.A. http://explorer.natureserve.org

iii. Identify a reference site of the same HGM class and provide a brief description of the site (HGM class, dominant species, ecological classification, soil description, watershed size, site coordinates, etc.)

8. **Mitigation work plan**. Detailed written specifications and work descriptions for the CM project, including, but not limited to, the geographic boundaries of the project; construction methods, timing, and sequence. (CFR 332.4(c)(7))

a. General Work Plan Considerations

i. *Soil Compaction.* If soil compaction and/or nutrient incompatibilities were identified as potential problems during baseline data collection, or if mass grading is planned for the proposed mitigation area(s), describe how soil compaction, loss of soil fertility, changes in soil character, (e.g. removing the surface soil horizons), etc. will be addressed (e.g. disking/topsoil management, soil amendments, mulching, addition of large woody debris) in the proposed wetland and/or stream buffer mitigation work plan.

ii. *Species Composition*. Describe how richness and density of species within the reference target has been considered in the plan.

iii. *Species Selection*. Describe how each wetland / upland or riparian buffer zone will be planted with suitable native plant species.

iv. *Soil Suitability*. Describe the soil fertility and soil chemistry suitable for the CM wetland site.

v. *Land Disturbance*. Describe the extent of grading necessary to accomplish the goals of the proposed CM. If applicable, describe where excess fill material will be placed. Describe how the topsoil will be managed during grading activities.

b. Stream Mitigation

i. The mitigation plan must describe:

1. Hydraulic assessments that were performed (stream velocity, shear stress and stream power shown in relation to stage and discharge);
2. Identification and verification of bankfull (were USGS gages or regional curves used to corroborate bankfull discharge and cross-sectional area); and
3. Sediment transport analysis (if necessary).

ii. The mitigation work plan should include information such as planform geometry, channel form (e.g., typical channel cross-sections), typical drawings of in-stream structures, riparian area plantings, and plans to control invasive plant species.

iii. *Work Approach*. Description of planned mitigation approach for each stream reach.

c. Wetland Mitigation

i. The mitigation work plan should include information such as anticipated source(s) of hydrology; methods for establishing the desired plant community; plans to control invasive plant species; proposed grading plan; soil management; and erosion control measures.

ii. *Land Management*. Describe proposed land management actions required to achieve the target ecological and Cowardin systems. Discuss any potential challenges that may affect the proposal as it is currently presented (e.g. karst topography, trespassing beavers, invasive species, etc.) and proposed solutions.

iii. *Unique Biological/Ecological Resources*. Include relevant discussion on the presence of special resources (e.g., endangered species/critical habitat, special aquatic sites, etc.).

iv. *Reference Site*. Provide the reference site or sites of the same HGM class and ecoregion (Level III) and provide a brief description of the site (HGM class, vegetation, soil description, watershed size, site coordinates, etc.).
v. *Work Approach*. Description of planned mitigation approach for mitigation site.

d. Planted Vegetation Stream/Wetland
i. *Planting List.* Provide a planting list spreadsheet to include common name, scientific name, seedling/sapling size, wetland indicator status (OBL, FACW, FAC, FACU, UPL), planting density (stems/acre) and percent composition of each species planted.
ii. *Source.* Identify the source of native plant species (salvaged from impact site, local source, seed bank) and stock type (bare root, potted, seed).
iii. *Natural Regeneration*. Describe any expected natural regeneration from existing seed bank, plantings, and natural recruitment.

9. Maintenance plan. A description and schedule of maintenance requirements to ensure the continued viability of the resource once initial construction is completed. (CFR 332.4(c)(8))

a. *Responsible Party*. Party responsible and their role for performing maintenance.

b. *Maintenance Activities*. Identify specific maintenance activities planned and anticipated schedule. Maintenance activities include, but are not limited to supplemental planting, invasive species treatment, erosion control, fencing, in-stream structures, water control structures, etc.

10. **Performance standards**. Ecologically-based standards that will be used to determine whether the CM project is achieving its objectives. (CFR 332.4(c)(9))

a. *Performance Standards*. Provide list of interim and final performance standards that objectively evaluate the project's trajectory toward final mitigation success and achievement of stated project goals and objectives. Refer to the Draft Performance and Monitoring Standards for Stream and Wetland Compensatory Mitigation Projects in Tennessee document for additional guidance.

b. *Format*. Ecological performance standards should be listed in table format and clearly document the interim and final performance requirements of the CM site.

c. *Functional Assessment*. For projects where a functional/condition assessment method is used to assess a mitigation project's "before" and "after" conditions, the projected "after" score shall be included as a performance standard.

11. **Monitoring requirements**. A description of parameters to be monitored in order to determine if the CM project is on track to meet performance standards and if adaptive management is needed. A schedule for monitoring and reporting monitoring results to the DE must be included. (CFR 332.4(c)(10))

a. *Monitoring Plan*. Provide a table that lists proposed monitoring parameters, frequency of specific monitoring, and length of monitoring period Refer to the Draft Performance and Monitoring Standards for Stream and Wetland Compensatory Mitigation Project in Tennessee document for additional guidance.

b. *Responsible Party*. Identify party responsible for monitoring the CM site.

c. *Reporting*. Propose the frequency for submitting annual monitoring reports.

d. *Reporting Format*. Describe format for reporting monitoring data and assessing CM site.

12. **Long-term management plan**. A description of how the mitigation project will be managed after performance standards have been achieved to ensure the long-term sustainability of the resource, including long-term financing mechanisms and the party responsible for long-term management. (CFR 332.4(c)(11))

a. *Long-Term Management Needs*. Description of long-term management needs, annual cost estimates for these needs, and identify the funding mechanism that will be used to meet these needs. The long-term management activities shall be performed by the responsible party and adequate funding shall be provided by the applicant. The long-term management activities shall be performed by the responsible party and adequate funding shall be provided by the applicant.

Long-Term Management Activities Include:
Maintenance of Signage
Conservation Easement Enforcement
Access / Gate Maintenance
Fencing
Non-native Invasive Species Management (See Section 12(a)(i))
Taxes
Property Insurance
Reporting
Other project specific items as listed in the CM plan

i. Non-native Invasive Species Management
Streams: Applicants that propose biological improvements for mitigation credit shall perform long-term management of non-native invasive species. The responsible party shall manage non-native invasive species in accordance with the approved mitigation plan.

Wetlands: Applicants that propose to perform wetland compensatory mitigation shall perform long-term management of non-native invasive species. The responsible party shall manage non-native invasive species in accordance with the approved mitigation plan.

b. *Responsible Party*. Identify the party responsible for the long-term management of the project. The responsible party may include, but is not limited to the applicant, federal, tribal, state, or local resource agencies, non-profit conservation organizations, or private land managers.

c. *Cost*. Estimated long-term management costs shall be provided in a format consistent with Appendix E. The costs include estimates of time and funding needed to conduct the long-term management activities. The table will include the itemized management activities by task and will be summarized as an annual cost. Administration fees, contingency fees, and current annual estimated capitalization rate shall be identified. Additionally, the total endowment cost shall be

identified in the table. Property Analysis Record (PAR) (Center for Natural Lands Management), Long-term Stewardship Calculator (The Nature Conservancy), or similar methods may be used for determining the amount of principal required to fully fund the long-term management fund.

d. *Funding*.
Long-term management funding shall be placed into a non-wasting endowment fund. Other long-term financing mechanisms including trusts, contractual arrangements with responsible parties, and other appropriate financial instruments may be considered by the Corps on a case-by-case basis.

13. **Adaptive management plan**. A management strategy to address unforeseen changes in site conditions or other components of the mitigation project, including the party or parties responsible for implementing adaptive management measures. (CFR 332.4(c)(12))

a. *Responsible Party*. Identify the responsible parties who will identify the problem and contact the Corps to develop appropriate corrective measures.

b. *Potential Problem*s. Potential problems that may trigger adaptive management.

c. *Corrective Measures*. Discussion of potential corrective measures.

d. *Timing*. Time frame for implementing corrective actions.

14. **Financial assurances**. A description of financial assurances that will be provided and how they are sufficient to ensure a high level of confidence that the mitigation project will be successfully completed, in accordance with its performance standards. (CFR 332.4(c)(13))

a. *Financial assurance*. For construction phase, maintenance, monitoring, remedial measures, and project success, identify: party responsible to establish and manage the financial assurance, the specific type of financial instrument (e.g., performance bonds, irrevocable trusts, escrow accounts, casualty insurance, letters of credit, etc.), the method used to estimate assurance amount, the date of establishment, and the release and forfeiture conditions. In order to ensure the financial assurances are adequate, an itemized spreadsheet listing costs associated with construction, planting, and maintenance of the mitigation site through the monitoring period (including potential adaptive management measures) should be prepared and included with the mitigation plan (See Appendix F).

b. *Review*. Identify the schedule by which financial assurances will be reviewed and adjusted to reflect current economic factors.

15. Other information. The district engineer may require additional information as necessary to determine the appropriateness, feasibility, and practicability of the mitigation project.

a. *Access to Property*. Provide written permission from the property owner to access the proposed mitigation site.
b. *Contact Information.* Provide the name and phone number of the person(s) who will manage the site after the mitigation effort is deemed successful?

C. Environmentally Preferable Considerations (332.3(a)(1), 332.3(b)(2)-(6), and 332.4(c)(2)-(14)) The following criteria must be evaluated by the district engineer to determine if the proposed mitigation is environmentally preferable. In making this determination, the district engineer must assess the likelihood for ecological success and sustainability, the location of the compensation site relative to the impact site and their significance within the watershed, and the costs of the compensatory mitigation project. For each consideration listed below (e.g. uncertainty and risk, size and ecological value, etc.), a description is provided from the Mitigation Rule that demonstrates why mitigation banks and in-lieu fee (ILF) are generally preferred. Using this information, provide a justification for each consideration that describes how your site compares to the benefits of the bank and/or ILF in that service area. These criteria will be used to determine if the proposed permittee responsible mitigation site is environmentally preferable when compared to mitigation banks and/or ILF.

1. Uncertainty and Risk [*Uncertainty – the element associated with whether the CM will successfully offset project impacts. Risk – the element associated with the potential for the proposed CM plan to fail*] :

Mitigation Bank: Mitigation bank credits are not released for debiting until specific milestones associated with the mitigation bank site's protection and development are achieved, thus use of mitigation bank credits reduce risk that mitigation will not be fully successful. Released credits represent a mitigation project that has undergone a specific program of data collection documenting the physical, chemical, and biological characteristics of the mitigation site (monitoring), and has fully met established ecological performance standards or displays a continuous and appropriate positive trend toward ecological success.

In-Lieu Fee: In contrast to mitigation banks, in-lieu fee programs generally initiate CM projects only after collecting fees, and there has often been a substantial time lag between permitted impacts and implementation of CM projects.

Additionally, in-lieu fee programs have not generally been required to provide the same financial assurances as mitigation banks. For all of these reasons, there is greater risk and uncertainty associated with in-lieu fee programs regarding the implementation of the CM project and its adequacy to compensate for lost functions and services.

Permittee-responsible: Discuss how aspects of the permittee-responsible CM address this issue. Describe the availability of bank and in-lieu fee credits and the status of the available bank and in-lieu fee mitigation providers. Also, please note the enclosed "Common Design Pitfalls" attached with this document as Appendix G.

2. Size and Ecological Value of Parcel; Watershed Approach [*how the site is ecologically suitable for providing desired functions – consider the physical characteristics, watershed scale features, size, and location; compatibility with adjacent land uses; and, likely effects on important resources*]:

Mitigation Bank: The bank site consists of a larger, consolidated mitigation parcel providing more ecological value to the watershed. The bank evaluation reflected a watershed approach that uses a landscape perspective that places primary emphasis on site selection through consideration of

landscape attributes that will help provide the desired aquatic resource types and ensure they are self-sustaining. The watershed approach also considers how other landscape elements (e.g., other natural resources and developments) interact with CM project sites and affect the functions they are intended to provide.

In-Lieu Fee: In-lieu fee projects typically involve larger, more ecologically valuable parcels, and more rigorous scientific and technical analysis, planning and implementation than permittee-responsible mitigation. They also devote significant resources to identifying and addressing high-priority resource needs on a watershed scale, as reflected in their compensation planning framework.

Permittee-responsible: Discuss how aspects of the permittee-responsible CM plan address this issue.

3. **Temporal loss** [*the time between the initiation of the mitigation plan and the maturation of anticipated ecological functions at a CM site*]:

Mitigation Bank: Availability of credits indicates that the mitigation project has undergone a close regulatory review, and has been determined to have a high likelihood to develop into a self-sustaining, functional ecosystem. In most cases mitigation activities have been implemented, and the project has reached at least some interim milestones and satisfied interim performance standards."

In-Lieu Fee: In-lieu fee programs generally initiate CM projects only after collecting fees, and there is often a lag time between permitted impacts and implementation of CM projects.

Permittee-responsible: Discuss how aspects of the permittee-responsible CM plan address this issue. Include discussions about the timing of mitigation implementation relative to the impacts to waters of the U.S., the anticipated time of ecological response to the proposed mitigation activities, etc.

4. **Scientific/Technical Analysis, Planning, and Implementation** [*as commensurate with the amount and type of impact, the level of scientific/technical evaluation required to appropriately and adequately assess the likelihood for ecological success and sustainability; the location of the compensation site and the significance in the watershed; and, other factors presented in a complete mitigation plan*]:

Mitigation Bank/In-Lieu Fee: Development of a bank or ILF project involves extensive review by the Interagency Review Team (IRT), an assemblage of agency representatives with varying and specific scientific/technical expertise. The IRT adopts a consensus based approach in evaluating all aspects of the mitigation plan and the mitigation banking instrument, ensuring the plan takes into consideration the needs of the watershed and an understanding of the ecological processes that drive the functions in that watershed. The IRT ensures the site is appropriately located within the landscape, is sustainable, and has a high likelihood of ecological success. They ensure mitigation performance standards are based on objective and verifiable attributes that measure functional capacity; they ensure there is a management strategy that anticipates likely challenges and provides for the implementation of adaptive management measures to address those challenges and they

evaluate any proposed modifications to the components of the mitigation plan and the banking/in-lieu fee instrument.

Permittee-responsible: Discuss how aspects of the permittee-responsible CM plan address this issue.

5. **Long-Term Viability of Mitigation/Mitigation Site** [*how the CM project will be managed after performance standards have been achieved to ensure long-term sustainability of the resource*]:

Mitigation Bank/In-Lieu Fee: Long-term management plans, along with the real estate protection instrument and financial assurances, ensure the long-term viability of the mitigation site. The long-term management plan establishes a plan of action and associated timetable to implement actions to establish and maintain desired habitat conditions/functional gain within the bank or in-lieu fee projects. Representative management actions include but are not limited to, water level manipulation, herbicide use, and mechanical plant removal, prescribed burning signage maintenance, fence repair, etc. The party responsible for the long-term management of the site was identified and evaluated to ensure capability of successfully managing the property.

Permittee-responsible: Discuss how aspects of the permittee-responsible CM plan address this issue.

6. **Site Protection** [*aquatic habitats, riparian areas, buffers, and uplands that comprise the overall CM must be provided long-term protection through real estate instruments or other available mechanisms, as appropriate*]:

Mitigation Bank/In-Lieu Fee: Site protection has been ensured through an approved real estate mechanism that is held by an appropriate third party; and, has undergone Office of Counsel review and approval. Existing restrictions, easements, rights of ways, or other encumbrances associated with the property have been extinguished or evaluated to ensure consistency/compatibility with the mitigation activities and long-term management of the property.

Permittee-responsible: Discuss how aspects of the permittee-responsible CM plan address this issue.

7. **Financial Assurances** [*description of financial assurances that will be provided and how they are sufficient to ensure a high level of confidence that the CM project will be successfully completed, as well as annual cost estimates for the long-term management needs of the site and the funding mechanism that will meet those needs*]:

Mitigation Bank: Financial assurances for bank implementation and long term management of the mitigation site have been established to ensure that a sufficient amount of money would be available for use to complete or replace the mitigation provider's obligations to implement the mitigation project and meet specified ecological performance standards in the event that the provider proves unable or unwilling to meet those obligations. The financial assurances considered the size and complexity of the mitigation project. The assurances are held by an approved entity; and, have undergone Office of Counsel review. Any modification, disbursement, or release of the assurances requires COE notification.

In-Lieu Fee: The district engineer has required sufficient financial assurances to ensure a high level of confidence that the CM will be successfully completed, in accordance with applicable performance standards.

Permittee-responsible: Discuss how aspects of the permittee-responsible CM plan address this issue.

8. **Other relevant factors** [*additional information contributing to the appropriateness, feasibility, or practicability of the mitigation project (ESA, wildlife corridor, unique habitat, State 401 water quality certification, etc.)*] *State 401 water quality certifications which authorize impacts to water resources and require compensatory mitigation may require an evaluation of the water resource status by the TN Department of Environment and Conservation in order to properly apply TDEC's Anti-Degradation rule. For streams, this evaluation determines (in part) if the resource currently fails to adequately support fish and aquatic life due to habitat impairment. If the resource is habitat impaired the proposed compensatory mitigation must be "in-system", which, under normal circumstances is the same HUC 12 in which the impacts occur. For wetlands, this evaluation determines (in part) the condition of the resource and if the condition is "moderate" or better, the proposed compensatory mitigation must be "in-system", which, under normal circumstances is the same HUC 12 in which the impacts occur.*

Mitigation Bank/In-Lieu Fee: Contributions by IRT members with specific technical expertise provide input to ensure site selection and development are focused on maximizing benefits to water quality, wildlife, and specific species requirements. Watershed approach and size of mitigation site provide opportunity for wider array of ecological and direct species benefits.

Permittee-responsible: Discuss how aspects of the permittee-responsible CM plan address this issue.

Appendix A. Catchment Assessment Form

Catchment Assessment Form

Rater(s):

Date:

Purpose: This form is used to determine the project's restoration potential.

Overall Watershed Conditon

CATCHMENT ASSESSMENT

Categories		Description of Catchment Condition			Rating (P/F/G)
		Poor	Fair	Good	
1	Concentrated Flow (Hydrology)	Potential for concentrated flow/impairments to reach restoration site and no treatments are in place	Some potential for concentrated flow/impairments to reach restoration site, however, measures are in place to protect resources	No potential for concentrated flow/impairments from adjacent land use	
2	Impervious cover (Hydrology)	Greater than 15%	Between 7% and 15%	Less than 7%	
3	Land Use Change (Hydrology)	Rapidly urbanizing/urban	Single family homes/suburban	Rural communities/slow growth or primarily forested	
4	Distance to Roads (Hydrology)	Roads located in or adjacent to project reach and/or major roads proposed in 10 year DOT plans	No roads in or adjacent to project reach. No more than one major road proposed in 10 year DOT plans.	No roads in or adjacent to project reach. No proposed roads in 10 year DOT plans.	
5	Watershed Hydrology (e.g., flow regime, basin characteristics) (Hydrology)	Flashy flow regime as a result of land use, rainfall patterns, geology, and soils.	Moderate flashy flow regime as a result of land use, rainfall patterns, geology, and soils.	Not Flashy flow regime as a result of land use, rainfall patterns, geology, and soils.	
6	Percent Forested (Watershed) (Hydrology)	<= 20%	>20% and <70%	>=70%	
7	Riparian Vegetation (Geomorphology)	<50% of contributing stream length has > 25 ft corridor width	50-80% of contributing stream length has > 25 ft corridor width	>80% of contributing stream length has > 25 ft corridor width	
8	Sediment Supply (Geomorphology)	High sediment supply from upstream bank erosion and surface runoff	Moderate sediment supply from upstream bank erosion and surface runoff	Low sediment supply. Upstream bank erosion and surface runoff is minimal	
9	Located on or downstream of a 303(d) listed stream TMDL list (Physicochemical)	On, upstream, or downstream of 303(d) and no TMDL/WS Mgmt plan to address deficiencies	On, upstream, or downstream of 303(d) and TMDL/WS Mgmt plan addressing deficiencies	Not on 303(d) list	
10	Agricultural Land Use (Physicochemical)	Livestock access to stream and/or intensive cropland immediately upstream of project reach.	Livestock access to stream and/or intensive cropland upstream of project reach. A sufficient reach of stream is between Ag. land use and project reach.	There is little to no agricultural land uses or the livestock or cropland is far enough away from project reach to cause no impact to water quality or biology.	
11	NPDES Permits	Many NPDES permits within watershed or some within one mile of project reach	A few NPDES permits within watershed and none within one mile of project reach	No NPDES permits within watershed and none within one mile of project reach	
13	Watershed impoundments (Biology)	Impoundment(s) located within 1 mile upstream or downstream of project area and/or has a negative effect on project area and fish passage	No impoundment within 1 mile upstream or downstream of project area OR impoundment does not adversely affect project area but a blockage could exist outside of 1 mile and impact and fish passage	No impoundment upstream or downstream of project area OR impoundment provides beneficial effect on project area and allows for fish passage	
14	Organism Recruitment (Biology)	Channel immediately upstream or downstream of project reach is concrete, piped, or hardened.	Channel immediately upstream or downstream of project reach has native bed and bank material, but is impaired.	Channel immediately upstream or downstream of project reach has native bed and bank material.	
15	Percent of Catchment being Enhanced or Restored	Less than 40% of the total catchment area is within the project reach.	40 to 60% of the total catchment area is within the project reach.	Greater than 60% of the total catchment area is within the project reach.	
16	Other				

EXISTING and PROPOSED REACH LEVEL STREAM FUNCTION-BASED RAPID ASSESSMENT FIELD DATA FORM

Watershed: _____ Rater(s): _____
Stream: _____ Date: _____
Reach Length: _____ Latitude: _____
Photo(s): _____ Longitude: _____
Reach ID: _____

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category		
		Functioning	Functioning-at-Risk	Not Functioning
Stream Function Pyramid Level 1 Hydrology				
Runoff	1. Concentrated Flow	No potential for concentrated flow/impairments from adjacent land use	Some potential for concentrated flow/impairments to reach restoration site, however, measures are in place to protect resources	Potential for concentrated flow/impairments to reach restoration site and no treatments are in place
	Existing Condition			
	Proposed Condition			
	2. Flashiness	Non-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover less than 6%	Semi-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover 7 - 15%	Flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover greater than 15%
	Existing Condition			
	Proposed Condition			
	If existing runoff is FAR or NF, provide description of cause(s) and stability trend and if F can not be potentially achieved, provide reason			
Stream Function Pyramid Level 2 Hydraulics				
Floodplain Connectivity (Vertical Stability)	3. Bank Height Ratio (BHR)	1.0-1.2	1.21 - 1.50	>1.50
	Existing Condition			
	Proposed Condition			
	4a. Entrenchment (Meandering streams in alluvial valleys or Rosgen C, E, DA Streams)	>2.2	2.2 - 2.0	<2.0
	Existing Condition			
	Proposed Condition			
	4b. Entrenchment (Non meandering streams in colluvial valleys or Rosgen B Streams)	= or >1.4	1.3 - 1.2	<1.2
	Existing Condition			
	Proposed Condition			
	5. Floodplain Drainage	no concentrated flow; runoff is primarily sheet flow; hillslopes < 10%; hillslopes >200 ft from stream; ponding or wetland areas and litter or debris jams are well represented	runoff is equally sheet and concentrated flow (minor gully and rill erosion occurring); hillslopes 10 - 40%; hillslopes 50 - 200 ft from stream; ponding or wetland areas and litter or debris jams are minimally represented	concentrated flows present (extensive gully and rill erosion); hillslopes >40%; hillslopes <50 ft from stream; ponding or wetland areas and litter or debris jams are not well represented or absent
	Existing Condition			
	Proposed Condition			
	6. Vertical Stability Extent	Stable: <5% of bottom affected by localized vertical channel down-cutting	Localized Instability: 5-50% of bottom affected by localized vertical stream channel down-cutting or scouring	Widespread Instability: 50% of bottom affected by widespread vertical down-cutting; head cuts present
	Existing Condition			
	Proposed Condition			
	Provide description of cause(s) and stability trend and if F can not be potentially achieved, provide reason			

Reach ID:	

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category		
		Functioning	Functioning-at-Risk	Not Functioning
Stream Function Pyramid Level 3 Geomorphology				
Riparian Vegetation	7. Buffer Width (ft) from top of bank	>50	30 - 49 ft	< 30 ft
	Left Bank Existing			
	Left Bank Proposed			
	Right Bank Existing			
	Right Bank Proposed			
	8. Riparian Vegetation Zone (EPA, RBP Habitat Assessment)	Good vegetation community diversity and density; human activities do not impact zone(optimal score 9-10)	Human activities impacted zone minimally (sub-optimal, score 6-8); width of riparian zone 20-40 feet (6-12 meters); human activities have impacted zone a great deal (marginal, score 3-5)	Little or no riparian vegetation due to human activities (poor score 0-2)
	Left Bank Existing			
	Left Bank Proposed			
	Right Bank Existing			
	Right Bank Proposed			
	9. Vegetative Protection	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. (optimal score 9-10)	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. (sub-optimal score 6-8); 50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. (marginal, score 3-5)	Less than 50% of the bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. (poor score 0-2)
	Left Bank Existing			
	Left Bank Proposed			
	Right Bank Existing			
	Right Bank Proposed			
	10.Riparian Zone Invasive Species	Invasive species not present or sparse	Invasive species well represented and alter the community	Majority of vegetation is invasive
	Left Bank Existing			
	Left Bank Proposed			
	Right Bank Existing			
	Right Bank Proposed			
	Provide description of cause(s) and stability trend and if F can not be potentially achieved, provide reason			

Stream Function Pyramid Level 3 Geomorphology				
Lateral Stability	11. Dominant BEHI/NBS Rating	L/VL, L/L, L/M, L/H, L/VH, M/VL	M/L, M/M, M/H, L/Ex, H/L, M/VH, M/Ex, H/L, H/M, VH/VL, Ex/VL	H/H, H/Ex, VH/H, Ex/M, Ex/H, Ex/VH, VH/VH, Ex/Ex
	Existing Condition (Right bank)			
	Proposed Condition (Right Bank)			
	Existing Condition (Left bank)			
	Proposed Condition (Left Bank)			
	12. Dominant Bank Erosion	Dominate bank erosion rate is low 10%	Dominate bank erosion rate is moderate 10-25%	Dominate bank erosion rate is high >25%
	Existing Condition			
	Proposed Condition			
	Provide description of cause(s) and stability trend and if F can not be potentially achieved, provide reason			

Reach ID:	

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category		
		Functioning	Functioning-at-Risk	Not Functioning
Bedform Diversity	13. Shelter for Fish and Macroinvertebrates (EPA 1999)	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, rubble, gravel, cobble and large rocks, or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)	20-70% mix of stable habitat; suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale)	Less than 20% mix of stable habitat; lack of habitat availability less than desirables obvious; substrate unstable or lacking
	Existing Condition			
	Proposed Condition			
	14. Large Woody Debris Index (LWDI)	LWDI of project reach equals LWDI of reference reach	LWDI of project reach does not equal reference reach, but is trending towards reference	LWDI of project reach does not equal LWDI of reference reach and is not trending towards reference
	Exisiting Condition			
	Proposed Condition			
	Streams in Alluvial Valleys (C, E)			
	15. Percent Riffle <3% slope	>60 - <70	70 - 80 or 40 - 60	> 80 or < 40
	Existing Condition			
	Proposed Condition			
	16a. Pool-to-Pool Spacing Ratio (Watersheds < 10 mi^2)	>4.0 - <5.0	3.0 - 4.0 or 5.0 - 7.0	< 3.0 or >7.0
	Existing Condition			
	Proposed Condition			
	16b. Pool-to-Pool Spacing Ratio (Watersheds > 10 mi^2)	>5.0 - <7.0	3.5 - 5.0 or 7.0 - 8.0	<3.5 or >8.0
	Existing Condition			
	Proposed Condition			
	17a. Pool Max Depth Ratio/Depth Variability (Gravel Bed Streams)	>1.5	1.2 - 1.5	<1.2
	Existing Condition			
	Proposed Condition			
	17b. Pool Max Depth Ratio/Depth Variability (Sand Bed Streams)	>1.2	1.1 - 1.2	<1.1
	Existing Condition			
	Proposed Condition			
	Moderate Gradient Streams in Colluvial Valleys			
	18. Pool-to-Pool Spacing Ratio (3-5% Slope)	0.5- 4.0	4.0 - 6.0	>6.0
	Existing Condition			
	Proposed Condition			
	19. Pool Max Depth Ratio/Depth Variability	>1.5	1.2 - 1.5	<1.2
	Existing Condition			
	Proposed Condition			
	20a. Percent Riffle 3% - 10% slope	>50 - <60	50 - 40 or 60 - 70	> 70 or < 40
	Existing Condition			
	Proposed Condition			
	20b. Percent Riffle >10% slope	>75 - 80	70 - 75	< 70
	Existing Condition			
	Proposed Condition			
	Provide description of cause(s) and stability trend and if F can not be potentially achieved, provide reason			

Reach ID:	

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category		
		Functioning	Functioning-at-Risk	Not Functioning
Water Quality and Nutrients (Do not complete if stream is ephemeral)	**Stream Function Pyramid Level 4 Physicochemical**			
	21. Water Appearance and Nutrient Enrichment (USDA 1999)	Very clear, or clear but tea-colored; objects visible at depth 3 to 6 ft (less if slightly colored); no oil sheen on surface; no noticeable film on submerged objects or rocks. Clear water along entire reach; diverse aquatic plant community includes low quantities of many species of macrophytes; little algal growth present	Frequent cloudiness especially after storm events; objects visible to depth 0.5 to 3.0 ft; may have slight green color; no oil sheen on water surface. Fairly clear or slightly greenish water along entire reach; moderate algal growth on stream substrate	Very turbid or muddy appearance most of the time; objects visible at depth< 0.5 ft; slow moving water maybe bright green; other obvious water pollutants; floating algal mats, surface scum, sheen or heavy coat of foam on surface; or strong odor of chemicals, oil, sewage, or other pollutants. Pea-green, gray, or brown water along entire reach; dense stands of macrophytes clogging stream; severe algal blooms creating thick algal mats in stream
	Existing Condition			
	Proposed Condition			
	22. Detritus (Petersen, 1992)	Mainly consisting of leaves and wood without sediment covering it	Leaves and wood scarce; fine organic debris without sediment	Fine organic sediment - black in color and foul odor (anaerobic) or detritus absent
	Existing Condition			
	Proposed Condition			
	Provide description of cause(s) and stability trend and if F can not be potentially achieved, provide reason			
Biology (Do not complete if stream is ephemeral)	**Stream Function Pyramid Level 5 Biology**			
	23. Macroinvertebrate Index Semi Quantitative Single Habitat (SQSH) Macroinvertebrate Sample (as defined in 2011 TN State QSSOP for macroinvertebrate surveys)	SQSH Score: >34 (Ecoregion 73A; >24)	SQSH Score: 30-34 (Ecoregion 73A; 20-24)	SQSH Score: <30 (Ecoregion 73A; <20)
	Existing Condition			
	Proposed Condition			
	24. Macroinvertebrate Tolerance from NCBI Metric Score (as defined in the 2011 TN State QSSOP for macroinvertebrate surveys)	Abundant intolerant species 6	Limited intolerant species 4	Only tolerant species <4
	Existing Condition			
	Proposed Condition			
	25. Fish Presence	Abundant	Rare	Not present
	Existing Condition			
	Proposed Condition			
	Provide description of cause (s) and stability trend and if F can not be potentially achieved, provide reason			

Hydraulic and Geomorphic Assessment Data Form

Form created by Stream Mechanics and modified by Corps on 5/17/2016

I. Bankfull Verification

A. Regional Curve _____

B. Drainage Area _____ sq. miles

C. Difference between bankfull stage and water surface _____ feet

D. Bankfull Width (Measured) _____ feet

E. Bankfull Area (Measured) _____ sq. feet

F. Bankfull Mean Depth (Area/Width) _____ feet

G. Bankfull Width (Regional Curve) _____ feet

H. Bankfull Area (Regional Curve) _____ sq. feet

I. Bankfull Mean Depth (Regional Curve) _____ feet

Area Calculations

II. Stream Classification

A. Bankfull W/D, calculate as $\frac{Bankfull\ Width}{Bankfull\ Mean\ Depth}$ _____ ft/ft.

B. Bankfull Max Riffle Depth (Dmax) _____ feet

C. Floodprone Area Width _____ feet

D. Entrenchment Ratio, calculate as $\frac{Floodprone\ Area\ Width}{Bankfull\ Width}$ _____ ft/ft.

E. Slope Estimate _____ ft/ft.

F. Channel Material Estimate _____

G. Rosgen Stream Type _____

III. Floodplain Connectivity

A. Bank Height/Riffle Data

	R_1	R_2	R_3	R_4
Low Bank Height (LBH)				
Dmax				
Bank Height Ratio (LBH/Dmax)				
Riffle Length				

B. Weighted Bank Height Ration, calculate as $\frac{\Sigma(Bank\ Height\ Ratio_i \text{ x Riffle Length}_i)}{\Sigma Riffle\ Length}$ _____ ft/ft.

C. Entrenchment Ratio from Riffle _____ ft/ft.

IV. Bedform Diversity

A. Pool Data

	P_1	P_2	P_3	P_4	P_5
Station					
Pool to Pool Spacing					
Pool Spacing Ratio, $\frac{Pool\ Spacing}{Bankfull\ Width}$					
Pool Depth (max depth at bankfull)					
Pool Depth Ratio, $\frac{Pool\ Depth}{Bankfull\ Mean\ Depth}$					

B. Average Pool Spacing Ratio _____ ft/ft.

C. Average Pool Depth Ratio _____ ft/ft.

V. Large Woody Debris[7]

A. Number of Pieces per 100m _____

B. Large Woody Debris Index _____

[7] Davis, Jeffrey C., G. Wayne Minshall, Christopher T. Robinson, Peter Landres. Monitoring Wilderness Stream Ecosystems. USDA Forest Service General Technical Report RMRS-GTR-70 (January 2001). http://www.fs.fed.us/rm/pubs/rmrs_gtr070.pdf

VI. Lateral Stability

A. Bank Data

BEHI/NBS[8] Score	Bank Length

B. Total Eroding Bank Length _____ ft.

C. Total Bank Length _____ ft.

D. Dominant BEHI/NBS Score _____

E. Percent of Bank Erosion, calculate as $\frac{Total\ Eroding\ Bank\ Length}{Total\ Bank\ Length}$ _____ %

VI. Riparian Vegetation

A. Riparian Vegetation Data

	Left	Right
Riparian/Buffer Width		
RBP Score		

VII. Channel Evolution

A. Rosgen Channel Type Succession _____

B. Simon Channel Evolution Model (Stage) _____

C. Provide a brief narrative describing the channel evolution trend.

_____

_____

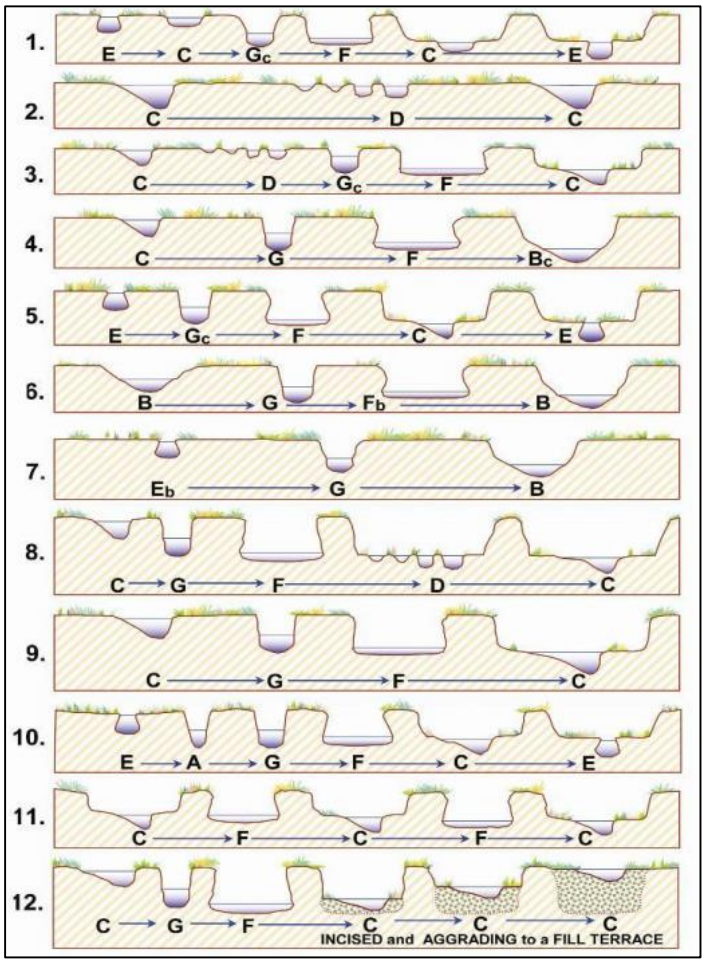
_____

_____

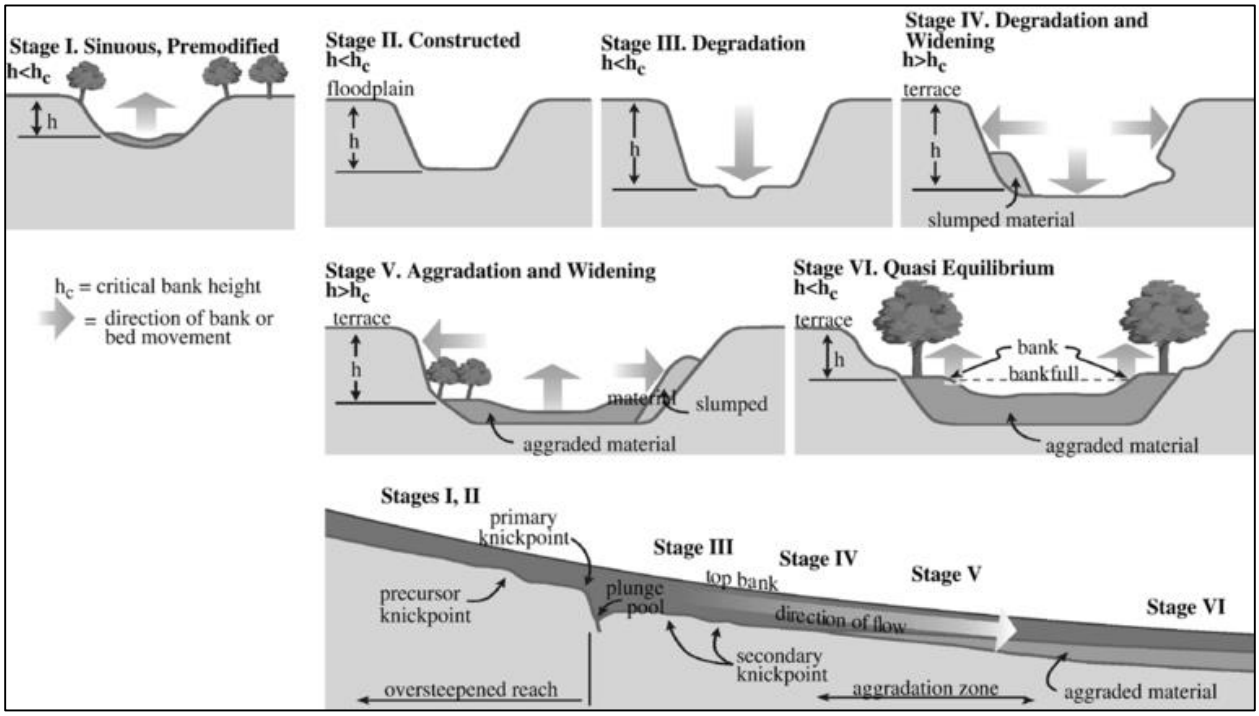
_____

[8] Rosgen, D. 2014. River Stability Field Guide (Second Edition). Wildland Hydrology, Fort Collins, CO.

Rosgen Channel Type Succession Scenarios



Simon Channel Evolution Model



Large Woody Debris Field Form

Name:

Stream Name:	Stream Type:
Reach ID:	Avg. Slope:
Reach Length:	Bed material:
Bankfull Width:	

Reach Descriptions:

	Score					
Pieces	**1**	**2**	**3**	**4**	**5**	**Total**
Length/Bankfull Width						
Diameter						
Location						
Type						
Structure						
Stability						
Orientation						
Total						
Debris Dams						
Length						
Height						
Structure						
Location						
Stability						
Total						

Notes:

LWD Key

	Score				
Pieces	**1**	**2**	**3**	**4**	**5**
Length/Bankfull Width	0.2 to 0.4	0.4 to 0.6	0.6 to 0.8	0.8 to 1.0	> 1.0
Diameter (Cm)	10 to 20	20 to 30	30 to 40	40 to 50	>50
Location	Zone 4		Zone 3	Zone 2	Zone 1
Type	Bridge		Ramp	Submersed	Buried
Structure	Plain		Intermediate		Sticky
Stability	Moveable		Intermediate		Secured
Orientation(degrees)	0 to 20	20 to 40	40 to 60	60 to 80	80 to 90
Debris Dams					
Length (% of bankfull width)	0 to 20	20 to 40	40 to 60	60 to 80	80 to 100
Height (% of bankfull depth)	0 to 20	20 to 40	40 to 60	60 to 80	80 to 100
Structure	Coarse		Intermediate		Fine
Location	Partially high flow	In high flow	Partially low flow	Mid low flow	In low flow
Stability	Moveable		Intermediate		Secured

Diameter Conversion

10 cm	0.33	feet
20 cm	0.66	feet
30 cm	0.98	feet
40 cm	1.3	feet
50 cm	1.6	feet

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HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT)
(See Protocol E for detailed descriptions and rank information)

STATION ID:			HABITAT ASSESSED BY:	
STREAM NAME:			DATE: TIME:	
STATION LOCATION:			ECOREGION: QC: Consensus Duplicate	
WBID/HUC: GROUP:			ASSOCIATED LOG #:	
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.	Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)	Natural stable habitat covers 20 -40% of stream reach or only 1-2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
2.Embeddedness of Riffles	Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.	Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.	Gravel, cobble, and boulder s are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.	Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
3. Velocity/ Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).	Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime. Others regimes too small or infrequent to support aquatic populations.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
4. Sediment Deposition	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.	Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
5. Channel Flow Status. .	Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.	Water covers > 75% of streambed or 25% of productive habitat is exposed.	Water covers 25-75% of streambed and/or productive habitat is mostly exposed.	Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				

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HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK)

Station ID_____ Date_____ Initials_____

	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.	Over 80% of reach channelized, dredged or affected by 4-wheelers. Instream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
7. Frequency of re-oxygenation zones. Use frequency of riffle or bends for category. Rank by quality.	Occurrence of re-oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.	Occurrence of re-oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.	Occasional re-oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.	Generally all flat water or flat bedrock; little opportunity for re-oxygenation. Distance between areas divided by average stream width >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE___(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE___(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Comments				
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-natives are rare (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	Less than 50% of the bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%)
SCORE___(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE___(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Comments				
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.	Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.
SCORE___(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE___(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Comments				

Total Score _____ Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW

If score is below guidelines , result of (circle): Natural Conditions or Human Disturbance

Describe

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QSSOP for Macroinvertebrate Stream Surveys
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HABITAT ASSESSMENT FIELD SHEET- LOW GRADIENT STREAMS (FRONT)
(See Protocol E for detailed descriptions and rank information)

STATION ID:			HABITAT ASSESSED BY:	
STREAM NAME:			DATE: TIME:	
STATION LOCATION:			ECOREGION: QC: Consensus Duplicate	
WBID/HUC: GROUP:			ASSOCIATED LOG #:	
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Over 50% of reach has natural, stable habitat for colonization by macroinvertebrates and/or fish. Three or more productive habitats are present.	Natural stable habitat covers 30-50% of stream reach or less than three habitats are present.	Natural stable habitat 10-30% of stream reach. Availability less than desirable, substrate frequently disturbed or removed. Habitat diversity is reduced.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
2. Channel Substrate Characterization	Good mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud or clay; or substrate is fissured bedrock, some root mats and submerged vegetation present.	All mud, clay, soft sand or fissured bedrock bottom, little or no root mat, no submerged vegetation present.	Hard-pan clay, conglomerate or predominantly flat bedrock; no root mat or submerged vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools are large-deep very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
4. Sediment Deposition	Sediment deposition affects less than 20% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of bottom affected. Slight deposition in pools.	Moderate deposition of fine material on old and new bars, 50-80% of bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition of pools.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
5. Channel Flow Status. If water backed up by obstructions (beaver dam, log jams, bedrock during low flow) move assessment reach above or below affected area or consider postponing sampling until accurate assessment of stream can be achieved.	Water reaches base of both lower banks throughout reach. Streambed is covered. Minimal productive habitat is exposed.	Water covers > 75% of streambed and/or < 25% of productive habitat is exposed.	Water covers 25-75% of streambed and/or stable habitat is mostly exposed.	Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				

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HABITAT ASSESSMENT FIELD SHEET- LOW GRADIENT STREAMS (BACK)

Station ID _____ Date _____ Initials _____

	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization, dredging or 4-wheel activity absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.	Over 80% of reach channelized, dredged or affected by 4-wheelers. Instream habitat greatly altered or removed. Artificial structures may have greatly affected flow pattern.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
7. Channel Sinuosity (Entire meander sequence not limited to sampling reach)	The bends in the stream increase the stream length 3-4 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion o 5-30% of bank eroded. If approaching 30% score marginal if banks steep.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Comments				
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-natives are rare (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	Less than 50% of the bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%)
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Comments				
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.	Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Comments				

Total Score _____ **Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW**

If score below guidelines, result of (circle): Natural Conditions or Human Disturbance

Describe

Appendix E: Estimated Long-Term Management Costs for the XXX mitigation site (Example)

Task	Expenditure	Labor/ Source	Specification	Unit	Number of Units: Project ($38/hr.)	Number of Units: Biologist ($30/hr	Item	Cost/ Item	Total Cost	Recurrence Interval (per	Total Annual Cost
Inspect boundary lines	annual	staff	Boundary line inspection and maintenance	L. hours		8	0.00	$30.00	$240.00	2	$480.00
Repaint boundary lines	annual	staff	Paint and mark boundary lines	L. hours		8	0.00	$30.00	$240.00	1	$240.00
Replace signs	annual	staff	Replace signs	L. hours		8	0.00	$30.00	$240.00	1	$240.00
Undesirable vegetation control	annual	contr.	Exotic and invasive vegetation control	Acres			5.00	$250.00	$1250.00	1	$1250.00
Annual Monitoring Report	annual	staff	Prepare annual monitoring report for IRT	L. hours	8		0.00	$38.00	$304.00	1	$304.00
Project Management	annual	staff	Project Management	L. hours	8		0.00	$38.00	$304.00	12	$3,648.00
Monthly General Inspections	annual	staff	General Inspections	L. hours		8	0.00	$30.00	$240.00	12	$2,880.00
Beaver Control	annual	staff	Monitor and control adverse beaver activity	L. hours		8	0.00	$30.00	$240.00	6	$1440.00
Road Maintenance	annual	contr.	clipping side of roads, repair erosion, etc.	Miles			3.00	$500.00	$1500.00	1	$1500.00
									Annual Maintenance Cost		$11,982.00
									10% Administration Fee		
									22% Contingency Fee		$2,636.04
Total Fund Deposit	$525,456.48								***Total Annual Cost***		***$14,618.04***
									Endowment starting Principle		$525,456.48
Contigency Fee	22%										
Net Interest Rate*	3.01%										
* Net interest is interest less inflation											
Note: Property tax is not calculated in the formula because XXXXX does not pay property tax as a non-profit.											

Appendix F: Estimated Financial Assurances for the XXX mitigation site (Example)

Task	Expenditure	Labor/ Source	Specification	Unit	Number of Units: Project Coord. ($38 Per Hr.)	Number of Units: Biologist ($30/hr.)	Cost/Item	Item No.	Total Cost	Recurrence Interval (per yr.)	No. Years	Total Cost
Construction of road	one time	staff	Entrance Road to Site	L. hours			$5000.00	1	$5000.00	1	1	$5000.00
Grading of wetland site	one time	staff	Construction of initial hydrologic modifications	L. hours			$200000.00	1	$200000.00	1	1	$200000.00
Planting of site (labor)	one time	staff	Initial tree planting & any additional plantings needed	L. hours			$750.00	75	$56250.00	1	1	$56250.00
Planting of Site (trees)	annual	contr.	Tree purchase and delivery	Acres			$1000.00	70	$70,000.00	1	1	$70,000.00
Undesirable vegetation control	annual	contr.	Exotic and invasive vegetation control	Acres			$250.00	70	$17,500.00	1	7	$122,500.00
Annual Monitoring Report	annual	staff	Prepare annual monitoring report for IRT	L. hours	8		$38.00	8	$304.00	1	7	$2128.00
Project Management	annual	staff	General oversight over project activities	L. hours	200		$38.00	200	$7600.00	1	7	$53,200.00
Monthly General Inspections	annual	staff	Inspections of site development	L. hours		8	$30.00	8	$240.00	12	7	$20,160.00
Installation of water monitoring wells	one time	staff	Installation of wells	L. hours		8	$30.00	8	$240.00	1	1	$240.00
Road Maintenance	annual	contr.	Clearing and maintenance of entrance road	Miles			$500.00	0.5	$250.00	1	7	$1750.00
									Combined Costs			$531,228.00
									22%Contingency Fee (Adaptive Management, Unforeseen Events, Inflation, etc.)			$116,870.16
									Total Project Cost			***$648,098.16***
									Total Fund Deposit			**$648,098.16**

Appendix G: Common Design Pitfalls

Past experience has shown that poor CM site selection and designs often result from CM proposals with insufficient analysis or where the CM design is incompatible with site characteristics or is forced to accommodate conflicting objectives (e.g., compensating for aquatic resource impacts while seeking to maintain flood protection). Below is a list of conflicts or questionable design features that should be avoided. It should also be noted if any of these constraints apply to a given CM proposal, this may warrant seeking alternative sites to provide CM that will achieve the desired objectives:

- Selection of a site unsuitable for fulfilling CM objectives: in such cases even the best design and engineering work will not result in an ecologically successful CM project. The site should include an existing water source(s) that can be used, and the amount of earthwork needed should be minimal.

- Insufficient soil characterization, for example: inadequate number or placement of soil pits to determine soil and subsoil characteristics that will allow for an analysis of the suitability of a site to support the targeted wetland restoration or establishment activity.

- Presence of structures that require long-term maintenance and/or disrupt or replace natural hydrology, such as drop structures; high-flow bypass structures; gabions or levees; buried structures (e.g. riprap); artificial hydrology (permanent irrigation, pumped water sources); and engineered slopes. Preferably, natural hydrology should be allowed to become reestablished rather than facilitated through active engineering devices to mimic a natural hydroperiod. When restoration is not an option, favor the use of passive devices that would have a higher likelihood to sustain the desired hydroperiod over the long term. Try to avoid designing a system dependent on complex, over-engineered water control structures or other artificial infrastructure that must be maintained in perpetuity in order for wetland hydrology to meet the specified design. Design the system for minimal maintenance. Whenever possible, avoid manipulating wetland processes using approaches that require continual maintenance.

- Presence of competing/conflicting uses (e.g., existing or proposed transportation, flood control structures, or planned flood control-related maintenance activities and easements, existing or proposed fuel modification areas).

- Insufficient buffers: insufficient buffer area to achieve plan objectives; buffers with mechanically or chemically manipulated fire breaks, i.e., disking, scraping, mowing, or spraying, buffers that are bypassed by pipes or other conveyances.

- Insufficient connectivity with other aquatic resources, and/or a CM project sited where future land uses in the immediate area would have a large impact on the physical, chemical, or biological components of the stream or wetland (increase in runoff, close proximity to future urban development, etc.).

- Placement where surface water can be diverted in the future or groundwater table lowered due to future land uses upstream or upslope.

- Insufficient analysis of hydrology and soil interaction. For example: 1) Planning a groundwater supported depressional wetland in clay soils that act as an aquiclude and would prevent groundwater from reaching the surface or near surface of the wetland to satisfy the wetland hydrology parameter; 2) Over-excavation to reach groundwater table resulting in open water; or 3) Under-excavation resulting in the absence of wetland hydrology conditions (i.e., the CM wetland is not inundated or saturated to the surface for sufficient duration to satisfy the wetland hydrology parameter).

- Over-excavation to soils or subsoils unsuitable for the growth and reproduction of the desired plant species.

- Planting vegetation species in unsuitable locations without appropriate hydrologic regimes or soil types (texture and chemistry). For example, "floodplain" wetlands lacking a surface water connection to the primary stream channel due to the presence of a berm or other barrier. No barriers, including berms or banks, should be left in place isolating or limiting proposed floodplain wetlands from receiving overbank flows from the primary channel during high-flow events. Wetlands proposed in the floodplain should flood on a regular basis typical for the wetland type in question. Alternatively, regular flooding can be accomplished by establishing breakout/secondary channels to convey flows through any barriers that cannot be removed. The associated stream type is also a factor to consider, since that will be the source of the floodwater.