

Coastal Wetlands Planning, Protection and Restoration Act

Wetland Value Assessment Methodology

Procedural Manual



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Introduction

The purpose of this manual is to provide guidance to biologists, planners, engineers, and others involved in the preparation of Wetland Value Assessments (WVA) for projects evaluated under the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA). The WVA methodology is the primary means of measuring the wetland benefits of candidate projects proposed for funding by the CWPPRA and allows for a comparison of benefits between those projects. The WVA methodology includes seven community habitat assessment models: 1) fresh/intermediate marsh, 2) brackish marsh, 3) saline marsh, 4) barrier island, 5) barrier headland, 6) swamp, and 7) coastal chenier/ridge.

This document describes the WVA process and the role of the Environmental Work Group (EnvWG) and Academic Advisory Group (AAG) in the evaluation of candidate projects for inclusion on a priority project list. The primary role of the AAG during project evaluations is to assist the EnvWG in projecting benefits for proposed projects. Therefore, future reference to the EnvWG in this document includes the AAG.

Evaluation of Nominated Projects

Each year, projects are nominated at regional planning meetings held at various locations along the coast. Each nominated project is assigned to one of the five Federal agencies (USFWS, EPA, NMFS, COE, and NRCS) for preparation of fact sheets which include a project description, preliminary costs, and an estimate of project benefits. The features, estimated benefits, and estimated costs for all nominated projects are reviewed by the EnvWG and Engineering Work Group (EngWG). The benefits and cost estimates, and other pertinent information are provided to the Planning and Evaluation Subcommittee which prepares a matrix containing all project information. The Technical Committee utilizes that information in selecting which projects to further evaluate as candidate Priority Project List (PPL) projects. Candidate projects remain assigned to one of the five Federal agencies. The LDNR usually serves in a supporting role to the Federal agencies although they may have the primary responsibility for preparing information for some candidate projects. The sponsoring agency serves as the point of contact for the project and is responsible for development of project features, preparation of cost estimates, and preparation of the draft WVA.

Field Investigation of Candidate Projects

The first step in evaluating candidate projects is to conduct a field investigation of the project area. This field investigation has several purposes: 1) familiarize the EnvWG and EngWG with the project area, 2) visit the locations of project features, 3) discuss a benefited area for the upcoming project boundary meeting, 4) determine habitat conditions in the project area, 5) compile a list of vegetative species and discuss habitat classification, and 6) collect data for the

WVA (e.g., densities of submerged aquatics, water depths, salinities, vegetative cover, tree diameter, etc.).

The sponsoring agency is responsible for field trip logistics and coordinating with landowners, local government, all CWPPRA agencies, the AAG, and other field trip attendees. Field trip attendees typically consist of each agency's EnvWG representative and members of the EngWG. Other individuals may be invited to attend, however, field trip groups should be kept to a manageable number (10-15) to facilitate discussion in the field and allow easier preparation of field trip logistics. The sponsoring agency should be familiar with the project area so that field time is spent efficiently.

The primary purpose of the field investigation is not to conduct surveys or take measurements for the sponsoring agency to develop designs and/or cost estimates for the project. The sponsoring agency should have obtained that information during previous field trips or should plan a follow-up field trip. It may be necessary to divide the group into small work parties to collect WVA information across the project area or to allow some areas to be investigated by at least a subset of the entire group. However, an effort should be made to keep the group together to facilitate discussion about wetland conditions in the project area, the causes of habitat loss, the project features, and the effectiveness of the project features.

Field Investigation Summary

- Purpose is a light-duty reconnaissance of the project area
- Sponsoring agency responsible for logistics
- Keep group to a manageable number (10-15)
- Purpose is not to collect engineering data for sponsoring agency
- Facilitate discussion in the field

Project Boundary Determination

The project boundary is the area where a measurable biological impact, in regard to the WVA variables, is expected to occur with project implementation. Project boundary meetings are usually scheduled after the completion of candidate project field trips. Boundary meetings are attended by the EnvWG, EngWG, and sometimes other interested parties such as landowners or their representatives. At the boundary meeting, the project sponsor provides a map(s) indicating the project features and presents the rationale for the proposed boundary. The boundary is discussed by the entire group and revisions to the boundary are made by consensus or, if necessary, by vote. The U.S. Geological Survey (USGS)-Baton Rouge Field Station provides GIS support and project boundaries are digitized at the meeting and boundary files created. The USGS-Baton Rouge Field Station provides baseline and historical habitat classification and land/water data and the COE provides historical land/water data. The digitized boundaries are referred to as "cookie-cuts" because the project boundary is digitized or "cut" from a larger data layer. Data obtained from the cookie-cuts include but are not limited to 1956, 1978, 1988/90 USGS/National Wetlands Inventory, (NWI) and 2000 Louisiana Coastal Area habitat classification data and 1990 and 2000 land/water data from satellite imagery. Hardcopies of the habitat classification and land/water data and maps are provided to the project sponsor by the USGS.

The COE uses the digitized project boundaries and provides historical land/water data to the project sponsor to calculate historical marsh loss rates. The land/water cookie-cuts include data from six time periods: the 1930s, 1956-58, 1974, 1983, 1990, and 2000. The land/water data are provided in tabular format to the project sponsor. COE land/water data are not available for extreme southwestern Louisiana (Figure 1).



Figure 1. Area not included within COE land loss data

It is the responsibility of the project sponsor to review all maps and information provided by the USGS and the COE to ensure that the correct boundary was digitized and that the necessary information is provided. The project sponsor should provide the USGS habitat data, USGS habitat classification maps (with the boundary indicated), and the COE land/water data to the EnvWG before or during the WVA meeting for that project.

Project Boundary Meeting Summary

- Project sponsor provides proposed boundary map to meeting attendees
- Project sponsor discusses boundary and rationale
- USGS provides GIS support
- Approved boundary determined by consensus or vote
- USGS and COE provide habitat classification data
- Review maps and other information provided by USGS and COE

- Habitat data, maps, and land loss data provided to group before or during WVA meeting

Boundary Determination for Marsh and Swamp Areas - The benefited area must be subdivided into subareas based on habitat type and should be delineated within the project boundary so that the correct marsh model can be applied to determine benefits for each area. The Chabreck and Linscombe Vegetative Type Maps (e.g., 2001, 1997, or 1988) are typically used to divide the benefited area into subareas. However, if agreed to by the EnvWG, recent field investigations or other data may be utilized to delineate habitat types within the project area. Any reclassification of the project area or subareas must be approved by the EnvWG. Reclassifying habitat should not be viewed as a means of reducing the number of subareas to simplify the project evaluation. Incorrect habitat classification can result in an inaccurate measure of project benefits, depending on project impacts.

The project area for shoreline protection projects is usually defined as the area that would erode at a given rate (ft/yr) over the project life (20 years) (Figure 2). In some instances, shoreline protection benefits may extend to an additional area beyond the area calculated using the 20-year erosion rate if areas of fragmented marsh could cause the erosion rate to accelerate or create “blowouts” (Figure 2). The project area also includes any open water between the shoreline and the shoreline protection feature (e.g., foreshore rock dike). Shoreline erosion rates should be determined by the USGS using aerial photography and GIS software. Typically, measurements are taken perpendicular to the shoreline for two or more time periods and an average of those measurements is calculated to determine the shoreline erosion rate. Anomalies (e.g., points along the shoreline) which could skew the average should be removed from the measurements.



Figure 2. Project area examples for shoreline protection projects.

In some instances, small areas of a particular habitat type may be combined with the more prevalent type within the project area. For example, a 100-acre area of intermediate marsh may be combined with an adjacent 5,000-acre area of fresh marsh. Determining the benefits for each

individual small area could unnecessarily complicate the evaluation, be time-consuming, and may not significantly affect the overall project benefits. Likewise for the swamp model, small insignificant areas of bottomland hardwoods, fresh marsh, or other wetland habitats may be included within the swamp project area. Any decision to combine a small area of one habitat type with a larger area of a different habitat type must be approved by the EnvWG.

Boundary Determination for Barrier Island/Headland Areas - Barrier island project boundaries encompass all emergent and subtidal habitat (i.e., 0.0 to -1.5 NAVD88) associated with the island, while deep open water habitat around the island is omitted. Subtidal habitat extends bayward to the -1.5 ft NAVD88 contour or a maximum distance of 1,000 feet from the island. Unlike marsh project areas, a barrier island project area changes throughout the evaluation period (i.e., 20 years) as the island erodes, migrates, and/or shrinks in size. As the island erodes, areas converting to deep open water (>-1.5 NAVD88) are removed from the project area and the boundary shrinks as the island shrinks.

Barrier island project areas must be divided into dune, supratidal, and intertidal subareas as per model definitions. Elevation data should be utilized to divide the island area into the different habitat types. Habitat data or vegetative species composition data can be used as a substitute if survey data are unavailable, although less emphasis should be placed on this method as the intertidal area is not delineated by plant zonation.

Project area size and habitat classification (i.e., dune, supratidal, etc.) are usually determined by the project sponsor from topographic, bathymetric and vegetation surveys, published literature, and GIS analyses. In the absence of bathymetric/topographic surveys, USGS habitat data can be beneficial to support the delineation of subareas. For barrier headland projects, only dune and supratidal habitats are included within the project boundary. Intertidal marsh behind the headland is evaluated with the appropriate marsh model. As with barrier island projects, the project area changes as future without-project (FWOP) and future with-project (FWP) conditions alter the size of the project boundary.

Boundary Determination for Coastal Chenier/Ridge Areas - Coastal chenier/ridge habitat includes forested barrier headland ridges, forested cheniers, and in some instances, forested spoil areas. Such areas are typically at an elevation capable of supporting trees and/or shrub/scrub vegetation and are not influenced by an average daily tide. The same rules for determining a boundary in the other habitat types also apply for coastal cheniers/ridges in that a measurable biological impact should occur within the project area.

Use of the Community Habitat Models

Each community model contains a set of variables which is important in characterizing the habitat quality of several coastal wetland habitat types relative to the fish and wildlife communities dependent on those environments. Baseline values are determined for each of those variables to describe existing conditions in the project area. Future values for those variables are projected to describe conditions in the area without the project and with the project. Projecting future values is the most complicated, and sometimes controversial, part of this process. It requires project sponsors to substantiate their claims with monitoring data, research findings, scientific literature, or examples of project success in other areas. Not all future

projections can be substantiated by the results of monitoring or research, and, as with all wetland assessment methodologies, some projections are based on best professional judgment and can be subjective. It should be noted that future projections are not the sole responsibility of the project planner. It is the responsibility of the evaluation team (i.e., agency representatives, academics, and others) to use the best information available in developing those projections. Many times, the collective knowledge of the evaluation team is the only tool available to predict project benefits. The various workgroups are comprised of many individuals with diverse backgrounds and all project scenarios are discussed by the group and a final outcome is usually reached by consensus.

An important point to consider when projecting benefits is the effect of constructed or authorized projects on the project area. Benefits attributed to those projects should be taken into consideration when projecting benefits for any candidate project. That procedure prevents a candidate project from being credited with benefits previously attributed to another project (i.e., “double-dipping”). Projects authorized under the cash-flow management system (\geq PPL9) are not taken into consideration unless authorized for construction. Project planners should also consider the benefits of non-CWPPRA projects funded by other authorities (e.g., WRDA, State-only projects, and landowner-funded projects).

Marsh Community Models

Model Application - The marsh community models are applied to all marsh and open water habitats within the coastal zone. Model application should correspond to the marsh type(s) found within the project area according to the habitat classification data obtained from USGS. However, field investigations or other data may more accurately indicate the marsh type within the project area.

In some instances, a project area may shift from one marsh type to another under FWOP and/or FWP conditions. Salinities may be expected to increase under without-project conditions and cause a shift from intermediate to brackish, or a freshwater diversion may cause a shift to fresher conditions. In those cases, two models are required for the evaluation with a model switch at an intermediate target year.

Baseline Habitat Classification and Land/Water Data - One of the first steps in preparation of a WVA is to determine the project area size and the acreage of emergent and open water habitat within that area. Those figures are usually obtained from the habitat classification data provided by USGS. Typically, the 2000 Louisiana Coastal Area (LCA) habitat data are used to determine the acreage of marsh, open water, and the total acreage for the project area or subarea. The marsh models calculate benefits to emergent and open water habitats separately and those benefits are combined to obtain the total project benefits. Therefore, acreage figures for each habitat component and an explanation of the calculations are needed. Uplands and other non-wetland habitats (e.g., spoil banks, developed areas, cropland) are usually removed from the project area.

Land loss rates for a project area are determined from the habitat classification and land/water data provided by the USGS and COE. USGS provides habitat classification data for 1956, 1978, 1988, and 2000 and land/water data for 1990 and 2000. The COE provides land/water data for six time periods; the 1930, 1956-58, 1974, 1983, 1990, and 2000. For most project evaluations,

the loss rate (%/year) for the most recent time period is used for the WVA. It is assumed that the most recent loss rate provides the best representation of current loss rates within the project area. However, observed (e.g., aerial video or field investigations) changes in the project area may provide the basis for using a loss rate from another time period, which could be a higher or lower rate depending on observed conditions in the project area.

Land loss rates, expressed as percent loss per year, for the various time periods should be calculated using the compound rate function (see example below). That loss rate can then be applied in a compound rate spreadsheet (i.e., Excel spreadsheet used by EnvWG) to calculate future loss.

Example Loss Rate Calculation

Compound Rate Function = $[(\text{ending acreage} / \text{beginning acreage})^{1/\text{number of years}}] - 1$
1978 Marsh Acreage – 5,789
2000 Marsh Acreage – 3,452

Compound Rate Function = $[(2000 \text{ acreage} / 1978 \text{ acreage})^{1/22}] - 1$

Annual Loss Rate = $[(3452 / 5789)^{1/22}] - 1 = -0.02323 \quad -0.02323 \times 100 = -2.323 \text{ \%/yr}$

Baseline acreages of marsh and open water for the project area are usually determined from the most recent USGS habitat classification data (i.e., 2000 Louisiana Coastal Area habitat data). However, those acreages do not represent current year acreages as those data are 6 years old (i.e., assuming the current year is 2006). Therefore, to obtain a current-year marsh acreage, 6 years of loss should be applied to the 2000 marsh acreage and projected to the current year. An Excel spreadsheet, which calculates the annual loss for each target year, is available to assist with marsh loss calculations. That spreadsheet, or a similar one, should be used for all marsh loss calculations in the WVA.

Project planners should be aware of the limitations and various anomalies associated with habitat classification and land/water data derived from aerial photography and satellite imagery. Any given form of data can contain misclassifications because of unusual water levels or other conditions. Users of such data should realize that they only provide a “snapshot” of the project area and that those conditions may or may not be representative of normal conditions in the project area. An effort should be made to review other data, examine aerial photography or satellite imagery from multiple years, and conduct field investigations or ground-truthing to obtain an accurate understanding of conditions in the project area.

Selection of Target Years - All candidate project WVAs are conducted for a period of 20 years which corresponds to the authorized project life. Target years (TY) represent points within the 20-year project life when habitat conditions in the project area are expected to change. Those changes can be caused by storms, increasing salinities, project implementation, maintenance, an increase in vegetative cover, etc. Target years are selected for FWOP and FWP conditions. Values for all variables must be determined for each target year and represent conditions at the end of that year.

Each project evaluation must include target years 0, 1, and 20. Target year 0 represents baseline or existing conditions in the project area and TY20 represents conditions at the end of the project life. For FWP, TY1 represents conditions in the project area at the end of the year the project is constructed and assumes the project has been in place for one full year. Although not absolutely necessary, variable values for FWOP-TY1 are usually determined.

The EnvWG has adopted certain conventions for selecting target years for certain project types. Although these conventions are generally applied, exceptions are sometimes proposed and may be accepted by the group. It should be noted that these conventions are based on assumptions developed by the group and have not been validated. It is the responsibility of the project sponsor to provide justification for deviating from these conventions. Conventions include:

Marsh Creation/Nourishment - In addition to the standard TY1, TY3 is generally applied to marsh creation/nourishment projects which include vegetative plantings. TY3 is selected because it is assumed that after three years, the created/nourished area has vegetated and compacted/dewatered to the point where it can function as a marsh.

Marsh Creation/Nourishment - For marsh creation projects which do not include vegetative plantings, TY5 is also selected. It is assumed that without vegetative plantings, it could take five years for the site to vegetate to the point where it can function as a marsh. However, exceptions to this rule are sometimes applied such as when the project area is located within a fresh system or located on the Atchafalaya or Mississippi River deltas. Fresh environments can often naturally vegetate much more rapidly than brackish or saline areas, especially in river delta systems.

V1 Percent Emergent Marsh - In each marsh model, this variable is weighted the highest and thus influences project benefits the most. Of the six variables, future projections for V1 require the most thought and are usually discussed at length during the WVA meeting.

FWOP projections for V1 typically involve applying the baseline land loss rate (e.g., 1990-2000 rate) to the existing marsh acreage for 20 years. A spreadsheet which calculates land loss annually should be used. Under some FWOP scenarios, that loss rate may be increased or decreased depending on expected changes in the project area. The effects of salinity, subsidence, erosion, breaching of a shoreline/bank, constructed projects in the area, future projects in the area, and any other factor which may alter the loss rate should be considered. The evaluation should include a TY when those changes are expected to occur.

FWP projections should address the changes expected to occur as a result of project implementation. The effects of the project on salinity, subsidence, nutrient availability, sediment availability, and any other factor affecting marsh loss should be considered. The planner should carefully consider the causes of loss in the area and the effects of the project on those causes. Future projections should be supported by monitoring data, scientific literature, examples of project success in other areas, previous WVAs, or personal knowledge of the project area. In some instances, best professional judgment provides the only basis for future projections. However, supporting data and other information should be thoroughly reviewed before relying solely on best professional judgment.

The EnvWG has adopted certain conventions for calculating V1 for some project types. Although these conventions are generally applied, exceptions are sometimes proposed and may be accepted by the group. It is the responsibility of the project planner to provide justification for deviating from these conventions. Conventions include:

Marsh Creation - At TY1, marsh creation projects typically receive credit for 25% of the created area if vegetative plantings are included as a project component. It has been assumed that a standard vegetative planting design (10'X5' spacing), will yield 25% coverage at the end of TY1. Even with vegetative plantings, coverage is not sufficient at TY1 for the entire marsh creation platform to be given credit as emergent marsh. At TY3, it is assumed that containment dikes have degraded and that the marsh platform has vegetated and consolidated to the point where it can achieve minimum wetland functions as necessary for the overall fish and wildlife community. The entire marsh platform receives full credit at that time. If vegetative plantings are not included as a project component, then 10% credit is applied at TY1, 30% at TY3, and full credit at TY5.

Marsh Nourishment - Marsh nourishment projects typically occur in areas of fragmented marsh and may only add 6 to 12 inches of material over the marsh surface. Vegetative plantings may be included. At TY1, 50% of the nourished area is given credit as emergent marsh. The addition of 6 to 12 inches of sediment to the marsh surface presumably allows those sites to vegetate more rapidly than sites created in open water. Therefore, these projects receive 100% vegetative credit at TY3.

Typically, a 50% reduction in the FWOP marsh loss rate is applied to the created or nourished marsh. However, other proposals are often considered by the group. Also, existing marsh indirectly benefited by the creation/nourishment could receive a reduction in the FWOP loss rate.

Shoreline Protection - For non-gulf shoreline protection projects, hard structures (e.g., rock dikes, rock revetments, breakwaters) are given credit for preventing 100% of the loss from shoreline erosion. Vegetative plantings are typically given credit for reducing shoreline erosion by 50%. Gulf shoreline protection projects do not receive credit for preventing 100% of the loss from shoreline erosion because of their increased susceptibility to storms as compared to interior shoreline protection projects. Modeling or engineering analyses should be conducted to determine the level of protection.

Diversions – Sediment and freshwater diversions deliver various levels of sediment into a designated area to nourish existing marsh or create new land. Estimating the amount of land created is made easier by the use of a multiple linear regression model developed by LDNR to evaluate such projects. The model was developed to estimate marsh growth for crevasse projects and considers parameters such as size of receiving area, parent channel order, and crevasse size. The model can be obtained from members of the EnvWG and runs on an Excel spreadsheet.

Marsh growth is also estimated for diversion projects by directly calculating the amount of sediment delivered to the receiving area. Such calculations consider the sediment

concentration in the fresh water source, discharge rates for the diversion, duration of operation, depth of the receiving area, and a sediment capture rate.

V2 Percent Open Water Covered by Submerged Aquatic Vegetation - The baseline (TY0) value for this variable is usually determined by ocular estimate during field investigations or from the personal knowledge of project planners, landowners, or land managers in the project area. Raking along pond bottoms can also provide an indication of submerged aquatic vegetation (SAV) densities. Video flights of the candidate projects are conducted each year and may assist in determining SAV coverage. Previous WVAs for other projects in the area can also be helpful.

Future projections for V2 should consider changes in salinity, freshwater introduction, nutrient input, turbidity, water depth, fetch, and other factors which affect SAV growth. Perhaps the two most important factors to consider under FWOP and FWP conditions are salinity and nutrient input as SAV growth is highly dependent on each of those factors. Few standard conventions have been adopted for projecting V2. Future projections should be supported by monitoring data, scientific literature, examples of project success in other areas, previous WVAs, or personal knowledge of the project area.

V3 Marsh Edge and Interspersion - The baseline (TY0) value for this variable is usually determined by examining recent aerial photography of the project area and comparing it to the interspersion classes illustrated in Appendix A of the Emergent Marsh Community Models document. In most cases, the project area is divided into different interspersion classes as most project areas contain more than one class. As with all variables, the baseline interspersion classes are discussed by the group and there is usually a group examination of the aerial photos.

Future projections for this variable can be difficult to develop. It requires the project planner to develop a mental “picture” of what the project area will look like after 20 years (and for intermediate years) of marsh loss under FWOP and also under improved conditions for FWP. One technique which may assist with that process is reviewing aerial photos of other areas. This approach can provide a “picture” of what the project area will look like in the future.

There are a few standard conventions which have been adopted for this variable. The percentages of marsh and open water can sometimes be used to determine the amount of the project area to assign to each interspersion class. For example, if an area is 50% marsh and 50% open water and the water area is large and contiguous, then the area could be classified as 40% Class 1 and 60% Class 4. A small amount of marsh is included within or around the large open water area associated with Class 4; thus, 60% of the area is characterized as Class 4. Assignment of interspersion Class 5 should be reserved for those areas which are entirely open water or contain a very small percentage of marsh (< 5%).

V4 Percent of the Open Water Area <= 1.5 Feet Deep - The baseline (TY0) value for this variable is usually determined during field investigations, from elevation surveys, or from the personal knowledge of project planners, landowners, or land managers in the area. Water level data from staff gages or continuous recorders should be used whenever possible to determine the average water elevation (in NAVD88) in the project area. Water level data can then be used in conjunction with elevations surveys in the project area to determine how much of the area is

<=1.5 feet deep. If gage data and/or elevation surveys are not available, then water depths in the project area should be in reference to marsh elevation. Previous WVAs for other projects in the area can also be helpful.

Future projections for V4 should consider marsh loss trends, the historic formation of open water habitat in the project area, subsidence, tidal exchange, sedimentation, and other factors which affect water depths. Few standard conventions have been adopted for projecting V4. For shoreline protection projects, the existing slope along the shoreline is usually held constant during future years, making the calculation of this variable somewhat easier. Open water habitat ≤ 1.5 feet created by terraces or unconfined dredged material disposal should also be considered. Future projections should be supported by monitoring data, scientific literature, examples of project success in other areas, previous WVAs, or personal knowledge of the project area.

V5 Salinity - The baseline (TY0) value for this variable is usually obtained from salinity data collected along the coast. Salinity data can be obtained from a number of sources; Louisiana Department of Wildlife and Fisheries, Louisiana Department of Health and Hospitals, USGS and COE monitoring stations, LDNR stations utilized for monitoring CWPPRA projects, field trip data, published research (e.g., Swenson and Turner 1998) or data from landowners/land managers. Determining the baseline value from long-term data is preferred to utilizing data from a field investigation which provides a one-time observation of salinity in the project area. Data utilizing both surface and bottom salinity measurements are preferred to surface-only or bottom-only measurements. Members of the AAG have been very helpful in providing project planners with salinity data.

Future projections for this variable are very important in determining the benefits for wetland restoration projects. Salinity is one of the most important factors affecting coastal land loss and decreasing salinities is the goal of many restoration projects. Salinity projections often directly affect projections for percent emergent marsh and percent SAV coverage and indirectly affect projections for marsh edge/interspersion and percent shallow open water. Future projections should consider changes in freshwater introduction and distribution, changes in the hydrology of the project area, and any other factors which may affect salinities. Historical data from the project area and recent trends can assist with future projections, especially under FWOP conditions. Monitoring data from freshwater diversion projects (e.g., Caernarvon, West Point a la Hache) can also be helpful in determining FWP conditions for diversion projects. Modeling conducted for various projects (e.g., Black Bayou Hydrologic Restoration, Hydrologic Investigation of the Chenier Plain, Hopedale Hydrologic Restoration) and COE feasibility studies (e.g., Lower Atchafalaya River Re-Evaluation Study, Morganza to the Gulf) can also be helpful.

Projects which reduce salinities under FWP are typically given credit for doing so at TY1. Those projects typically include features to either reduce saltwater intrusion or introduce freshwater to the system, both of which would have an immediate effect. Few standard conventions have been adopted for projecting V5. Future projections should be supported by monitoring data, scientific literature, examples of project success in other areas, previous WVAs, or personal knowledge of the project area.

V6 Aquatic Organism Access - The baseline (TY0) value for this variable is determined by the method described in Appendix B of the Emergent Marsh Community Models document. A field investigation of the project area and examination of aerial photos is usually necessary to determine the baseline access value. Previous WVAs for other projects can also be helpful. Future projections for V6 should consider changes in access routes under FWOP and FWP conditions. In most FWOP scenarios, the access value does not change from the baseline value. Access may change under FWP conditions depending on what types of structures are built as part of project implementation. Some standard conventions have been adopted for determining V6:

Hydrologic Restoration/Marsh Management - For this project type, the V6 value should be determined using one of two methods. The first method is to apply the structure rating as per Appendix B of the Emergent Marsh Community Models document which lists the most common structures which impact fisheries access. However, some proposed structures (e.g., structure with barge bay) may not exactly correspond to one of the structure types listed. Therefore, a second method is to determine a structure rating based on the rating for a comparable structure.

Marsh Creation - Marsh creation projects typically utilize some form of dike or levee to contain dredged material, thus impacting fish access. If the containment dikes are breached upon project completion, then the access value remains at 1.0, as for an open system. However, if the containment dikes are not breached and remain intact for some time after project completion, then the access value is 0.0001, as for a solid plug. The access value would increase to 1.0 when it is determined that the dikes would breach and access is restored to the area.

Shoreline Protection - Some shoreline protection projects include continuous dikes along the shoreline which restrict fish access. If no other access route is available, those projects should receive an access value comparable to a solid plug (0.0001), as access to the shoreline is completely restricted. However, most shoreline protection projects include gaps or “fish-dips” which allow access to the shoreline and the marsh surface. The elevation of the crest of the fish-dip is an important consideration in determining the access value. If the crest of the fish-dip is no higher than the bottom elevation, then access is equivalent to an open system (1.0). If the crest elevation is above the bottom elevation, then the access value may correspond to a rock weir set at ≥ 1 foot below marsh level (0.6) or another comparable structure. The spacing of fish-dips should also be considered. Typically, fish-dips placed every 1,000 feet with a crest set at bottom elevation are assumed to provide full access (i.e., access rating of 1.0).

Swamp Community Model

Model Application - The swamp community model should be applied to areas supporting or capable of supporting a canopy of woody vegetation which covers at least 33 percent of the area,

and with at least 60 percent of that canopy consisting of any combination of baldcypress, tupelogum, red maple, buttonbush, and/or waterelm. The model also states that if woody canopy cover is less than 33 percent, the fresh marsh model should be applied. However, the EnvWG recognizes that some areas with less than 33% canopy cover provide functions and values more closely associated with a swamp than a fresh marsh. Therefore, the EnvWG agreed that the 33% canopy cover criterion should be treated as a general rule of thumb for model application and that some exceptions may exist. If greater than 40 percent of the woody vegetation canopy consists of species such as oaks, hickories, American elm, green ash, sweetgum, sugarberry, boxelder, persimmon, honeylocust, red mulberry, eastern cottonwood, American sycamore, etc., a bottomland hardwood community model should be applied.

Baseline Habitat Classification and Land/Water Data - Typically, the 2000 Louisiana Coastal Area (LCA) habitat data provided by USGS are used to determine the project area size. Upland and/or non-wetland habitats (e.g., spoil banks, developed areas, cropland) are usually removed from the project area. Acreages for those habitat types should not be included within the project area acreage.

Wetland loss is the conversion of emergent habitat to open water. However, in many areas along the coast, the historic loss of swamp habitat has not resulted in a conversion to open water but conversion to marsh. Because much of the historic loss of swamp has not resulted in a conversion to open water, COE/USGS habitat and land/water data generally do not allow the calculation of a “loss” rate for swamp habitat. However, habitat classification data could be utilized to determine a “conversion” rate of swamp to marsh and that rate could be utilized in the WVA. In those instances, areas of swamp converting to fresh marsh should be evaluated as open water habitat using the fresh marsh model. Allowing those areas to be evaluated as marsh habitat would underestimate project benefits as conversion to marsh, under FWOP, would not result in a net loss of wetland habitat. If an area of swamp was determined to completely convert to marsh over the project life, then protecting that swamp (i.e., FWP) may not result in benefits as the marsh habitat, which exists under FWOP, may be just as valuable as the swamp (i.e., as measured by the WVA). Therefore, in order to allow swamp restoration/enhancement projects to be treated fairly, the converted habitat is treated as open water and evaluated using the fresh marsh model.

In other instances, where swamp has converted to open water, a loss rate could be calculated for the WVA. In addition, the Coast 2050 reports provide estimated loss rates for swamp by mapping units (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1998). That information should also be investigated and provided to the EnvWG for discussion during the WVA. Whichever scenario exists for the project area, whether it is loss of habitat to open water or conversion to marsh, the project planner should investigate the situation carefully and provide as much supporting documentation as possible for the workgroup to consider.

Some swamp restoration project evaluations do not consider the loss rate or conversion rate. Such projects obtain benefits by enhancing the existing swamp community or by preventing the swamp from deteriorating to a less desirable condition. In those instances, a swamp community will still exist at the end of the project life (FWOP-TY20) and a conversion to marsh or open water will not occur.

As previously discussed for the emergent marsh models, baseline habitat acreages from the 2000 LCA habitat data do not represent current year acreages as those data are 6 years old. Therefore, to obtain a current-year swamp acreage, 6 years of loss/conversion at the appropriate rate should be applied to the 2000 swamp acreage.

Selection of Target Years - All candidate project WVAs are conducted for a period of 20 years which corresponds to the authorized project life of a CWPPRA project. During that 20-year analysis period, target years are selected which represent time intervals when habitat conditions in the project area are expected to change. Those changes can be caused by storms, an event which causes salinities to increase, increased frequency and duration of flooding, project implementation, a maintenance event, an increase in vegetative cover, etc. Target years are selected for FWOP and FWP conditions and values for all variables must be determined for each target year. The variable values represent conditions at the end of that year.

Each project evaluation must include target years 0, 1, and 20. Target year 0 (TY0) represents baseline or exiting conditions in the project area and TY 20 represents conditions at the end of the project life. For FWP, TY1 represents the conditions in the project area one year after project construction. Although not absolutely necessary, variable values for FWOP-TY1 are usually determined.

No conventions for the selection of target years have been adopted for swamp restoration projects.

V1 Stand Structure - The baseline (TY0) value for this variable is usually determined during field investigations of the project area. Typically, plots or transects are conducted by the project sponsor or by a group during the EnvWG field trip. Video flights of the candidate projects may assist in determining vegetative coverage. Previous WVAs for other projects in the area can also be helpful.

Future projections for V1 must consider the effects of those processes causing loss/conversion in the project area and how those processes will change under FWOP and FWP conditions. Factors to consider include flooding depth and duration, salinity, subsidence, nutrient and freshwater availability, and water exchange. The effects of those factors on tree growth, scrub-shrub growth, and herbaceous growth should be considered. FWP projections should obviously address how the project will change those factors from FWOP conditions. Future projections should be supported by monitoring data, scientific literature, examples of project success in other areas, previous WVAs, or personal knowledge of the project area.

V2 Stand Maturity - The baseline (TY0) value for this variable is usually determined during field investigations of the project area. Typically, plots or transects are conducted by the project sponsor or by a group during the EnvWG field trip. Previous WVAs for other projects in the area can also be helpful.

Future projections for V2 must consider the effects of those processes causing loss/conversion in the project area and how those processes will change under FWOP and FWP conditions. Factors to consider include flooding depth and duration, salinity, subsidence, nutrient and freshwater

availability, and water exchange. The effects of those factors on tree growth should be considered. FWP projections should address how the project will change those factors from FWOP conditions.

Future projections should be supported by monitoring data, scientific literature, examples of project success in other areas, previous WVAs, or personal knowledge of the project area. A tree growth spreadsheet developed by FWS and COE biologists can be used to assist with tree growth projections. That spreadsheet was developed to project the growth of several swamp and bottomland hardwood species. Another reference to assist with tree growth projections is the U.S. Department of Agriculture's Silvics of North America. That publication contains growth information for several swamp species.

V3 Water Regime - The baseline (TY0) value for this variable is usually determined during field investigations or from the personal knowledge of landowners/managers. Data from a nearby water level gage, such as those monitored by the COE or USGS, can also be helpful in determining the flooding duration of the project site. Previous WVAs for other projects in the area can also be helpful.

Determining the baseline value for this variable, as well as making future projections, often requires the project planner to examine conditions outside of the project area. Navigation channels, flood protection levees, forced drainage systems, and drainage canals outside of the project area should be investigated to determine their effect on the hydrology of the project area. FWOP conditions may not change from baseline if the hydrology of the area is not modified. Many swamp restoration projects include features to improve the hydrology of the project area. Many swamps along the coastal zone are experiencing increased flooding, poor water exchange, poor water quality, and a lack of fresh water and nutrients. Therefore, many projects attempt to improve one or more of those parameters. Projections for FWP should consider the effects of the project in changing baseline hydrologic conditions.

V4 Mean High Salinity During the Growing Season - The baseline (TY0) value for this variable is usually obtained from salinity monitoring data collected along the coast. Salinity data can be obtained from a number of sources; Louisiana Department of Wildlife and Fisheries, Louisiana Department of Health and Hospitals, U.S. Geological Survey, and COE monitoring stations, LDNR monitoring stations utilized for monitoring CWPPRA projects, field trip data, or data from landowners/land managers. Determining the baseline value from long-term data is preferred to utilizing data from a field investigation which provides a one-time observation of salinity in the project area. Members of the AAG have been very helpful in providing project planners with salinity data.

Future projections for this variable are very important in determining the benefits for wetland restoration projects. Salinity is one of the most important factors affecting coastal land loss and decreasing salinities is the goal of many restoration projects. Because of its effect on tree growth, canopy cover, herbaceous cover, and other factors, salinity affects other variables in the fresh swamp model such as stand structure and stand maturity. Future projections should consider changes in freshwater introduction and distribution, tidal exchange, changes in the hydrology of the project area, and any other factors which may affect future salinities. Historical data from the project area and recent trends can assist with future projections, especially under

FWOP conditions. Monitoring data from freshwater diversion projects (e.g., Caernarvon, West Point a la Hache) can also be helpful in determining FWP conditions for diversion projects into swamp habitat. Modeling conducted for various projects and COE feasibility studies can also be helpful.

Projects which reduce salinities under FWP conditions are typically given credit for doing so at TY1. Those projects typically include features to either reduce saltwater intrusion or introduce freshwater to the system, both of which would have an immediate effect. Few standard conventions have been adopted for projecting this variable. Future projections should be supported by monitoring data, scientific literature, examples of project success in other areas, previous WVAs, or personal knowledge of the project area.

Barrier Island/Headland Community Models

Model Application - The barrier island community model should be applied to barrier island habitats found gulfward of bay or lake systems. This model was developed to evaluate restoration projects on barrier islands in the Terrebonne and Barataria Basins (e.g., Isles Dernieres, Timbalier, and Grand Terre). Application to the Chandeleur Islands, which contain extensive seagrass beds on the bayside, may require model revisions as the value of those seagrass beds is not specifically captured by this model.

The barrier headland community model was developed to complement the barrier island model and should be applied to shoreline areas along the coast which consist of beach, dune, and supratidal habitat and which naturally decrease in elevation to an intertidal marsh. By nature, barrier headlands are contiguous with the mainland marsh and have not yet detached and begun formation of a barrier island.

Baseline Habitat Classification and Land/Water Data - One of the first steps in preparing a WVA for a barrier island/headland project is to determine the total project area size and the acreage of each of the habitat components (e.g., dune, supratidal, and intertidal). The total project area size and acreage of each habitat type should be determined using topographic or bathymetric surveys. Aerial photography and habitat classification data can be helpful to divide the island/headland into the different habitat types. It is also helpful to use both elevation and habitat data to characterize the habitats across the island. As with marsh projects, if the project area acreage is not current, then the erosion rate should be applied to that acreage and adjusted to the current year. Adjustments to the project area acreage could also be obtained from process-based barrier island morphological modeling results and other supporting information.

Selection of Target Years - All candidate project WVAs are conducted for a period of 20 years, which corresponds to the authorized project life of a CWPPRA project. During that 20-year analysis period, target years are selected which represent time intervals when habitat conditions in the project area are expected to change. Those changes can be caused by storms, project implementation, a maintenance event, an increase in vegetative cover, etc. However, waves, wave-generated currents, tidal currents, and winds determine island size, shape and position. Therefore, target years are typically selected based on storm events, storm recovery, and significant changes in vegetative cover. Target years are selected for FWOP and FWP

conditions. Values for all variables must be determined for each target year. Variable values represent conditions at the end of that year.

Each project evaluation must include target years 0, 1, and 20. Target year 0 (TY0) represents baseline or existing conditions in the project area and TY 20 represents conditions at the end of the project life. For FWP, TY1 represents the conditions in the project area one year after project construction. Although not absolutely necessary, variable values for FWOP-TY1 are usually determined.

Since development of the barrier island/headland models a few conventions have been adopted for selection of target years. Although not mandatory, target years 3 and 5 are often used to capture the benefits of complete vegetative cover of the marsh platform (TY3) and the area planted with woody vegetation (TY5). It is assumed that complete vegetative cover would take longer to develop in areas planted with woody vegetation. Because the planting of woody species is a relatively new feature of CWPPRA restoration projects, more information on the growth and spread of various species is needed.

A target year to capture the effects of a storm event is also usually applied. A storm event can impact a barrier island in several ways; 1) erosion rates could increase if the island is fragmented and/or if the shoreline is breached, 2) a decrease in vegetative cover as the island is overwashed, or 3) conversion of dune to supratidal habitat and supratidal habitat to intertidal habitat as elevations are reduced. Storm frequencies for the Louisiana coast vary depending on the period of record but are generally 8 to 10 years. Selection of a storm impact target year should be based on the storm return frequency that would result in substantial impact (e.g., overtopping, breaching, etc.). Storm impact and return frequency (Stone et al. 1997), by barrier system, should be used as justification when selecting target years.

V1, V2, V3 - Percent Dune, Percent Supratidal, and Percent Intertidal - Baseline (TY0) values for these variables should be determined from elevation surveys conducted in the project area. If elevation data are unavailable, then habitat classification data and/or vegetative species composition data can be used as a substitute. However, elevation data are preferable as the habitat types are defined by elevation. The percent intertidal variable (V₃) is not included within the barrier headland model.

Barrier islands/headlands are unique in that as they erode, the distribution of habitat types changes. On barrier islands, dune is converted to supratidal, supratidal to intertidal, and intertidal to subtidal as the island erodes and elevation decreases. Therefore, future projections for these three variables must not only address the loss of habitat but also the conversion of one habitat type to another. Predicting barrier island/headland habitat change under FWOP and FWP conditions is one of the more complex tasks facing coastal planners.

Fortunately, there are coastal engineering models and other analytical tools which can be utilized to assist in predicting future habitat conditions. Some models, such as the Storm Induced Beach Change Model (SBEACH) can be utilized to predict storm-induced changes in an island's profile under various FWP designs (e.g., different dune heights, different marsh platform widths, etc.). Other models, such as the Generalized Model for Simulating Shoreline Change (GENESIS) and

others, (e.g., DNRBS, NMLONG) predict shoreline position by modeling the movement of sand due to waves over several years.

Two models frequently used to determine the effects of coastal processes on existing conditions and design alternatives are SBEACH and GENESIS. The SBEACH model predicts cross-shore storm impacts and simulates beach profile changes that result from varying storm waves and water levels. Changes in island profile can be predicted for various target years, for different island cross sections, and for different types of storms. The GENESIS model calculates shoreline change produced by spatial and temporal differences in longshore sand transport produced by waves. The existing shoreline can be altered (i.e., FWP) by the addition of sand or hard structures and the shoreline response predicted over time. Literature available on barrier island modeling includes Coastal Planning and Engineering 2001, Dean 1997, Herbich 2000a, Herbich 2000b, List et al. 1997, and Tait 2000. Desktop PC versions of some of these models are available.

A third possible modeling approach is the use of a two- or three-dimensional process based morphological model to simulate most of the relevant physical processes that occur on barrier islands/headlands. One such example is the Delft3D system which bases predictions on detailed, process-based formulations that are resolved over a three-dimensional grid covering the project area. Processes solved include hydrodynamics, storm surge and profile inundation, waves, bottom shear stresses, sediment transport, and bottom changes (Moffatt and Nichol 2004).

Another commonly used engineering analysis is the development of a sediment budget, which considers both longshore and cross-shore transport. The sediment budget tracks the movement of sediment into, out of, and within a barrier island to predict shoreline change.

Several agencies including the NMFS, EPA, NRCS, and the LDNR have utilized many of the coastal engineering methods previously discussed. Their expertise should be utilized when assessing projects via the barrier island/headland habitat model. In particular, the NMFS has worked extensively with private contractors utilizing many of these coastal engineering tools to evaluate barrier island project designs. In working with private contractors, the NMFS saw the need to develop a document which clearly defines the data requirements for the barrier island/headland habitat model. That document, "*Data Requirements to Support Environmental Benefits of Barrier Island and Barrier Headland Projects Assessed with Community Based Models*" is attached as Appendix A. Project planners should review Appendix A and utilize it if working with private contractors to evaluate barrier island/headland design alternatives.

V4- Percent Vegetative Cover of Dune, Supratidal, and Intertidal Habitats – The baseline (TY0) value for this variable is usually determined during field investigations of the project area. Video flights of the candidate projects are conducted each year and may assist in determining vegetative coverage. Previous WVAs for other projects can also be helpful. Vegetative cover in the intertidal zone is not included in the barrier headland model.

Future projections should consider island/headland height and width which affect the frequency of overtopping and thus vegetative cover. Stable, unfragmented islands/headlands could be assumed to have greater vegetative cover, less frequent overtopping, and the ability to recover

more quickly after storm events. The opposite would be true for fragmented, low-elevation islands/headlands which would experience more frequent overtopping.

Based on guidance from the AAG and scientific literature, the group adopted some standard conventions for FWP for the PPL11 candidate projects. With an appropriate planting design, vegetative cover was assumed to be 25% in each habitat type at TY1 and would become optimal by TY3. A slight reduction in vegetative cover was experienced at the target year when a storm event was expected to occur. However, vegetative cover returned to optimal the following year. However, as with all conventions, other scenarios can be presented and discussed by the group.

V5 Percent Cover by Woody Species - The baseline (TY0) value for this variable is usually determined during field investigations of the project area. Video flights of the candidate projects conducted each year may assist in determining cover by woody species. However, a field inspection may be necessary to determine the number of woody species present. Islands with two or more woody species are considered of higher habitat value than those with only one species. Previous WVAs for other projects can also be helpful. This variable is listed as V3 in the barrier headland model.

Projections for this variable are similar to those for the vegetative cover variables for dune, supratidal, and intertidal habitats. However, this variable addresses cover by woody species for the entire island/headland. Future projections should consider island/headland elevation and width which affect the frequency of overtopping and thus vegetative cover by woody species. Stable, unfragmented islands/headlands could be assumed to have greater vegetative cover, less frequent overtopping, and the ability to recover more quickly after storm events. The opposite would be true for fragmented, low-elevation islands/headlands which would experience more frequent overtopping.

For FWP projections, the group adopted some standard conventions when evaluating PPL11 candidates. With an appropriate planting design, woody cover was assumed to be 5% at TY1 and would become optimal by TY5. A slight reduction in woody cover may be experienced at the target year when a storm event is expected to occur. However, cover could return to optimal conditions in subsequent years. Other scenarios can be presented and discussed by the group. Because the planting of woody species is a relatively new feature of CWPPRA restoration projects, more information on the growth and spread of various species is needed.

V6 Edge and Interspersion - The baseline (TY0) value for this variable is usually determined by examining recent aerial photography of the project area and comparing it to the interspersion classes illustrated in the barrier island community model. The project area may be divided into different interspersion classes as most project areas contain more than one class. The baseline interspersion classes are discussed by the group and there is usually a group examination of the aerial photos.

Future projections for this variable can be difficult to develop. It requires the project planner to develop a mental "picture" of what the island will look like after 20 years (and for intermediate years) of deterioration. One technique which could assist with that process is reviewing historical aerial photos of the project area as well as photos of other islands which could provide a "picture" of what the project area will look like in the future. Also, modeling the platform

response and the resulting acreage of each habitat type can be a means to justify the percentages and types of interspersed classes.

V7 Beach/Surf Zone Features - The baseline (TY0) value for this variable is determined from field investigations or by reviewing aerial photography or aerial videos. The shoreline may encompass more than one beach zone feature. For example, a portion of the shoreline may contain rock breakwaters and the rest of the shoreline may have no structures. It is therefore necessary to determine which percent of the shoreline is in each class. This variable is listed as V4 in the barrier headland model.

Future projections for V7 should consider such things as whether or not the hard structures will remain intact, migration of the island/headland away from any hard structures, fill material placed over hard structures, and erosion of containment dikes during the equilibration process.

Coastal Chenier/Ridge Community Model

Model Application - The coastal chenier/ridge community model was developed to determine the suitability of coastal forested ridges in providing foraging and resting habitat for transient migratory landbirds. This model has only been used for one evaluation by the EnvWG. The model should be applied to forested habitats within the coastal zone consisting of non-grazed barrier headland ridges, cheniers, and in some cases, spoil areas. Those areas should be at an elevation capable of supporting woody vegetation such as trees and/or shrub/scrub habitat and are not influenced by the average daily tide. This model is not intended to be applied to other forested habitats such as bottomland hardwoods or cypress-tupelo swamp.

Baseline Habitat Classification and Land Loss Data - Baseline data can be obtained from the 1988/90 habitat classification data provided by USGS which delineates forested areas. As with other project types, if the project area acreage is not current, then the erosion rate should be applied to that acreage and adjusted to the current year. For coastal ridge habitats located along the gulf shoreline, erosion data could be obtained from the U.S. Geological Survey's Louisiana Barrier Island Erosion Study-Atlas of Shoreline Changes in Louisiana from 1853 to 1989 and the Atlas of Sea-Floor Changes from 1878 to 1989. For ridges or cheniers located within interior areas, USGS habitat data or COE land loss data may be helpful.

Selection of Target Years - All candidate project WVAs are conducted for a period of 20 years, which corresponds to the authorized project life of a CWPPRA project. During that 20-year analysis period, target years are selected which represent time intervals when habitat conditions in the project area are expected to change. Those changes can be caused by storms, project implementation, a maintenance event, an increase in vegetative cover, etc. Target years are selected for FWOP and FWP conditions. Values for all variables must be determined for each target year. Variable values represent conditions at the end of that year.

Each project evaluation must include target years 0, 1, and 20. Target year 0 (TY0) represents baseline or existing conditions in the project area and TY 20 represents conditions at the end of the project life. For FWP, TY1 represents the conditions in the project area one year after project construction. Although not absolutely necessary, variable values for FWOP-TY1 are usually determined.

No conventions have been adopted for selecting target years for coastal chenier/ridge project areas. For sites located along the gulf shoreline, it may be necessary to select a target year which corresponds to a storm event which is likely to occur within the 20-year project life. A storm event can impact a coastal ridge by increasing erosion rates if the ridge is breached or a decrease in vegetative cover could result. Storm frequencies for the Louisiana coast vary depending on the period of record analyzed but are generally 8 to 10 years.

V1 Percent Tree Canopy Cover - The baseline (TY0) value for this variable should be determined during field investigations of the project area. Plots or transects conducted in the project area should be designed to provide the best estimate of canopy cover. Video flights of the candidate projects are conducted each year and may assist in determining canopy cover.

Future projections for this variable must consider the effects of land loss processes in the project area and how those processes will change under FWOP and FWP conditions. Factors to consider include flooding duration, salinity, subsidence, and storm events. The effects of those factors on tree growth should be considered. Future projections should be supported by monitoring data, scientific literature, examples of project success in other areas, previous WVAs, or personal knowledge of the project area.

V2 Percent Shrub/Midstory Cover - The baseline (TY0) value for this variable should be determined during field investigations of the project area. Plots or transects conducted in the project area should be designed to provide the best estimate of midstory cover. Video flights of the candidate projects are conducted each year and may assist in determining canopy cover of shrub/midstory species.

Future projections for this variable must consider the effects of land loss processes in the project area and how those processes will change under FWOP and FWP conditions. Factors to consider include flooding duration, salinity, subsidence, and storm events. The effects of those factors on shrub and midstory growth should be considered. Future projections should be supported by monitoring data, scientific literature, examples of project success in other areas, previous WVAs, or personal knowledge of the project area.

V3 Native Woody Species Diversity - The baseline (TY0) value for this variable should be determined during field investigations of the project area. Plots or transects conducted in the project area should be designed to provide the best estimate of the number of woody species present.

Future projections for this variable must consider the effects of land loss processes in the project area and how those processes will affect species diversity under FWOP and FWP conditions. Factors to consider include flooding duration, salinity, subsidence, and storm events. Future projections should be supported by monitoring data, scientific literature, examples of project success in other areas, previous WVAs, or personal knowledge of the project area.

Additional Notes

All project WVAs should be prepared in the Project Information Sheet (PIS) format (attached) which was adopted by the EnvWG. At the time of the WVA meeting, a copy of the PIS should be provided for each agency and each member of the AAG. At a minimum, the PIS should provide; 1) baseline habitat analysis, 2) marsh/wetland loss analysis, 3) the calculations for each variable, and 4) a list of literature cited and/or reference material. Project evaluations are conducted much more efficiently when the project planner is well-prepared and all necessary information is presented in the PIS. The PIS should be revised after the WVA meeting to reflect all decisions made by the group during that meeting. A copy of the revised PIS should be provided to each member of the EnvWG.

The official calculation of project benefits is the responsibility of the EnvWG chairman. However, project planners are encouraged to also calculate project benefits to serve as a means of checking the numbers provided by the chairman to the Planning and Evaluation Subcommittee. Project benefits are calculated using Excel spreadsheets which have been developed specifically for each habitat model. An example of one of those spreadsheets is attached.

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