PENNSYLVANIA
FUNCTION BASED AQUATIC RESOURCE COMPENSATION PROTOCOL

Draft Version 1.0

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Waterways Engineering and Wetlands
Division of Wetlands, Encroachments and Training

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Waterways Engineering and Wetlands

DOCUMENT NUMBER: 310-2137-001

TITLE: Pennsylvania Function Based Compensation Protocol

EFFECTIVE DATE: Upon publication of notice as final in the *Pennsylvania Bulletin*

AUTHORITY: The Dam Safety and Encroachments Act, Act of November 26, 1978, P.L. 1375, as amended, P.S. § 693.1 et seq.

POLICY: This document provides guidance for establishing a system for valuing compensatory mitigation for use with Chapter 105 actions.

PURPOSE: To provide standard guidelines for evaluating need for aquatic resource mitigation for the purposes of meeting application requirements contained in Chapter 105. The guidance outlines how to conduct evaluations, the factors to consider and establishes a system for quantifying mitigation requirements and proposals to meet those requirements. This guidance is developed for use with the three Level 2 Resource Condition Assessment Protocols (310-2137-002, 310-2137-003 and 310-2137-004).

APPLICABILITY: The guidance document applies to consulting professionals performing mitigation evaluations for planning and permitting requirements for obtaining Chapter 105 Water Obstruction and Encroachment permits and mitigation bank instruments.

DISCLAIMER: The policies and procedures outlined in this guidance are intended to supplement existing requirements. Nothing in the policies or procedures shall affect regulatory requirements.

The policies and procedures herein are not an adjudication or a regulation. There is no intent on the part of DEP to give the rules in these policies that weight or deference. This document establishes the framework within which DEP will exercise its administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.

PAGE LENGTH: 36 pages

Table of Contents

Purpose

The purpose of this protocol is to:

1. Establish a process for determining aquatic resource compensation requirements.

2. Establish a process for determining the potential value of proposed aquatic resource compensation projects.

This protocol is intended for use in determining functional compensation requirements for projects effecting watercourses (streams and rivers); floodways and floodplains; wetlands and open bodies of water, such as lakes and reservoirs; requiring authorization by Pennsylvania Department of Environmental Protection (DEP) and the Army Corps of Engineers (ACOE) regulatory programs.

This protocol does not take the place of avoidance and minimization of a project's proposed direct and secondary impacts or take the place of a project specific review and evaluation. An applicant for a Chapter 105 permit is required to provide a mitigation plan. 25 Pa. Code § 105.13(d)(1)(ix). Mitigation is defined as follows:

> (i) An action undertaken to accomplish one or more of the following:
>
> (A) Avoid and minimize impacts by limiting the degree or magnitude of the action and its implementation.
>
> (B) Rectify the impact by repairing, rehabilitating or restoring the impacted environment.
>
> (C) Reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action.
>
> (ii) If the impact cannot be eliminated by following clauses (A)—(C), compensate for the impact by replacing the environment impacted by the project or by providing substitute resources or environments.

25 Pa. Code § 105.1. Accordingly, the project specific review may result in adjustments to the compensation requirements or credits obtained through the application of this process.

This protocol is intended to:

1. Provide a process in which compensation is required to offset proposed aquatic resource impacts.

2. Assist in identifying measures that minimize proposed project effects and thereby reduce subsequent compensation requirements.

3. Evaluate proposed compensation projects performed on-site, off-site, at a mitigation bank, or through an in-lieu fee project.

The utilization of this protocol ensures a standardized process for determining compensation requirements, evaluating and crediting compensation projects regardless of the method of implementation. This protocol and companion aquatic resource condition level 2 rapid assessment protocols (**See Section 1.0**) can be found on the World Wide Web at www.dep.state.pa.us/XXXXX.

Introduction

One of the purposes of Chapter 105, among others, is to protect the natural resources, environmental rights and values secured by the PA Const. Art. I, § 27 and conserve and protect the water quality and carrying capacity of watercourses. 25 Pa. Code § 105.2(4). DEP has established this protocol to outline an acceptable process for determining aquatic resource compensation requirements that result from impacts to aquatic resources authorized pursuant to Chapter 105 authorizations. This protocol is intended to ensure that compensation requirements and proposals, at a minimum, meet the requirements of Chapter 105, as well as the ACOE and Environmental Protection Agency's (EPA) Final Joint Federal Mitigation Rule published in April 2008. 33 C.F.R. §§ 332.1-332.8; 40 C.F.R. §§ 230.91-230.98.

The following protocol applies to all intermittent and perennial watercourses (wadeable and non-wadeable), floodways and floodplains, wetlands and other open bodies of water such as lakes and reservoirs.

1.0 Aquatic Resource Functions

Each type of aquatic resource (i.e. riverine, palustrine and lacustrine environments) has an inherent suite of ecosystem services that may be present or occurring, herein referred to as "functions". The functions occurring within an aquatic resource can naturally vary due to differences in the chemical, physical and biological composition of the resource at any given location. In addition, anthropogenic influences can greatly affect the presence or performance level of these inherent functions. To account for the natural variation in functions, function groupings were established for each aquatic resource type. The function groups represent multiple functions that have similar or related physical, chemical or biological attributes. The current condition of a resource is important to understanding the ambient level of functioning that is occurring in the resource and should be considered in establishing any compensatory mitigation requirements. This process considers the existing resource condition during the determination of compensatory requirements. The effects that anthropogenic activities outside of the proposed project have on the existing aquatic resource conditions is in most cases established through the use of resource condition level 2 rapid assessment protocols. The three companion resource condition assessment protocols are:

- **Pennsylvania Wetland Condition Level 2 Rapid Assessment Protocol**
- **Pennsylvania Riverine Condition Level 2 Rapid Assessment Protocol**
- **Pennsylvania Lacustrine Condition Level 2 Rapid Assessment Protocol**

There may be instances where more detailed assessments of resource conditions are required by DEP. This process was developed to accommodate other intensive measures of resource conditions such as Hydrogeomorphic (HGM) functional models, Habitat Evaluation Procedure (HEP) models and Index of Biological Integrity (IBI) models, provided the results of the procedures can be indexed or converted to a 0-1 scale. DEP will direct an applicant on the process of utilizing such procedures on a case-by-case basis.

The function groups for each aquatic resource type are identified and briefly described below. The groups described for each aquatic resource type provide the basis for determining functional compensation requirements, however, these function groups are not intended to represent all

resource functions occurring within a given aquatic resource type. They are designed to represent the predominant functions present within each resource. Additional compensation may be required based upon a project's effect on other functions that are not considered as part of this process. These requirements will be determined on a case-by-case basis.

The grouping and labeling of aquatic resources within this protocol utilizes the terminology from the Cowardin classification system. This terminology is used for organizational purposes only and should not be confused with specific state or federal regulatory classification requirements, nor should they be interpreted to replace or supplant regulatory definitions and requirements. At this time these group labels include Riverine, Palustrine/Tidal and Lacustrine environments. While there are numerous ways of classifying aquatic resources, the use of Cowardin classification system provided a common bridge between the state and federal regulatory programs that in some instances may label resources differently for various purposes. This labeling may differ from the current terminology used by either of the state or federal regulatory programs; however, the intent for establishing these categories is for organizational and instructional purposes only and in no way expands or diminishes either state or federal regulatory program authorities. The following functional groups have been established for each of the resource categories.

1.1 Riverine: Watercourses, Streams, Wadeable Rivers and their Floodplains

The traditional approach for evaluating a project's effect on this type of resource has been to primarily focus on the wetted perimeter or instream habitat component of the watercourse. To ensure the long-term viability of this aquatic resource, it is necessary to consider a project's effect on the entire resource and not just the instream habitat component of the resource. The functions inherent to this resource are driven by more than instream habitat and a more holistic or encompassing view of the resource is necessary to ensure the long-term health and viability of these ecosystems.

In more recent efforts led by the ACOE's Ecosystem Management and Restoration Research Program (Fischenich, 2006), three key functions in five functional groupings were selected from a list of over 60 identified functions associated with riverine environments. There is a significant amount of interdependence between these functions and the framework established by that effort underscores the complexity of riverine ecosystems. While this framework provides a significant advance in understanding stream functioning and their interrelationships, it is not yet clear how this effort would integrate with existing regulatory program requirements. However, this work does provide a glimpse into future efforts at the state and federal levels for ensuring impacts to riverine functions are avoided, minimized and compensated when affected.

While the above mentioned work provides a glimpse into the future, the concept of the riparian ecotone provides the comprehensive view of the resource that will meet the current regulatory program requirements. The coupling of these two approaches will be investigated in the future through program development efforts. The riparian ecotone provides a robust basis for defining the extent of this aquatic resource, delineating its boundaries and is useful for describing the basic processes and functions that occur within this type of aquatic resource.

Ecotones are an assemblage of ecosystems that interact with each other chemically, physically and biologically. Riparian ecotones are a three dimensional space of interaction that include terrestrial and aquatic ecosystems that extend down into the groundwater, up above the canopy, outward across the floodplain, up the near-slopes that drain water laterally into the terrestrial ecosystem, and along the water course at a variable width. The riparian ecotone includes the watercourse, 100 year floodplain and 100 feet landward along the valley. Where obvious slumps or landslides occur near the floodplain, they are banded 45 feet around their edge instead of 100 feet, adapted from Verry et al. (2004). The riverine functions have been grouped into four basic function groups:

- **Hydrologic**
- **Biogeochemical**
- **Habitat**
- **Recreation or Resource Support**

Diagram 1 below depicts the location of these basic functions relative to a typical riverine resource cross-section. The Hydrologic function group encompasses the channel and floodplain, the Biogeochemical function group occurs within the floodplain and any islands within the channel, the Habitat function group occurs within the banks of the channel and the Recreation or Resource Support both occur within the channel as well.

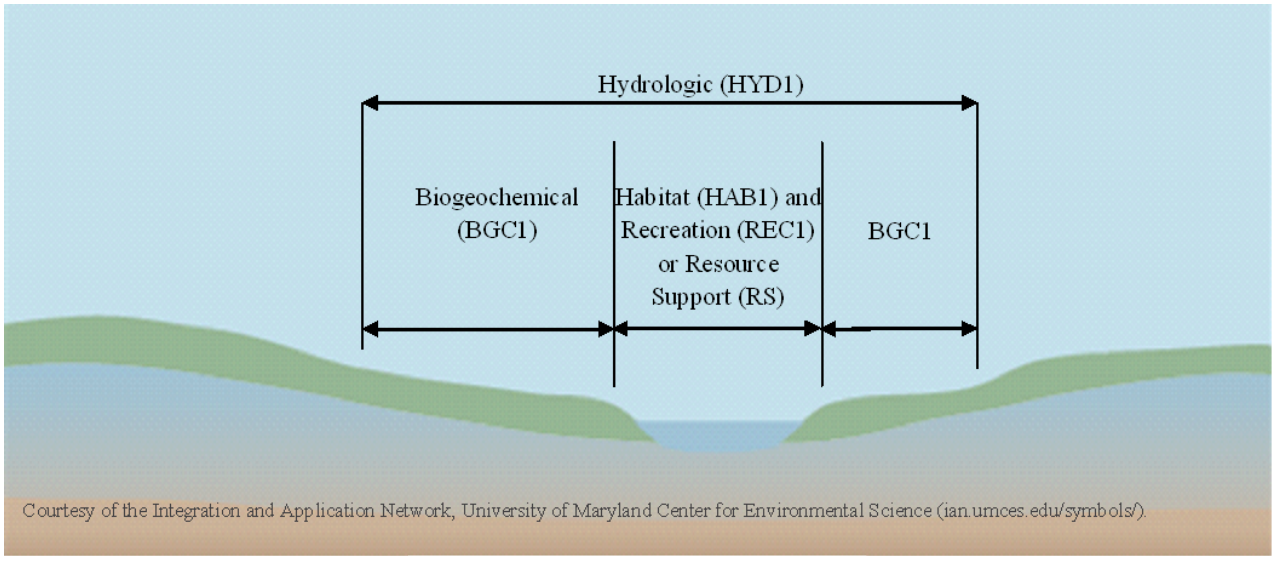

Diagram 1 Riverine Function Groups

The following function groups are representative of the basic functions occurring within the riparian ecotone that are most affected by the typical structures and activities seeking authorization. These function groups provide the basis for determining compensatory requirements or valuation of compensation proposals:

- **Hydrologic (HYD1)** function group includes the storage capacity of the floodplain, energy dissipating characteristics, maintenance of characteristic watershed hydrologic dynamics (e.g., seasonal and storm flow patterns), geomorphic channel stability and sediment transport processes. The level of

performance of this function group is primarily driven by channel characteristics and accessibility to the floodplain as well as contributory watershed conditions.

- **Biogeochemical (BGC1)** function group includes the biogeochemical processes, temperature regulation, nutrient cycling and organic matter cycling (both above and below ground). The level of performance of this function group is primarily driven by the type and quality of riparian vegetation located within the floodplain and the vegetation root system's interactions with the ground water table.

  Note: *This function group will be applied in the context of Chapter 105 and does not encompass the role of a best management practice (BMP) for removing nutrients or pollutants from particular sources. The role of a BMP may provide additional credits under other regulatory or non-regulatory programs and may be considered above and beyond the inherent biogeochemical functions evaluated under this protocol*.

- **Habitat (HAB1)** function group is comprised of numerous attributes within and immediately adjacent to the watercourse. This area is commonly referred to as instream habitat. The ordinary high water mark (OHWM) and/or the banks of the watercourse provide easily observable delineating points to establish the physical boundaries of this area. These functions include providing for the life requirements of invertebrate, vertebrate, emergent plant, macrophytes and other plant species located within or on the banks of an active watercourse. Standard habitat types will be utilized to provide consistency in the process; however, other habitat types may be identified for unique resources on a case-by-case basis. The protected uses for aquatic life contained in 25 Pa. Code Chapter 93 Water Quality Standards will be used to categorize general habitat types consisting of cold water fishery (CWF), warm water fishery (WWF), trout stocked fishery (TSF) and migratory fishery (MF).

- **Recreation or Resource Support (REC1 or RS)** is a dual function group in which values are comprised of either public recreational opportunities (REC1) that include fishing, boating, swimming, etc. ***or*** the chemical, physical and biological attributes (RS) that contribute to maintaining downstream water quality designations and uses. The RS group also may include the maintenance of downstream existing and designated recreational uses. The protected uses for recreation and fish consumption contained in 25 Pa. Code Chapter 93 Water Quality Standards will be used to categorize the general types of recreation consisting of boating (B), fishing (F), water contact sports (WC) and esthetics (E). The applicable function group is established first by determining whether recreational opportunities are present, if none are designated or known to exist then the RS function group becomes the default function group. RS functions should be categorized using 25 Pa. Code Chapter 93 Water Quality Standards nomenclature for special protection waters exceptional value (EV) or high quality (HQ) and the protected uses for aquatic life described above previously CWF, WWF, TSF and/or MF.

1.2 Wetlands: Palustrine/Tidal

The HGM wetland classification system provides a robust basis for describing the basic processes and function groups that occur within any given wetland type. There are currently eleven HGM function models that were developed for use in Pennsylvania as listed in Table 1 (Brooks, 2004). However, greater than 95% of wetland impacts are not sufficient in size to warrant the use of HGM function models. Wetland functions vary greatly from one wetland to another due to a variety of factors, including landscape position, hydrodynamics and naturally occurring differences in the chemical, physical and biological composition of the wetland. This resource category represents all wetland types as defined in § 105.1 and includes those wetlands classified by Cowardin as palustrine, tidal, estuarine and lacustrine.

The HGM function models developed represent the predominant functions that occur across the range of HGM wetland types found in Pennsylvania. The HGM models are grouped into three basic function groups:

- **Hydrologic (HYD2)**
- **Biogeochemical (BGC2)**
- **Habitat (HAB2)**

Table 1. HGM Functions by Functional Group

Group	Function	Description
HYD2	F1	Energy Dissipation/Short-Term Surface Water Detention
	F2	Long Term Surface Water Storage
	F3	Maintain Characteristic Hydrology
	F4	Reserved
BGC2	F5	Removal of Imported Inorganic Nitrogen
	F6	Solute Adsorption Capacity
	F7	Retention of Inorganic Particulates
	F8	Export of Organic Carbon (dissolved and particulate)
HAB2	F9	Maintain Characteristic Native Plant Community Composition
	F10	Maintain Characteristic Detrital Biomass
	F11	Vertebrate Community Structure and Composition
	F12	Maintain Landscape Scale Biodiversity

The following three function groups are representative of the basic functions occurring within wetlands and will provide the basis for determining any compensatory requirements or valuation of compensation projects:

- **Hydrologic (HYD2)** function group includes energy dissipation, short-term and long-term surface water detention, and maintenance of characteristic hydrology. These functions are driven by the hydrodynamics of the wetland, gradient, roughness, landscape position, macrotopography, hydrologic source, recharge zones, aquatic connectivity, as well as, other geomorphological features. The source of water (surface versus ground) may also be a determinate of plant communities (Bishop, 2004).

- **Biogeochemical (BIOG2)** function group includes inorganic nitrogen removal, solute adsorption capacity, inorganic particulate retention and export of dissolved and particulate organic carbon. These functions are driven by the percent of organic matter, reduction/oxidation processes, gradient, biomass, roughness, macrotopography, coarse woody debris and fine woody debris.

- **Habitat (HAB2)** function group is comprised of characteristic native plant community compositions, characteristic detrital biomass, vertebrate community structure and composition and maintenance of landscape scale biodiversity. These functions are driven by species composition, vegetation regeneration capability, coarse woody debris, fine woody debris, snags, organic matter, habitat attributes, landscape condition and aquatic connectivity. While standard habitat types will be utilized as described in Table 2, specific habitats types may be identified for unique resource types on a case-by-case basis. The Cowardin classification system will be used in most cases as follows:

Table 2. Wetland Habitat Types

CODE	DESCRIPTION
EAB	Estuarine Aquatic Bed
EEM	Estuarine Emergent
EFL	Estuarine Flat
LAB	Lacustrine Aquatic Bed
LEM	Lacustrine Emergent
LFL	Lacustrine Flat
PAB	Palustrine Aquatic Bed
PEM	Palustrine Emergent
PFL	Palustrine Flat
PFO	Palustrine Forested
PSS	Palustrine Scrub/Shrub

1.3 Lacustrine: Lakes, Reservoirs and Non-Wadeable Rivers

Though these three water bodies differ substantially in some ways, several characteristics demonstrate a convergence in functions. This resource category does not include wetland areas that meet the definition of wetland as defined in § 105.1. Lakes lack significant flow while rivers are defined by flow for most of their length. Reservoirs are largely manmade hybrids of the former systems. However, as rivers approach their mouths and the gradient decreases, lacustrine qualities predominate under normal and low flow conditions in many areas of large rivers and inputs become more autochthonous. Shoreline and backwater areas can be indistinguishable from a lake or reservoir environment.

The following function groups are representative of the basic functions occurring within lakes, reservoirs and large rivers that will provide the basis for determining any compensatory requirements or valuation of compensation projects:

- **Habitat (HAB3)** function group is comprised of numerous attributes within and immediately adjacent to the wetted perimeter of the lake, reservoir or large non-

wadeable river. These functions include the physical requirements to provide invertebrate, vertebrate and macrophyte species life requirements. These functions are driven by the composition of the substrate, water depth and velocity, shoreline vegetation, near shore vegetation condition, etc. Some standard habitat types may be utilized; however, specific habitats types may be identified for unique resource types on case-by-case basis. The protected uses for aquatic life contained in 25 Pa. Code Chapter 93 Water Quality Standards will be used to categorize general habitat types consisting of CWF, WWF, TSF and MF.

- **Recreation (REC2)** function group values are comprised of public recreational opportunities including fishing, boating, swimming, etc. This group also includes the maintenance of existing and designated recreational uses. The protected uses for recreation and fish consumption contained in 25 Pa. Code Chapter 93 Water Quality Standards will be used to categorize general types of recreation consisting of B, F, WC and E.

2.0 Compensation Requirement Evaluation

The evaluation process for determining whether a project may require compensation begins with establishing a project's potential effect on the respective function groups for the applicable resource category. This process begins with determining the area of impact for each applicable resource category function group and then proceeds to determining the project effect category for each of the applicable function groups. Compensation requirements will be determined for each resource function group. The determination of compensation follows the evaluation of avoidance and minimization of project impacts that is performed during the permit application review in accordance with Chapter 105 requirements.

2.1 Area of Impact

The area of impact(s) must be determined for each of the resource category function groups proposed to be affected. Acreage is calculated to the nearest one hundredth of an acre (0.00). In many instances, the project may affect more than one function group. Impacts may be comprised of both direct and indirect project effects. Direct impacts are considered to have both acreage and functional losses, whereas indirect impacts result in a change in function without the loss of acreage.

Direct impacts consist of filling, draining or conversion of a resource to another type such as a wetland to an open body of water. Examples include placement of fill in a wetland, placement of a box culvert in a stream, placement of fill in the floodplain, building a dam where the impoundment area will flood resources (stream, floodplain or wetlands) with a sufficient depth as to change the existing aquatic resource to another aquatic resource type. This would include changes such as converting a riverine system to a lacustrine system, changing a palustrine wetland to a lacustrine system, etc.

Indirect impacts consist of altering the chemical, physical or biological components of an aquatic resource to the extent that changes to the functions of the resource results. However, indirect impacts do not result in a loss of resource acreage. Changes include such things as conversion of a forested wetland system to a non-forested state through chemical, mechanical or hydrologic manipulation that results in a maintained state of

vegetation; altered hydrologic conditions (increases or decreases) such as stormwater discharges or water withdrawals that alter the chemical, physical or biological functions of the resource, areas upstream and downstream of a culvert or bridge that require periodic excavation to ensure waterway openings (e.g. bedload deposition removal), etc.

Criteria for establishing direct and indirect impacts associated with navigational and commercial dredging projects are not considered in this process. The impacts from these activities have unique conditions and this process was not developed to establish compensatory requirements for these types of projects. However, impacts associated with maintenance dredging around facilities can be addressed by this process and should be applied. Compensatory mitigation for navigational and commercial dredging projects can use this basic framework established by this protocol, however, unique measures of resource condition, function groups, project effect factors and compensation value tables may need to be determined on a case-by-case basis.

2.2 Project Effect Category Value (P_E)

Impacts may result in varying levels of effect to aquatic resources and their corresponding functions. Different types of impacts can therefore be classified based upon the degree to which they are expected to affect the various functions. However, the effects of a project are not necessarily equal across the suite of a resource's functions. A project's effect is evaluated for each applicable function group of the aquatic resource category proposed to be affected. **Table 3** provides example criteria for each of the four Project Effect Categories (Severe, Moderate, Limited, and Minimal) for each of the aquatic resource types and function groups. Each Project Effect Category has a corresponding P_E value, as provided in **Table 3**, the more severe the effect the higher the P_E value. Therefore, an activity considered to have a severe effect has the highest P_E value of 3.0 representing an activity or structure that has a complete or near-complete loss of all beneficial functions for the applicable resource function group. Conversely, an activity considered to have a minimal effect has a P_E value of 0.0. These activities or structures generally will not require compensation; however, they are included in **Table 3** to show that project designs or modifications can result in the minimization of a project's effect. Project design modifications may be documented in the permit application to demonstrate the extent of efforts to minimization impacts. This minimization may reach the point to which that activity or structure falls into the Minimal Project Effect Category and therefore compensation may not be required.

As described above, the project's effect is **individually** evaluated for each applicable resource category function group. A project may have differing P_E values for individual function groups depending on the project specifics. The criteria listed in **Table 3** or discussed in the narrative can be used directly or used to guide project reviewers for establishing additional equivalent criterion. If an identified criterion for a project's effect is not listed for an applicable resource function group, then best professional judgment should be used in determining the most applicable Project Effect Category. A project reviewer may identify alternative criteria to determine the Project Effect Category.

2.2.1 Riverine: Watercourses, Streams, Wadeable Rivers and their Floodplains

- **Hydrologic (HYD1)** A project can have significant effects on the carrying capacity of the floodplain by altering the cross-sectional area of the floodplain, roughness or flood storage capacity. Secondary effects are possible by altering hydraulic characteristics of the stream resulting in possible changes to aquatic habitat and sediment transport processes. Additional changes may occur from altering runoff amounts from rainfall events and the timing of runoff due to landscape alterations. The P_E value is determined by the extent of the change in 100 year frequency flood event elevation, the existence of detailed flood studies, or extent of the fill placement in portions of the floodplain of streams with ≤ 6,400 acre drainage areas.

- **Biogeochemical (BGC1)** A project can have significant effects on the fundamental nutrient, organic matter processing and chemical or biological processes that occur within or originate from these areas. Particular attention is placed on the ability of the floodplain area to support a mature forested community or vegetated wetland when present. The key to determining the project effect value of this function group is evaluating the ***potential ability*** of the floodplain area to support a forested condition or to maintain vegetated wetlands. The interaction of the floodplain vegetation with the groundwater table or the interference of such interaction factors into determining the value. The current condition of the floodplain area (forested versus lawn) does not factor into the P_E value determination. However, the existing floodplain condition is factored into the process through the resource condition assessment and is reflected in the resulting resource condition score.

- **Habitat (HAB1)** A project can have significant effects on aquatic habitat from direct losses through the placement of fill materials, structures; or indirectly affected through hydraulic changes, scour and redeposition, sediment transport changes or through re-occurring long term maintenance activities of a project. The P_E value is determined by evaluating the capacity of the area to be used as habitat after the project is completed or the extent of the changes or transformations of the area that may result from indirect sources. In addition, the resulting condition of the stream banks (i.e. armoring banks with riprap stone) is another factor that is used to evaluate the need for compensation.

- **Recreation or Resource Support (REC1 or RS)** This is a dual function group and, where present, recreation uses are primary over resource support functions and will be used for compensation determination. If recreation functions are not present, then the Resource Support function group becomes the primary and is used for any compensation determination. A project can have significant effects on the ability of the public to utilize the resource for recreational opportunities by preventing access to the resource, blocking navigation, eliminating use of the resource, etc. In watercourses that do not provide recreation (i.e. small to

headwater streams), a project can affect the physical, chemical and biological processes that contribute to the maintenance of downstream designated or existing uses. The P_E value is determined by evaluating the total stream length of an individual stream affected or the total stream length affected in a watershed through elimination, enclosing, culverting, etc. (disconnecting form groundwater interaction).

2.2.2 Wetlands: Palustrine/Tidal

- **Hydrologic (HYD2)** A project can have significant effects on surface water drainage patterns, regulation of flow or source of hydrology, which can result in long term changes to other function groups that may not be readily observable or measurable and may take extended periods of time to manifest, while in other instances, the changes may be quick and dramatic. Landscape position plays a dominate role in establishing the source of hydrology and the general movement or pathway taken. The P_E value is determined by evaluating the project's effect on conversion of wetland areas to open water, dry land, and connection to surface water sources, draining or topographic modification occurring. Increases in stormwater discharges, infiltration or diminution of hydrology through withdrawal of surface or groundwater that results in departures from typical hydrographs for the appropriate HGM subclasses may also be considered.

- **Biogeochemical (BGC2)** A project can have significant short- and long-term effects on the biogeochemical processes when changes occur to the typical hydroperiod of specific HGM subclass of wetland as a result of a project. The P_E value is determined by evaluating the project's effect on direct losses, hydrologic modifications, decreased macrotopography, biomass and both coarse and fine woody debris through vegetation management may also result in modifications to the biogeochemical functioning of a wetland. Many types of projects not associated with direct losses, such as utility line crossings, may result in changes to this function group depending upon the level of disturbance, regeneration technique, vegetation management and relationship of disturbed area to overall wetland size.

- **Habitat (HAB2)** A project can have significant effects to habitat functions through direct loss of habitat acreage, conversion of resources from palustrine to lacustrine or from vegetation management activities. The P_E value is also determined by evaluating the project's effect on vegetation structure or interference with the potential for regeneration through management, while not a loss of wetland area they are considered a secondary loss of function. The method of revegetation and the likelihood of invasive species colonization will also be evaluated. Cowardin vegetation classification in the form of aquatic bed (AB), emergent (EM), scrub shrub (SS) and forested (FO) will form the basis for recording loss of habitat functions. Species specific habitat may form the basis for compensation, especially where threatened or endangered species are

concerned or unusual or rare palustrine wetland communities may be used as the basis.

Note: Vernal pools are considered Palustrine wetlands HGM subclasses: DFC or DFA.

2.2.3 Lacustrine: Lakes, Reservoirs and Non-Wadeable Rivers

- **Habitat (HAB3)** A project can have significant effects on aquatic habitat through actual losses through the displacement of the habitat, areas affected by shading and sediment transport and deposition pattern changes and areas affected through long term maintenance activities resulting from the project**.**

- **Recreation (REC2)** A project can have significant effects on the ability of the public to utilize the resource for recreational opportunities by preventing access to the resource, blocking navigation, eliminating the resource, etc. Projects can also result in interference of processes that contribute to the maintenance of downstream recreational opportunities such as flow regulation.

Table 3 Project Effect Category

<table>
<tr><th colspan="6">Project Effect Category</th><th>Value</th></tr>
<tr><td colspan="6">Severe Effect</td><td rowspan="11">3.0</td></tr>
<tr><th>Function Group</th><th>Riverine</th><th>Function Group</th><th>Wetland</th><th>Function Group</th><th>Lacustrine</th></tr>
<tr><td rowspan="3">HYD1</td><td>1. Fills or structures that result in any increase in the 100-year frequency water surface elevation in a delineated FEMA mapped floodway; or</td><td rowspan="3">HYD2</td><td>1. Wetland area converted to open water or dry land (non-wetland) through inundation or filling; or</td><td colspan="2" rowspan="4">N/A</td></tr>
<tr><td>2. Fills that eliminate significant portions of the floodplain of streams with ≤ 6,400 acre drainage areas extending along > 500 linear feet of stream length.</td><td>2. Wetland connection to stream/floodplain or other natural surface drainage features lost contributing to hydrologic source of wetland; or</td></tr>
<tr><td>3. Wide spread hydrologic modification through draining, flooding or topographic modification.</td></tr>
<tr><td rowspan="3">BGC1</td><td>1. Floodplain ability to support vegetation eliminated through filling/development; or</td><td rowspan="3">BGC2</td><td>1. Wetland area converted to open water or dry land (non-wetland); or</td></tr>
<tr><td>2. Floodplain converted to open body of water through inundation; or</td><td>2. Wide spread activities effecting surface roughness (vegetation clearing or maintenance, clearing or grubbing (macro and microtopography reduction); or</td></tr>
<tr><td>3. Floodplain vegetation isolated from accessing groundwater table via activities that lower groundwater table levels (e.g. dredging of stream channel, filling of floodplain areas).</td><td>3. Wide spread hydrologic modification through draining, flooding or topographic modification (project results in 4 or more hydrologic stressors from Level 2 RAP).</td></tr>
<tr><td rowspan="2">HAB1</td><td>1. Stream substrate replaced with concrete, metal, plastic, riprap, buried with fill, etc.; or</td><td rowspan="2">HAB2</td><td>1. Wetland area converted to open water or dry land (non-wetland); or</td><td rowspan="2">HAB3</td><td>1. Bottom substrate of near shore areas replaced with concrete, metal, plastic, riprap, buried with fill, etc.; or</td></tr>
<tr><td>2. Stream bank armoring along > 1000 linear feet of stream bank (each bank length measured independently).</td><td>2. Greater than 60% of the individual delineated wetland area effected by vegetation clearing or long term vegetation management.</td><td>2. Structure that causes extenisve shading of near shore bottom prohibiting macrophyte growth resulting from project.</td></tr>
<tr><td>REC1</td><td>1. Recreational use potential eliminated or altered to the point of unavailbility or non-use.</td><td colspan="2" rowspan="2">N/A</td><td>REC2</td><td>1. Recreational use potential eliminated or altered to the point of unavailbility or non-use.</td></tr>
<tr><td rowspan="2">RS</td><td>1. Greater than 500 feet of continuous stream eliminated, enclosed or disconnected from the groundwater table; or</td><td colspan="2" rowspan="2">N/A</td></tr>
<tr><td>2. Cumulative effect of a project is > 2,000 linear feet of stream in any one State Water Plan watershed.</td></tr>
</table>

Table 3 Project Effect Category con't

Project Effect Category						Value
Moderate Effect						
Function Group	**Riverine**	**Function Group**	**Wetland**	**Function Group**	**Lacustrine**	
HYD1	1. Fills or structures that result in > 1.0 foot rise in the 100-year frequency water surface elevation of the natural unobstructed water surface elevation; or 2. Fills that eliminate significant portions of the floodplain of streams with ≤ 6,400 acre drainage areas extending along > 100 but ≤ 500 linear feet of stream length.	HYD2	1. Hydrologic patterns altered from typical hydrographs for HGM wetland subclass (i.e. seasonal saturation / fluctuation changed to static persistent level); or 2. Multiple stormwater runoff sources directed to wetland whether point or non-point in origin; or 3. Moderate hydrologic modification through draining, flooding or topographic modification.	N/A		2.0
BGC1	1. Floodplain vegetation maintained in a non-forested state through physical, mechanical or chemical means (e.g. maintaining right of ways); or 2. Floodplain vegetation removed and left to natural regeneration and likelihood of invasive species colonization is moderate to high. 3. Loss of macrotopographic features or features contributing to surface roughness due to project; or	BGC2	1. Wetland vegetation maintained in a non-forested state through physical, mechanical or chemical means (e.g. maintaining right of ways); or 2. Wetland vegetation removed and left to natural regeneration, likelihood of invasive species colonization is moderate to high. 3. Loss of macrotopographic features or features contributing to surface roughness due to project; or			
HAB1	1. Structure results in stream substrate being altered by flow and velocity changing scour and deposition features; or 2. Areas upstream and downstream of a structure authorized to be maintained to ensure waterway opening capacity; or 3. Stream bank armoring along > 500 but ≤ 1000 linear feet of stream bank (each bank length measured independently).	HAB2	1. Greater than 30% but ≤ 60% of the individual delineated wetland area effected by vegetation clearing, long term vegetation management or other activities that would alter habitat conditions.	HAB3	1. Areas of structure > 0.1 ac. and any mainenance dredging extending outward no more than 10 feet around structure; or 2. Bottom substrate of near shore areas authorized to be maintained for docking or mooring purposes or for other activities that extend beyond 10 feet from the structure; or 3. Structure that causes significant shading of near shore bottom prohibiting macrophyte growth resulting from project.	
REC1	1. Recreational use potential disrupted or restricted due to project; or 2. Recreational use interference or loss extensive in scope but temporary in nature.	N/A		REC2	1. Recreational use potential disrupted or restricted due to project;or 2. Recreational use interference or loss extensive in scope but temporary in nature.	
RS	1. Greater than 100 but ≤ 500 feet of a single continuous stream is eliminated, enclosed or disconnected from the groundwater table; or 2. Cumulative effect of a project > 1,000 but ≤ 2,000 feet of stream effected in any one State Water Plan watershed.			N/A		

Table 3 Project Effect Category con't

<table>
<tr><th colspan="6">Project Effect Category</th><th>Value</th></tr>
<tr><td colspan="6">Limited Effect</td><td rowspan="9">1.0</td></tr>
<tr><th>Function Group</th><th>Riverine</th><th>Function Group</th><th>Wetland</th><th>Function Group</th><th>Lacustrine</th></tr>
<tr><td>HYD1</td><td>1. Fills or structures that result in an increase of the 100-year frequency water surface elevation of the natural unobstructed water surface elevation but result in less than a 1.0 foot rise; or</td><td>HYD2</td><td>1. Hydrologic patterns altered from typical hydrographs for HGM wetland subclass but within 25% of normal range (i.e. seasonal saturation); or</td><td colspan="2" rowspan="3">N/A</td></tr>
<tr><td></td><td>2. Fills that eliminate significant portions of the floodplain of streams with ≤ 6,400 acre drainage areas extending along < 100 linear feet of stream length.</td><td></td><td>2. Limited hydrologic modification through draining, flooding or topographic modification; or</td></tr>
<tr><td>BGC1</td><td>1. Floodplain vegetation removed and left to natural regeneration and likelihood of invasive species colonization is low.</td><td>BGC2</td><td>1. Wetland shrub and forested vegetation removed and left to natural regeneration and likelihood of invasive species colonization is low.</td></tr>
<tr><td>HAB1</td><td>1. Bridges spanning the channel and floodplain, with instream piers; or
2. Stream bank armoring along ≤ 500 feet of stream bank (each bank length measured independently).</td><td>HAB2</td><td>1. Greater than 10% but ≤ 30% of the individual delineated wetland area effected by vegetation clearing, long term vegetation management or other activities that would alter habitat conditions.</td><td>HAB3</td><td>1. Area of dock > 0.02 ac. but ≤ 0.1 ac. and mainenance dredging extending outward no more than 10 feet around dock structure.</td></tr>
<tr><td>REC1</td><td>1. Recreational use interference or loss limited in scope and temporary in nature (< 1 year in duration).</td><td colspan="2" rowspan="3">N/A</td><td rowspan="2">REC2</td><td rowspan="2">1. Recreational use interference or loss limited in scope and temporary in nature (< 1 year in duration).</td></tr>
<tr><td rowspan="2">RS</td><td>1. Less than 100 feet of continuos stream channel eliminated, enclosed or disconnected from the groundwater table; or</td></tr>
<tr><td>2. Cumulative total of a project > 100 but ≤ 1,000 linear feet of stream effected in any one State Water Plan watershed.</td><td colspan="2">N/A</td></tr>
</table>

Table 3 Project Effect Category con't

Project Effect Category						Value
Minimal Effect						0.0
Function Group	**Riverine**	**Function Group**	**Wetland**	**Function Group**	**Lacustrine**	
HYD1	1. Fills or structures that do not result in a rise in the 100-year frequency water surface elevation of the natural unobstructed water surface elevation and fills are not located in portions of the floodplain of streams with ≤ 6,400 acre drainage areas.	HYD2	1. No hydrologic modification through draining, flooding, topographic modification or from stormwater discharges.	N/A		
BGC1	1. Floodplain tree canopy closure maintained; or 2. Potential for tree canopy closure remains and area restored with native tree and shrub species plantings.	BGC2	1. Typical hydrology, hydrodynamics and vegetation structure maintained for HGM subclass and vegetation type.			
HAB1	1. Bridges spanning the channel and floodplain, no instream piers.	HAB2	1. Less than or equal to 10 % of the individual delineated wetland area effected by vegetation clearing or long term vegetation management.	HAB3	1. Area of dock ≤ 0.02 ac. and mainenance dredging extending outward no more than 10 feet around structure.	
REC1	1. Recreational uses unimpeded or maintained without altering recreational use.	N/A		REC2	1. Recreational uses unimpeded or maintained without altering recreational use.	
RS	1. Stream not eliminated, enclosed or disconnected from the groundwater table; or 2. Cumulative total of a project less than 100 feet in any one State Water Plan watershed.			N/A		

3.0 Aquatic Resource Value Category

Evaluation of a project's effect and the amount of compensatory mitigation requires consideration of the aquatic resource's uniqueness, special characteristics, related classification, etc. and assignment of an Aquatic Resource Value (R_V). There are five categories of Aquatic Resource Values: Significant Resource Waters, Special Resource Waters, Quality Resource Waters, Support Resource Waters and Minimal Resource Waters.

All Commonwealth waters have designated and existing use protections as defined in 25 Pa. Code Chapter 93 Water Quality Standards. The Aquatic Resource Value Category takes into consideration these certain uses as well as other criteria for assigning a resource value such as, resource condition, biological communities; special regulation areas established by the Pa. Fish and Boat Commission and other unique or regional public recreational opportunities.

The Aquatic Resource Value Category is determined by using the criteria below and applying it to the reach or area assessed as part of a permit application or proposed compensatory mitigation project. The highest resource value that occurs within the assessment area should be used in determining compensation requirements or valuing compensatory mitigation proposals.

DEP staff reviewing permit applications or compensatory mitigation proposals may establish the Aquatic Resource Value Category using alternative criteria provided justification is provided in writing in the record of decision and the applicant is informed of the reasoning for the establishing alternative criteria. Alternative criteria should have a solid regulatory and scientific basis for establishment.

Table 4. Aquatic Resource Value Category

Aquatic Resource Value Category			Value
Significant Resource Waters			
Riverine	**Wetland**	**Lacustrine**	
Waters with a designated or existing use of Exceptional Value under Chapter 93 (relating to water quality standards). Presence of federal or state threatened or endangered species.	Wetlands classified Exceptional Value in accordance with 105.17. Wetlands that support a significant aquatic community scoring equal to or greater than 0.87 using the DEP's Level 2 Wetland Rapid Assessment Protocol. Wetlands characterized by DCNR's wetland plant community classification and designated a State Rank of S1 Critically Imperiled or S2 Imperiled.	Waters with a designated or existing use of Exceptional Value under Chapter 93 (relating to water quality standards). Presence of federal or state threatened or endangered species.	3.0
Special Resource Waters			
Riverine	**Wetland**	**Lacustrine**	
Waters with a designated or existing use of High Quality under Chapter 93 (relating to water quality standards). Waters with a designated or existing use of Migratory Fish and used by migratory fish populations for reproduction (not just passage). Waters designated with special regulations by the PA FBC as big bass waters or trophy trout waters. Geographically unique or rare fisheries (i.e. salmon or steelhead waters, naturally reproducing northern pike waters).	Wetlands that are located in or along the floodplain of the reach of waters with a designated or existing use listed as high quality under Chapter 93 (relating to water quality standards). Wetlands that support a high quality aquatic community based upon scoring equal to or greater than 0.58 but less than 0.87 using the DEP's Wetland Condition Level 2 Rapid Assessment Protocol. Wetlands characterized by the DCNR's natural community classification system and designated a State Rank of S3 Vulnerable.	Waters with a designated or existing use of High Quality under Chapter 93 (relating to water quality standards). Waters designated with special regulations by the PA FBC as big bass waters or trophy trout waters.	2.5

Table 4. Aquatic Resource Value Category Con't.

Aquatic Resource Value Category			Value
Quality Resource Waters			2.0
Riverine	**Wetlands**	**Lacustrine**	
Small streams with greater than 1,280 acre drainage areas but less than or equal to 6,400 acre drainage areas, streams designated Trout Stocked Fisheries (TSF) under Ch. 93 and streams with other recreation valued species present with sufficient populations to provide recreational opportunities.	This category includes all other wetlands not categorized as significant, special, support or minimal resource wetlands. Wetlands that support a quality aquatic community based upon upon scoring equal to or greater than greater than or equal to 0.42 but less than 0.58 using the DEP's Wetland Condition Level 2 Rapid Assessment Protocol.	Includes all other waters not categorized as significant, special, support or minimal resource waters.	
Support Resource Waters			1.5
Riverine	**Wetland**	**Lacustrine**	
Headwater streams with less than or equal to 1,280 acre drainage areas and streams containing non-recreation valued fisheries (CWF and WWF) not identified in above sections.	Wetlands that support an aquatic community based upon scoring less than 0.42 using the DEP's Wetland Condition Level 2 Rapid Assessment Protocol.	Private ponds (including farm or stock ponds) equal to or greater than 10 acres in size.	
Minimal Resource Waters			1.0
Riverine	**Wetland**	**Lacustrine**	
Armored swales, gabion lined channels, riprap lined channels, concrete lined channels and channels constructed to control erosion and sediment or to convey stormwater.	Wetlands as defined in 105.12a(6) related to erosion and sediment control and stormwater management. Treatment wetlands as defined in 105.12a(5) constructed and maintained for the treatment of mine drainage, sewage, or other waste.	Private ponds (including farm or stock ponds) less than 10 acres in size.	

4.0 Resource Condition Assessment

Three companion resource condition assessment protocols have been developed and should be used in establishing the applicable resource condition for utilization in determining the compensation requirements as outlined in **Section 5.0 Determining Compensation Requirements**. This protocol is designed to work with those condition assessment protocols and the use of other condition assessments or measures of biological integrity, etc. are not permitted without prior written approval by DEP. The resource condition protocols were developed to be rapid and cost effective while providing reliable estimates of resource condition. The condition assessments also provide additional information that is considered during the environmental review performed by DEP and ACOE.

There may be instances where intensive Level 3 HGM functional assessments, IBI protocols, Habitat Suitability Models or other such quantitative methods as approved by the DEP are performed in addition to these rapid condition assessments. These circumstances are dealt with on a case-by-case basis.

The condition assessment protocols have been designed to result in a single score that does not exceed 1.0. Results will fall between 0 and 1 and are carried to two decimal places (0.00). The following condition assessment protocols can be found on the World Wide Web at www.dep.state.pa.us/XXXXX.

- **Pennsylvania Wetland Condition Level 2 Rapid Assessment Protocol**
- **Pennsylvania Waterway Condition Level 2 Rapid Assessment Protocol**
- **Pennsylvania Lacustrine Condition Level 2 Rapid Assessment Protocol**

Proposed compensation projects for permittee responsible mitigation, mitigation bank development or in-lieu program should refer to Section 6.0 Evaluating Compensation Proposals for direction on utilizing resource condition assessments or more intensive methods for establishing condition differential.

5.0 Determining Compensation Requirements

The Compensation Requirement (CR) for a project is calculated after the following values have been determined:

1) Determine the area(s) of direct and secondary impacts in acres to the nearest hundredth of an acre (A_I) for each of the applicable resource category function groups;

2) Determine the Project Effect Category and P_E value (s) for each of the applicable functional groups from Table 3;

3) Determine the appropriate R_V value(s) for each of the applicable resources from Table 4;

4) Obtain the appropriate resource condition score(s) for each of the applicable resource categories.

The CR for **each applicable function group** is calculated using the following equation:

Compensation Requirement (CR) = A_I x P_E x R_V x C_I
Where,

CR = Compensation Requirement
A_I = Area of Impact (in acres, 0.00)
P_E = Project Effect Factor (Table 3)
R_V = Resource Value (Table 4)
C_I = Condition Index Value (0.00) (from applicable resource condition assessment)

To determine the CR, the area of impact (A_I) is multiplied by the P_E obtained from Table 3, then multiplied by the R_V from Table 4, then multiplied by the applicable resource C_I. The end product is the amount of compensation credits necessary to offset the effects the project has on each functional group. Where both direct and secondary impacts are documented the CR for each of the impact types for the applicable function groups should be determined independently. The CR should indicate (label) which type of impact direct or secondary for each applicable function group as well.

6.0 Evaluating Compensation Proposals

Proposals for compensating aquatic resource impacts from an applicant, mitigation banker or an in-lieu-fee program, will utilize the following process to evaluate whether the mitigation project proposal will provide adequate compensation to offset the function compensation requirements as determined in **Section 5.0**. Projects proposed by mitigation bankers and in-lieu-fee program may be evaluated independent of compensation requirements to determine the type and amount of function credits generated by a compensatory mitigation project.

6.1 Compensation Value Factor

The compensatory mitigation project will be evaluated for each applicable aquatic resource function group and the level of credits will be determined on a resource function group basis. The same process for determining function compensation requirements is applied to compensatory mitigation project proposals, except instead of the Project Effect Factor table, reviewers will use the Compensation Value Factor table (Table 5) in the calculation to determine the overall value of the compensation proposal. Additional adjustment factors and procedures that may alter the Compensation Value Factor are outlined in **Section 7.0 Compensation Value Adjustment**.

6.2 Condition Differential

The difference between the condition of the resource pre-project implementation and post-project implementation must be determined for each applicable resource proposal. This condition differential will be used to determine the function gains realized as a result of the project. The initial function gain will be based upon design plans and expectations as outlined in the final compensatory mitigation project proposal.

The Level 2 resource condition rapid assessment protocols discussed previously, may be utilized in the planning stages to establish the potential for condition improvement and under some limited circumstances may be sufficient to document the condition

differential; however, in most instances more intensive methods will be needed to ascertain the amount of improvement in resource condition and the methods may vary from function group to function group.

It is especially important to evaluate and provide hydrologic monitoring data for wetland rehabilitation efforts where the intent to restores a wetland's hydroperiod to approximate pre-disturbance patterns.

The resource condition starting point for determining functional gains under the following circumstances will be considered 0 and the compensation project will be given the maximum function gain based upon the final resource state using appropriate and approved measures that can demonstrate improvements to the resource function groups:

- Dam removal with riverine and floodplain reestablishment
- Legacy sediment removal with riverine and floodplain reestablishment
- Wetland establishment and reestablishment (does not included rehabilitation)

The resource condition starting point for determining functional gains under the following circumstances will be based upon the existing resource condition:

- Enhancement of wetland, riverine or lacustrine resources
- Rehabilitation of wetland, riverine or lacustrine resources

In most cases, it will be necessary to perform more detailed or intensive resource condition, functional or other approved measures, including but not limited to HGM functional assessments, Index of Biological Integrity, Habitat Evaluation Procedure, Hydrologic, Hydraulic, or other resource specific modeling. When enhancement or rehabilitation of existing resources is proposed, project developers should coordinate with the DEP and ACOE early in the process to determine the need for more intensive assessment methods. It may be necessary to convert or aggregate intensive findings.

After the project has stabilized and successfully completed monitoring requirements, the selected methods would be performed again and the condition differential would be calculated to determine the final amount of resource credits generated from the project. The timing of the second evaluation may vary from project to project and will be decided upon by DEP and the ACOE.

6.3 Calculating Functional Credit Gain (FCG)

The Functional Credit Gain (FCG) for a compensation project proposal is calculated after the following values have been determined:

1) Determine the area(s) anticipated to gain in functional capacity in acres to the nearest hundredth of an acre (A_P) for each of the applicable functional groups;

2) Determine the appropriate R_V value(s) for each of the applicable resources from Table 4;

3) Determine the Compensation Value Category and C_V value(s) for each of the applicable aquatic resources from Table 5;

4) Obtain the existing resource condition score for each of the applicable resources, utilize protocols and design plans to project final resource condition upon project completion; calculate the condition index differential (CI_{diff}) by subtracting the existing resource condition from the projected resource condition.

The FCG for **each applicable function group** is then calculated using the following equation:

Functional Credit Gain (FCG) = A_P x R_V x C_V x CI_{diff}

FCG = Functional Credit gain
A_P = Area of Project for applicable function group (in acres, 0.00)
R_V = Resource Value (Table 4)
C_V = Compensation Value (Table 5)
CI_{diff} = Condition Index Differential Value (0.00) (this is the difference between the existing condition and the projected condition post project implementation for each applicable resource condition assessment)

Table 5. Compensation Value Factor

Aquatic Compensation Value Category			Value
Extensive			3.0
Riverine	**Wetland**	**Lacustrine**	
1.) Project entails reestablishment of stream and floodplain areas as appropriate in consideration of existing watershed conditions and restoration potentials; or	1.) Project entails reestablishment of wetlands; not rehabilitation, establishment or enhancement. Projects must be equal to or greater than 5.0 acres in size; or	1.) Project entails a comprehensive effort including public recreation access improvement through acquisition/easements; and habitat improvement; or	
2.) Riverine reestablishment or rehabilitation providing 3 of 4 riverine function groups, as appropriate in consideration of existing watershed conditions and restoration potentials and in conjunction with a wetland reestablishment component.	2.) Any size wetland reestablishment in conjunction with a riverine reestablishment or rehabilitation providing 3 of 4 riverine function groups, as appropriate in consideration of existing watershed conditions and restoration potentials	2.) Project including one of the objectives in 1.) above and other efforts involving water quality improvements such as: phosphorus control, sediment control, nitrate control; or shoreline and riparian zone reestablishment or rehabilitation; or contributory riverine, floodplain or wetland reestablishment or rehabilitation.	
Moderate			2.0
Riverine	**Wetland**	**Lacustrine**	
1.) Riverine reestablishment or rehabilitation providing 3 of 4 riverine function groups, as appropriate in consideration of existing watershed conditions; or	1.) Wetland reestablishment project equal to or greater than 1.0 acre but less than 5.0 acres in size; or	1.) Project providing either public recreation improvements or access acquisition\easements and habitat reestablishment or rehabilitation, enhancement or establishment; or	
2.) Any riverine reestablishment or rehabilitation in conjunction with a wetland restoration or approved enhancement project.	2.) Any wetland establishment or enhancement project with specific function targets in conjunction with riverine or floodplain reestablishment or rehabilitation project; or 3.) Wetland establishment or enhancement projects equal to or greater than 5.0 acres in size with specific function targets.	2.) Project coupled with either riverine, floodplain or wetland reestablishment or rehabilitation; must provide 1 of 2 function groups.	
Limited			1.5
Riverine	**Wetland**	**Lacustrine**	
1.) Stream or floodplain rehabilitation or enhancement project; must provide a minimum 2 of 4 functional groups; or	1.) Wetland reestablishment or rehabilitation project < 1.0 acre in size; or 2.) Wetland establishment or enhancement projects < 5.0 acres in size with specific function targets; or	1.) Project provides at least 1 of 2 functional groups; if HAB3 functional group physical habitat improvement must be done. Invasive species control or aquatic plantings ineligible (see Minimal Project Category).	
2.) Any stream or floodplain project coupled with wetland or lacustrine project; must provide 1 of 4 function groups excluding HAB1 function group.	3.) Any wetland reestablishment, rehabilitation or enhancement project with riverine, floodplain or lacustrine project; must provide 1 of 3 function groups.		
Minimal			1.0
Riverine	**Wetland**	**Lacustrine**	
1.) Proposed project only entails riverine habitat (HAB1) function group.	1.) Proposed project only entails wetland habitat (HAB1) function group.	1.) Proposed project only entails lacustrine habitat (HAB3) function group such as invasive species control or efforts to establish native aquatic plant species.	

7.0 Compensation Value Adjustment (C_{VAF})

The conservation of aquatic resources in lieu of providing compensatory mitigation through enhancing or restoring aquatic resources is not accepted as compensatory mitigation for offsetting projects authorized to effect aquatic resources pursuant to Chapters 105. However, there is a role for conservation of lands through deed restrictions, conservation easements or resource management plans related to compensatory mitigation enhancement or restoration projects.

As required pursuant to the joint federal mitigation rule (33 C.F.R. § 332.7; 40 C.F.R. § 230.97), areas that encompass the enhancement or restoration project area must be protected under a conservation easement or deed restricted covenants. Lands owned by government entities must have project area facility management plans or integrated natural resource plans. The areas that are directly part of the enhancement or restoration project are not considered conservation areas for the purposes of adjusting the compensation value. However, conservation of lands surrounding the project areas in conjunction with enhancement or restoration of aquatic resources will be considered, but they must be directly linked to and contribute to the long-term viability of the project and for private lands placed under a conservation easement or deed restrictions. Government lands must extend coverage of the resource management plans to include such areas.

The Compensation Value (C_V) established in **Section 6.0** may be adjusted according to the requirements outlined in **Sections 7.1 – 7.3** resulting in an Adjusted Compensation Value (C_{VAF}). The C_{VAF} is then used in place of the C_V value for calculating the potential function credit generation from a project. The C_{VAF} values are determined for the applicable resource and are not used across resource types. The area of conservation must meet the minimum requirements as indicated below for each applicable resource type in order to adjust the C_V initially determined for the proposed project.

7.1 Riverine Conservation Areas

There are two types of conservation that may be used to adjust the Compensation Value of a Riverine project; Riverine Upstream Corridor Conservation (RUCC) and Riverine Lateral Conservation (RLC). Projects that do not provide a continuous or unbroken conservation area according to the criteria listed below may be evaluated for a partial adjustment factor. If the condition of the area is anticipated, then the adjustment factor is an anticipated one and the final rating will be determined at a point in time based upon the proposed project's monitoring plans, time scales and the established success criteria.

The RUCC type of conservation area must consider, at a minimum, the following:

- Riparian Ecotone Condition Index of the proposed RUCC area as evaluated utilizing the **Pennsylvania Riverine Condition Level 2 Rapid Assessment Protocol**;
- Length of the RUCC area in relation to the downstream project length;
- RUCC area must be immediately upstream of the enhancement or restoration project and conservation area must also include the 100 year floodplain.

The RLC type of conservation area must consider, at a minimum, the following:

- The condition of the vegetation/land cover of the RLC area utilizing the Riparian Zone of Influence (RZOI) Condition Index procedures from the **Pennsylvania Riverine Condition Level 2 Rapid Assessment Protocol** and adjusting the boundaries based upon the RLC distance;

- The distance extends laterally from the floodplain boundary of the enhancement or restoration project and at a minimum must include the RZOI.

7.1.1 Riverine Upstream Corridor Conservation

The RUCC area extends upstream from the compensation project's most upstream boundary; and extends laterally to encompass the stream channel, the 100 year floodplain and the Riparian Zone of Influence (RZOI) area as defined in the ***Riverine Condition Level 2 Rapid Assessment Protocol***. The overall RECI of the RUCC area must be ≥0.65. The example to the right depicts a project with a proposed RUCC area that is greater than 2X's the project length and with a RECI condition >0.65. This RUCC would provide an additional value of 0.65 - 1.0 to the compensation value established in **Section 6.0**.

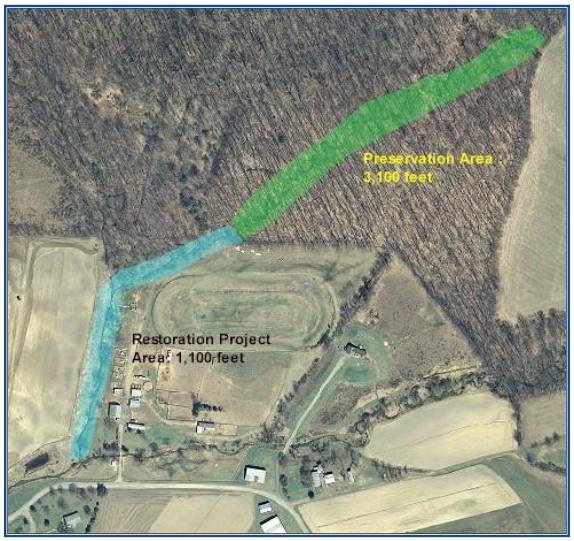

Table 6 RUCC Adjustment Factor provides the ranges and length of conservation corridor to project length criteria that will be considered.

Table 6. RUCC Adjustment Factor

Conservation Area (length of stream)	**Adjustment Factor** (A_F)	**Value Range** RECI x A_F
≤ ½ of project stream length	0.25	0.17 – 0.25
½ – Equal to project stream length	0.50	0.33 – 0. 50
Equal to – 2 times project stream length	0.75	0.49 – 0.75
>2 times project stream length	1.0	0.65 – 1.00

The following formula is used to determine the Adjusted Compensation Value (C_{VAF}) for use in calculating the function credit gain as described in **Section 6.0**:

$$\mathbf{C_{VAF} = C_V + (RECI \times A_F)}$$

7.1.2 Riverine Lateral Conservation

The RLC area must be immediately adjacent to the 100 year floodplain of the project area and at a minimum, extend to the limits of the RZOI and extend along the compensation project area. Using the procedures for the RZOI Condition Index (CI) and applying them to the RLC area; the CI for the RLC area must be $\geq$0.65.

Table 7 RLC Adjustment Factor provides the ranges and lateral extent of the conservation area extending from the Riparian area (100 year floodplain) that will be considered.

Table 7. RLC Adjustment Factor

Conservation Area (length of stream)	**Adjustment Factor** (A_F)	**Value Range** RZOI CI x A_F
RZOI of project area	0.25	0.17 – 0.25
RZOI of project area plus $\geq$100 feet	0.50	0.33 – 0. 50
RZOI of project area plus $\geq$200 feet	0.75	0.49 – 0.75
RZOI of project area plus $\geq$300 feet	1.0	0.65 – 1.00

The following formula is used to determine the adjusted compensation value for use in calculating the function credit gain as described in **Section 6.0**:

$$\mathbf{C_{VAF} = C_V + (RZOI\ CI\ x\ A_F)}$$

7.2 Wetland Conservation Areas

Wetland Conservation (WC) areas include the conservation of upland areas adjacent to wetland enhancement or restoration project. The area proposed to be conserved must extend from the wetland boundary into the uplands and at a minimum encompass the Wetland Zone of Influence (WZOI) area as defined in the ***Wetland Condition Level 2 Rapid Assessment Protocol***.

WC must consider, at a minimum, the following:

- Condition of the proposed conservation area
- HGM wetland class (important to establishing areas beyond the WZOI)
- Area adjacent to the wetland known as the WZOI is considered the minimum area necessary for conservation
- Physical barriers such as roads, vertical topography, adjacent streams, etc.

The WZOI condition index must have an existing condition or a projected increase in condition of $\geq$0.65 (the outer boundary of assessment must be adjusted to the conservation area boundary). If the increase in condition is anticipated, then the adjustment factor is an anticipated one and the final rating will be determined at a point in time based upon the proposed project's monitoring plans, time scales and the established success criteria.

If the averaged condition index fails to meet the minimum condition rating, no adjustment factor may be awarded for the conserved areas and the project's credit determination will be adjusted accordingly. Projects that do not provide a continuous or unbroken WC area may be evaluated for a partial adjustment factor.

Table 8 WC Adjustment Factor provides the ranges and lateral extent of conservation extending from the wetland boundary that will be considered.

Table 8. WZOI Conservation Area Adjustment Factor

Conservation Area	**Adjustment Factor** (A_F)	**Value Range** WZOI CI x A_F
WZOI of project area	0.25	0.17 – 0.25
WZOI of project area plus ≥ 100 feet	0.50	0.33 – 0. 50
WZOI of project area plus ≥ 200 feet	0.75	0.49 – 0.75
WZOI of project area plus ≥ 300 feet	1.0	0.65 – 1.00

The following formula is used to determine the adjusted compensation value for use in calculating the function credit gain as described in **Section 6.0**:

$$\mathbf{C_{VAF} = C_V + (WZOI\ CI\ x\ A_F)}$$

7.3 Lacustrine Conservation Areas

Lacustrine Conservation (LC) areas include the conservation of upland areas adjacent to lacustrine enhancement or restoration compensation projects. The area proposed to be conserved must extend from the lacustrine boundary into the adjoining lands and at a minimum encompass the Lacustrine Riparian Shoreline Vegetation (LRSV) area and the Riparian Zone of Influence (RZOI) area which in combination extends 100 feet from the edge of water as defined in the ***Lacustrine Condition Level 2 Rapid Assessment Protocol***.

LC must consider, at a minimum, the following:

- Condition of the proposed conservation area
- Area adjacent to the lacustrine resource known as the RZOI is considered the minimum area necessary for conservation
- The type of lacustrine environment such as reservoir, large river, small impoundment, etc.

The minimum conservation area, the averaged LRSV and the RZOI condition indexes will be used to determine the value range of the adjustment factor. If the averaged condition index fails to meet the minimum condition rating, no adjustment factor will be awarded for the conserved areas and the project's credit determination will be adjusted accordingly.

The ***averaged*** LRSV and the RZOI condition indexes must have an existing condition or an anticipated increase in condition of ≥ 0.65. If the increase in condition is anticipated,

then the adjustment factor is an anticipated one and the final rating will be determined at a point in time based upon the proposed project's monitoring plans and time scales and the established success criteria. If the area is larger than the combined LRSV and RZOI area, then the condition should be established using the same process and criteria excepting the expanded boundary and it would encompass the entire area (i.e. no need to average LRSV and RZOI scores).

Table 9 LC Adjustment Factor provides the ranges and lateral extent of conservation extending from the Riparian Shoreline that will be considered.

Table 9. LC Adjustment Factor

Conservation Area	**Adjustment Factor** (A_F)	**Value Range** $\left(\frac{(\text{LRSV} + \text{RZOI CI})}{2}\right) \times A_F$
LRSV and RZOI area	0.25	0.17 – 0.25
LRSV and RZOI area plus ≥100 feet	0.50	0.33 – 0. 50
LRSV and RZOI area plus ≥200 feet	0.75	0.49 – 0.75
LRSV and RZOI area plus ≥300 feet	1.0	0.65 – 1.00

The following formula is used to determine the adjusted compensation value for use in calculating the function credit gain as described in **Section 6.0**:

$$C_{VAF} = C_V + \left(\left[\frac{(\text{LRSV CI} + \text{RZOI CI})}{2}\right] \times A_F\right)$$

7.4 Addressing TMDL Related Impairments

Projects that directly address sources of impairments with related TMDLs may receive additional compensation value adjustment factors. The proposed project must result in reduction of sources that are addressed as part of the TMDL. These projects will be handled on a case-by-case basis. The compensation value may be adjusted up to an additional 1.0.

Projects requesting adjustment under this section must provide an analysis of how the enhancement or restoration project contributes to reducing or eliminating the source(s) of impairment. This analysis should entail some quantitative measures related to the TMDL.

7.5 Adjusting the Overall Functional Credit Calculation

The $\mathbf{C_{VAF}}$ calculated in the above sections is used in place of the $\mathbf{C_V}$ in the functional credit calculation, thereby increasing the overall credit value for each applicable function group. The $\mathbf{C_{VAF}}$ values in some instances are additive, such as the RUCC and RLC adjustment factors. However, the values may also differ for components of larger projects and may not be carried forward to another stream reach or separate wetland area for example.

Functional Credit Gain (FCG) = $A_P \times R_V \times C_{VAF} \times CI_{DIFF}$

Resources

25 Pa. Code Chapters 93 and 105.

ACOE and Environmental Protection Agency's (EPA) Final Joint Federal Mitigation Rule published in April 2008. 33 C.F.R. §§ 332.1-332.8; 40 C.F.R. §§ 230.91-230.98.

Brooks, R. P., M. M. Brinson, K. J. Havens, C. S. Hershner, R. D. Rheinhardt, D. H. Wardrop, D. F. Whigham, A. D. Jacobs, and J. M. Rubbo. 2011. Proposed hydrogeomorphic classification for wetlands of the Mid-Atlantic Region, USA. Wetlands 31(2):207-219.

Cowardin, L. M., Carter, V., Golet, F. C. and LaRoe, E. T.; 1979, "Classification of Wetlands and Deepwater Habitats of the United States", FWS/OBS-79/31, U.S. Fish and Wildlife Service. Office of Biologic Services, Washington, D.C., 102 pp.

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. http://el.erdc.usace.army.mil/elpubs/pdf/sr52.pdf.

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.

Harrelson, Cheryl C; Rawlins, C. L.; Potyondy, John P. 1994. Stream channel reference sites: an illustrated guide to field technique. Gen. Tech. Rep. RM-245. Fort Collins, CO; U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 p.

Stream Mitigation Method; February 2007. U.S. Army Corps of Engineers, State of Missouri.

Stroud Water Research Center: 2008, Protecting Headwaters: The Scientific Basis for Safeguarding Stream and River Ecosystems. A Research Synthesis from the Stroud™ Water Research Center.

Unified Stream Methodology; January 2007. U.S. Army Corps of Engineers, Norfolk District and Virginia Department of Environmental Quality.

Verry, E.S., Dolloff, C.A., and Manning, M.E.: 2004, Riparian Ecotone: A functional definition and delineation for resource assessment. Water, Air and Soil Pollution: Focus 4:67-94.

Appendix A

Aquatic Resource Function Compensation

Worksheets

Aquatic Resource Function Worksheet 1

Compensation Requirement Determination

Version 1.0

Project Name:	Resource Identifier:

Resource Type	Function Group	Area of Impact (A_I in 0.00 acres)	Project Effect Factor (P_E)	Resource Value Factor (R_V)	Resource Condition Value (C_I)	Compensation Requirement (credits 0.00)
Streams and/or Floodplains	HYD1	0.00	0	0	0.00	0.00
	BGC1	0.00	0	0	0.00	0.00
	HAB1	0.00	0	0	0.00	0.00
	REC1 - RS	0.00	0	0	0.00	0.00
Wetlands	HYD2	0.00	0	0	0.00	0.00
	BGC2	0.00	0	0	0.00	0.00
	HAB2	0.00	0	0	0.00	0.00
Reservoirs and Large Rivers	HAB3	0.00	0	0	0.00	0.00
	REC2	0.00	0	0	0.00	0.00

Aquatic Resource Function Worksheet 2

Proposed Compensation Valuation

Version 1.0

Project Name:	Site Identifier:

Resource Type	Function Group	Area of Project (A_p in 0.00 acres)	Compensation Value Factor (C_V)	Resource Value Factor (R_V)	Resource Condition Differential Value (C_I)	Proposed Compensation Value (credits 0.00)
Streams and/or Floodplains	HYD1	0.00	0	0	0.00	0.00
	BGC1	0.00	0	0	0.00	0.00
	HAB1	0.00	0	0	0.00	0.00
	REC1 - RS	0.00	0	0	0.00	0.00
Wetlands	HYD2	0.00	0	0	0.00	0.00
	BGC2	0.00	0	0	0.00	0.00
	HAB2	0.00	0	0	0.00	0.00
Reservoirs and Large Rivers	HAB3	0.00	0	0	0.00	0.00
	REC2	0.00	0	0	0.00	0.00