Attachment 1 - Functional Value Assessment

As part of this assessment of the Evergreen Mill Creek Point Mitigation Bank, a set of wetland functions have been identified that are anticipated to be restored, re-established, rehabilitated and enhanced at the Bank site. Additionally, the extent to which these functions provide services and value beyond the limits of the bank parcel is the crux of the assessment of regional watershed value and the potential ability of the Bank to compensate for wetlands functions, services and values lost elsewhere in the region.

The Evergreen Mill Creek Point (MCP) Mitigation Bank will provide special and unique ecological and wetland functions. The following functions, values and services have been assessed at the Bank site to demonstrate functional value uplift and the appropriateness of wetland bank credit utilization to replace lost wetlands functions, values and services lost as a result of permitted impacts in another part of the Service Area:

- Water Quality
- Wetland Hydrology
- Flood Storage
- Sediment/Toxicant Retention
- Nutrient Exchange
- Sediment Transport
- Sediment and Shoreline Stabilization
- Production Export
- Finfish Habitat
- Invertebrate Community
- Wildlife Habitat
- Plant Community Composition
- Endangered Species Habitat
- Social Significance

Functions, Services and Values

Evergreen has investigated wetland bank functions, services and values and compared existing conditions to proposed conditions. Every wetland performs some number of functions such as water quality improvement or wildlife habitat that make wetlands a valued resource that are subject to significant regulatory protection. The service and value of a wetland function is directly related to the opportunity for that function to make a measurable and meaningful difference in a particular location within its hydrogeomorphic setting. Often these services and values are achieved only within a localized watershed or drainage; a function such as flood storage is such an example. Other functions are realized within the broader hydrogeomorphic setting in areas that are not necessarily defined and limited to a watershed; a function such as wildlife habitat, finfish habitat or public recreation can transcend drainage boundaries.

According to the Department of the Army, Corps of Engineers, 33 CFR Parts 325 and 332, Environmental Protection Agency, 40 CFR Part 230 Compensatory Mitigation for Losses of Aquatic Resources, Proposed Rule. Federal Register / Vol. 71, No. 59 / Tuesday, March 28, 2006;

"In addition to providing important ecological functions, wetlands and other aquatic resources also perform important services, such as wildlife viewing and education that can only be accomplished when people have opportunities to interact with those aquatic resources. The functions and services that aquatic resources perform in turn provide the basis for the values that society derives from them. These include use values, such as recreation, and non-use values such as biodiversity and stewardship for future generations. Aquatic resource functions, services, and values should be considered when evaluating sites in developed areas as options for providing compensatory mitigation. Mitigation projects for impacts authorized by DA (Department of the Army) permits should compensate or lost functions and services."

The Rules go on to define the terms Functions, Services and Values as follows:

*"**Functions** means the physical, chemical, and biological processes that occur in aquatic resources and other ecosystems. The primary purpose of compensatory mitigation is to replace lost aquatic resource functions at the impact site. The agencies have a long standing policy of achieving no overall net loss for wetland acreage and functions.*

***Services** means the benefits that human populations receive from functions that occur in aquatic resources and other ecosystems. For example, providing habitat for birds is a biological function of some aquatic habitat types, which in turn provides bird watching services to humans. In general, compensatory mitigation projects, in replacing lost functions at the impact site, should also replace the lost services associated with these functions.*

***Values** means the utility or satisfaction that humans derive from aquatic resource services. Values can be described in monetary terms or in qualitative terms, although many of the values associated with aquatic resources cannot be easily monetized. Values can be either use values (e.g., recreational enjoyment) or non-use values (e.g., stewardship ethic)."*

As part of this assessment of the Bank, a set of wetland functions have been identified that are anticipated to be restored, re-established, rehabilitated and enhanced at the Bank site. The extent to which these functions provide service and value is the crux of the assessment of credits and the potential ability of the Bank to compensate for wetlands functions, services and values lost elsewhere in the region.

- ***Water Quality***

This function presents one of the key attributes of any wetland system: water quality improvement, maintenance and protection. It is the main reason why wetlands are regulated under the Clean Water Act. The ability of a wetland to filter and metabolize water impurities is critical to fish, wildlife and human populations of the watershed and region.

Tidal water quality, such as that to be restored at the Evergreen MCP Mitigation Bank, is defined by several parameters including regional pollution levels, turbidity, salinity and dissolved oxygen. Turbidity is often a function of underlying creek and marsh substrate, disturbance due to flows and storms and, in urbanized areas, runoff and pollutant loadings. Sediment removal will restore tidal hydrology to the wetland. The surrounding marsh water quality and the water quality predicted to be restored to the site once the Bank design is implemented will be that of a

large, contiguous, relatively undisturbed tidal marsh reconnected to the river and the tidal marshes of the Meadowlands. The Evergreen MCP Mitigation Bank will serve to filter receiving waters of impurities from the adjacent waterbodies as well as runoff from adjacent developed lands.

Dissolved oxygen levels are also related to pollutant loadings, temperature, biological demand and the surface area of interaction between marsh and receiving waters. The greater the surface area of the water/marsh interface, the greater the opportunity for waters to be oxygenated. The Bank design will greatly enhance the opportunity for water/wetland interface and increase oxygenation of receiving waters.

The Bank design will serve to replace this service and function within the watershed potentially lost as a result of wetland impacts in region.

- ***Wetland Hydrology***

Tidal water conveyances such as creeks and bays are bordered by the wetlands, usually marshes, they support hydrologically. This function is predicated on the ability of a wetland to provide tidal wetland hydrology via channel density; stream sinuosity; channel width; and channel depth. Restrictions to tidal flow such as elevated marsh plains, berms, tide gates, culverts and bulkheads are examples of impediments to tidal wetland hydrology.

The Evergreen MCP Mitigation Bank will lower grades that have been artificially raised. Tidal wetland hydrology will be restored to the elevated and filled areas of the tract.

The Bank design will serve to replace this service and function potentially lost as a result of wetland impacts in the region.

- ***Flood Storage***

Another wetland service and function that is of value to regional populations is the ability of the wetland to protect adjacent lands from storm surges and attenuate flooding.

Tidal marshes in the Meadowlands region provide this function and service to adjacent developed lands. The Bank site design will open a tidally restricted property and lower site elevations to increase flood storage capacity and buffer storm surges. Net sediment removal from the site will increase flood storage capacity. The restored site will have the ability to absorb and store riverine floodwaters.

The Bank design will serve to replace this service and function potentially lost as a result of wetland impacts in the region.

- ***Sediment/Toxicant Retention***

This function relates to the effectiveness of the wetland as a trap for sediments, toxicants, or pathogens in runoff water from surrounding uplands or upstream eroding wetland areas. This function reduces or prevents degradation of water quality by the sequestration and transformation of sediment borne toxicants.

Wetland restoration has the potential for being an effective trap for sediment, toxicants, or pathogens from runoff water or tidal receiving waters. Currently, the Bank site has limited connection to tidal waters. The proposed mitigation concept would promote a higher level of marsh interface with tidal waters and promote sediment and toxicant retention and reduction through natural attenuation metabolization.

The mitigation design will also remove sediments with levels of contaminants above ecological screening criteria.

The Bank design will serve to replace this service and function potentially lost as a result of wetland impacts in the region.

- ***Nutrient Exchange***

Tidal wetlands export and/or import nutrients and organic carbon via tidal flushing, deposition and erosion. This function and service is critical to the circulation of nutrients into the food chain from tidal marshes known to be some of the most biologically productive habitats. Such exchange requires tidal conveyances as has been described above as well as an interface with the marsh substrate and plant cover that metabolizes and produces nutrients as well as makes use of such nutrients. The marsh also serves to sequester carbon as part of the marsh depositional process as well as photosynthetic biomass production.

The Bank design will restore and create tidal flushing and water/plant interface to facilitate and improve nutrient exchange. Nutrient exchange service of the wetlands at the Evergreen MCP Mitigation Bank will become similar to that of the restored wetlands of the Meadowlands. The Bank's nutrient exchange will foster invertebrate and forage fish populations similar to those of the natural marshes of the region.

The Bank design will serve to replace this service and function potentially lost as a result of wetland impacts in the region.

- ***Sediment Transport***

The ability of a wetland site to maintain a stable elevation that supports tidal marsh hydrology and tidal marsh vegetation is predicated on sediment transport. Marsh elevation is sustained by the deposition of inorganic and organic particles from the water column, vertical accumulation of plant litter, and the removal of excess wrack, debris and plant litter (primarily through physical processes). In the ideal, stable marsh system, sediment accretion and deposition rates are balanced by sediment subsidence and erosion rates.

A marsh system must have vegetation and mudflats to trap sediments and free-flow of tidal waters to export sediments down gradient. Currently, the site is tidally above and beyond the elevation of tidal flow and the interface of tidal waters and sediments. Several factors in marsh restoration ecology affect sediment transport including: removal of hydrological obstructions (e.g., dikes, berms, culverts, etc.), insure that the wetland is free and open to the twice-daily exchange of tidal waters, and increase the on-site coverage by native vegetation species.

The physical energies of an environment and the vegetative cover affect sediment transport, but the underlying substrate is the key factor that determines transport rates, often directly related to

particle size. The Evergreen MCP Mitigation Bank will promote tidal exchange and sediment transport from the Bank site as well as to the wetlands of the region. The exchange is predicted to be a relatively balanced import and export of sediments predicated on a stable marsh plain that serves to hold sediments yet permits tidal waters to carry accreted organics and up-gradient sediments received via runoff flows down-gradient via the marsh plain, tidal channels and direct creek connection.

The Bank design will serve to replace this service and function potentially lost as a result of wetland impacts in the region.

- ***Sediment and Shoreline Stabilization***

The function of sediment and shoreline stabilization is related to the ability of the wetland to bind the soil matrix and dissipate the erosion forces impacting the wetland. Wetland vegetation stabilizes sediments by increasing the durability of the sediment-root matrix. Binding of sediments by roots is responsible for the greater shear strength of sediments compared to unvegetated sediments.

This function is dependent on the wetland having vegetation composed of either a dense energy absorbing, resilient herbaceous layer or a mixture of trees and large multi-stemmed shrubs that can withstand high flow velocities and/or wave action. This function is likely being provided if the wetland is so situated in the landscape, has the dense vegetation, and no evidence of such erosional signs as gullies, rills, exposed soil, scour marks, and slumping in the down gradient watercourse.

Currently the site is tidally restricted, but dense Phragmites has stabilized most of the site sediments. The Bank design will result tidal flow with commensurate sediment transport to a vegetated tidal marsh that will create a stable sediment-root matrix of native plants. This vegetative cover in concert with the landscape position of the tidal marsh adjacent to several tidal waterbodies provides an ideal setting to increase sediment accretion and shoreline stabilization functions as compared to existing conditions. The excavation of accreted and contaminated, man-made sediment, the reintroduction of tidal flows and the establishment of native emergent marsh species will create gentler stream bank slopes that are more stable.

The Bank design will serve to replace this service and function potentially lost as a result of wetland impacts in the region.

- ***Production Export***

This function evaluates the effectiveness of the wetland to produce food or usable products for humans or other living organisms.

Wetland restoration will produce plant detritus for living organisms. Compared to the *Phragmites* marsh today, *Spartina* marshes develop and export a much greater proportion of biomass. Detritus development and export will occur within this tidal emergent wetland bank. The adjacent creek and river provide an ideal conduit for export of biomass production from this tidal marsh wetland. The restored wetland will increase the degree of plant community structure and species diversity and thereby increase production export.

The Bank design will serve to replace this service and function potentially lost as a result of wetland impacts in the region.

- ***Finfish Habitat***

The potential utilization of a marsh by finfish is a primary wetland function and service. Variables important to this wetland function include the amount of marsh/water interface (i.e., aquatic edge), the hydrologic regime of the site, and the complexity of the habitat available to resident nekton (i.e., the amount and number of habitat types available on-site).

Improvements to finfish habitat in tidal systems can be achieved by removing tidal restrictions in order to increase the hydrologic regime within the site, increasing the amount of aquatic edge within the site (e.g., restoring the tidal drainage network by replacing straight mosquito ditches with "naturally" meandering tidal channels), and by increasing the habitat complexity within the site (e.g., the replacement of one dominant habitat type that covers a site with a mosaic composed of several different habitat types).

The Bank site will provide restored shallow water finfish habitat from a currently tidally restricted area that will benefit populations of forage fish that represent the lower levels of the food chain. Additionally, the Bank site is in an area where juvenile finfish take cover and feed until they are ready to enter the open waters of the bays and ocean. The Bank design will restore habitat for juvenile species and forage fish populations. The Bank will provide habitat for forage fish, juvenile finfish and marsh plain surface spawning habitat similar to that habitat that exists in the Meadowlands.

The Bank design will serve to replace this service and function potentially lost as a result of wetland impacts in the region.

- ***Invertebrate Community***

The potential for a wetland to produce and maintain a characteristic benthic invertebrate community is a function and service directly related to the productivity of a wetland at the lowest trophic levels. This function is affected by the amount of marsh/water interface (i.e., aquatic edge) and the hydrologic regime of the site. Another variable related to this function is the relative proportion of the site that is covered with emergent macrophytic vegetation (i.e., total percent vegetative cover). To positively enhance the invertebrate community of a wetland, increasing the amount of aquatic edge and restoration of the tidal regime would be required.

The Bank design will increase the benthic invertebrate community in an area where it currently is limited. Invertebrates to benefit include benthic worms and more mobile invertebrates such as blue crabs and resident fiddler crabs and possibly mollusks such as ribbed mussels. These species of benthic invertebrates are typical of the Meadowlands tidal marsh systems of relatively low wave energy. Improved dissolved oxygen levels of the tidal channels and marsh plain also will augment this function.

The Bank design will serve to replace this service and function potentially lost as a result of wetland impacts in the region.

- ***Wildlife Habitat***

This function describes the potential utilization of the wetland by resident and migratory avifauna, herpefauna and mammals. Factors that affect this function and service include size of the wetland, its connectedness to adjacent wildlife habitat, the effective area of all undeveloped wetland or upland habitat patches within one-half mile of the wetland boundary, a measure of wildlife habitat complexibility (i.e., the number of different habitat types present on or within one-half mile of the site), and the percent cover by native plant species on the site.

The Bank design will benefit wetland dependent wildlife species including aquatic mammals (e.g., muskrat), diamondback terrapins and wading birds and waterfowl that prefer wetlands. These bird species are highly mobile, often migratory and able to move from area to area in a diurnal pattern to take advantage of tidal cycle or to take shelter in the upland/wetland marsh interface during storm events. Species have been observed to move across the Meadowlands region marshes from one end to the other to feed based on such tidal cycle variations during the course of a day in order to take advantage of prime fish-feeding opportunities. The wildlife habitat function also will be greatly improved due to the re-connection to the river.

The mitigation plan in general removes much of the accreted and manmade fill and restores wetland in a classic restoration implementation plan. This wetland restoration plan generates habitat for aquatic species such as benthic invertebrates and finfish while restoring wetland functions and values including flood storage, water quality and sediment transport.

The Bank design will serve to replace this service and function potentially lost as a result of wetland impacts in the region.

- ***Plant Community Composition***

The ability of a wetland to support a native plant community of characteristic species composition is a function of great importance and relevance in eco-restoration design. Higher contributions of exotic or nuisance species will lower this wetland function. Improving this wetland function would require the replacement of nonnative vegetation with native species.

The Bank design will serve to restore tidal hydrology, remove accreted sediments and fill and promote native vegetative species establishment in a tidal marsh that interfaces with adjacent marshes and has a component of upland island habitats. The design will also reduce non-native invasive species such as invasive *Phragmites*, and replace the habitat with native species such as *Spartina*.

The Bank design will serve to replace this service and function potentially lost as a result of wetland impacts in the region.

- ***Endangered Species Habitat***

This value considers the suitability of the wetland to support threatened or endangered species. These values become factors when the wetland contains documented occurrence of a state- or federally listed species. A species is considered endangered if it is in danger of extinction throughout all or a significant portion of its range. A species is considered threatened if it is likely to become endangered in the future. The Endangered Species Act of 1973 (ESA) provided a legal framework to conserve and protect species and their habitats. In this law, U.S. Congress recognized, "endangered species of fish, wildlife, and plants are of aesthetic, ecological,

educational, historical, recreational, and scientific value to the Nation and its people". Congress further stated its intent that the Act should conserve the ecosystems upon which endangered and threatened species depend. The U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) share responsibility for implementing the ESA for Federally listed species. The New Jersey Division of Fish and Wildlife – Bureau of Endangered and Non-game Species and the New Jersey Natural Heritage Program are responsible for State listed threatened and endangered species.

The wetland bank has the potential to be valuable habitat for several protected species, including the peregrine falcon (NJ-endangered), yellow-crowned night heron (NJ-threatened), snowy egret (NJ-special concern [SC], regional priority [RP]), glossy ibis (NJ-SC,RP), and little blue heron (NJ-SC). In addition, bald eagles (NJ-endangered) were observed near the bank site during field investigations. The mitigation design will increase marsh and open water habitat for waterfowl and wading birds and increase passerine habitat and prey sources for raptors.

The restoration and preservation of the Bank site, and the habitat connectivity with the river and adjacent tidal marshes makes the restoration of the site a key component to endangered species habitat in the region.

The Bank design will serve to replace this service and function potentially lost as a result of wetland impacts in the region.

- ***Social Significance***

The functions and values of wetlands go beyond environmental quality and wildlife benefits and include direct benefits to society. Wetlands are unique habitats that, when accessible, afford people the opportunity to see and experience landscapes and wildlife species. The loss of wetlands eliminates public access, passive recreation, and the ability to view wildlife and their habitat.

The Bank site will restore and protect wetlands of the Meadowlands region. Visible from the adjacent ball fields, the Bank site will provide additional opportunities for people to see and observe wetland habitat and the wildlife inhabitants. As a restoration site, it will also afford people the educational opportunity to observe a restoration project in various stages of development.

The Evergreen MCP Mitigation Bank site has the opportunity to replace socially significant functions and values lost as a result of projected permitted impacts in relatively close proximity and in a virtually identical landscape position that is intended to recreate wetland habitat lost. Not many mitigation bank sites are in a location to provide such a direct replacement of socially significant wetland functions and values; a resource that will be enjoyed by many people including naturalists and birders.

The Bank design will serve to replace this service and function potentially lost as a result of wetland impacts in the region.