MARYLAND COMPENSATORY MITIGATION GUIDANCE

Developed by the Interagency Mitigation Task Force which is comprised of the following agencies:

U.S. Army Engineer District, Baltimore (Corps)
U.S. Environmental Protection Agency (EPA)
U.S. Fish and Wildlife Service (FWS)
National Marine Fisheries Service (NMFS)
Federal Highway Administration (FHWA)
Maryland Department of the Environment (MDE)
Maryland Department of Natural Resources (DNR)
Maryland State Highway Administration (SHA)

August 1994

COMPENSATORY MITIGATION GUIDANCE

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COMPENSATORY MITIGATION GUIDANCE

INTRODUCTION

The following Compensatory Mitigation Guidance was developed by the Interagency Mitigation Task Force (IMTF) comprised of the following agencies.

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The members of the IMTF have training and work experience in wildlife biology, fishery biology, botany, forestry, water quality, and wetlands, including their regulation, delineation, and compensation.

This Guidance is to facilitate the understanding and consistency of compensatory mitigation requirements as they pertain to regulated activities in waters and wetlands.

Guidance is critical to the mitigation process for both the regulator and the applicant. Promulgation of clear and concise guidelines will promote a better understanding of the objectives of compensatory mitigation. Ultimately this will serve to achieve greater success with mitigation as we attempt to refine techniques to replace and restore vital ecosystems. The procedures for developing a mitigation site as set forth in these documents were based on existing regulations, policy, state of the science methodologies, and best professional judgement. These procedures are currently implemented by the regulatory and resource agencies and utilized by the regulated public in the development of mitigation sites. The standards in these papers are the minimum acceptable criteria for use in the development of compensatory mitigation. However, as these papers are developed for guidance purposes, there is room for change or added options based on the best available technology.

The guidance set forth in the following Chapters does not supercede existing Federal or State laws and regulations. All permit conditions and requirements are at the discretion of the permit evaluator. This guidance is to provide assistance and direction in the compensatory mitigation process for both the regulator and permit applicant.

COMPENSATORY MITIGATION GUIDANCE

Glossary of Definitions

1. **Advance** -- compensatory mitigation performed at least two years prior to the activity for which wetland mitigation will be required and is completed as designed and determined to meet the two year performance standards. Advance mitigation includes, but is not limited to, mitigation banking.

2. **As-built plans** -- plan drawings to scale depicting actual grading elevations and planted vegetation zones once construction of the mitigation site has been completed.

3. **Compensatory mitigation** -- creation, restoration, enhancement, and preservation of vegetated wetlands, or, some other method of improving a waterway/wetland ecosystem with the intent to replace the functions and values of wetlands altered or lost as a result of permitted activities.

4. **Concurrent** -- compensatory mitigation performed simultaneously with the activity for which the wetland mitigation is required.

5. **Conservation easement** -- a legally enforceable, two-party agreement between the grantor, i.e., landowner, and grantee, wherein certain rights are given up to utilize the land. The grantor retains ownership and the grantee agrees to ensure compliance with the terms of the easement. A conservation easement does not convey title.

6. **Creation** -- actions performed which establish functional wetlands on upland (non-wetland) sites.

7. **Deed restriction** -- a written statement made part of a deed which prohibits specified activities on a mitigation site. Legal mechanisms by which to impose deed restrictions are conservation easements and restricted covenants. The deed restriction serves notice to potential purchasers, offerers, or grantees, that certain activities are restricted on the mitigation site that may alter the ecological integrity of the site.

8. **Enhancement** -- actions performed in existing, or severely degraded wetlands to increase one or more wetland functions. Enhancement differs from restoration activities in that the former occurs in existing wetlands.

9. **In-kind** -- the replacement of a specific wetland system, subsystem, class, and subclass with the same system, subsystem, class, and subclass. (The system, subsystem, class, and subclass

are defined by Cowardin, et al. (1979) wetland classification system.) Vegetation community, hydroperiod, and location in the landscape are among the factors considered when attempting to replace in-kind wetland functions.

10. **Interagency Mitigation Task Force (IMTF)** -- a group consisting of one mitigation specialist representing each of the following agencies:

a. U.S. Army Engineer District Baltimore (Corps)
b. U.S. Environmental Protection Agency (EPA)
c. U.S. Fish and Wildlife Service (FWS)
d. National Marine Fisheries Service (NMFS)
e. Federal Highway Administration (FHWA)
f. Maryland Department of the Environment (MDE)
g. Maryland Department of Natural Resources (DNR)
h. Maryland State Highway Administration (SHA)

11. **Maryland Non-tidal Wetland Compensation Fund** -- the non-tidal wetlands regulations for the State of Maryland allow the Department of Natural Resources to accept monetary compensation in lieu of mitigation, if it is determined that mitigation is not a feasible alternative. As a special condition of a Section 404 permit, the Maryland Compensation Fund may be used to satisfy the mitigation requirement. Monetary compensation may be accepted under one or more of the following circumstances:

a. the size of the non-tidal wetland loss is less than one acre and mitigation is not feasible at the site.

b. in-kind mitigation of non-tidal wetland losses is technically infeasible (springs, bogs, etc.).

c. an acceptable mitigation site cannot be located within the sub-basin or county of the non-tidal wetland loss.

12. **Natural regeneration** -- the colonization of a site by volunteer plant species.

13. **On-site** -- within or adjacent to the project property boundaries within the same sub-watershed.

14. **Out-of-kind** -- replacement of a specific wetland system, subsystem, class, and subclass with wetlands of another system, subsystem, class, and subclass.

15. **Practicable** -- available and capable of implementing after cost, existing technology, and logistics in light of overall project purpose have been considered.

16. **Preservation** -- the protection of lands for the purpose of increasing the functional value of wetlands, which will result in an overall benefit to the ecosystem mosaic. Such lands include wetlands and adjacent areas, and may receive credit as compensatory mitigation. Fee simple acquisition, conservation easement, or other legal mechanisms that provide for perpetual protection will be required.

17. **Restoration** -- actions performed which establish functional wetlands on former wetland sites.

18. **Sub-watershed** -- a smaller drainage area within a watershed. In Maryland, the "sub-watershed" corresponds to the "segment" watershed designation established by the Water Resources Administration.

19. **Topsoil** -- a presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress lawns and gardens.

20. **Watershed** -- the total drainage area contributing runoff to a single point. In Maryland, the "watershed" corresponds to the "sub-basin" watershed designation established by the Water Resources Administration.

21. **Waterway Rehabilitation and Improvement** -- actions performed to protect water quality or improve the functions of aquatic sites and resources. Examples include stream restoration and fisheries enhancement.

22. **Wetlands** -- those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

COMPENSATORY MITIGATION GUIDANCE

Chapter 1

Acreage Replacement Ratios

I. Justification for Establishing Acreage Replacement Ratios

A. Established acreage replacement ratios are preferred for consistency and simplicity.

B. Acreage replacement ratios are based upon the following factors: wetland functions and values (as may be assessed by best professional judgement, HEP, WET2 or other methodologies); acreage; cover type; timing, type, and location of mitigation.

C. The acreage replacement ratios will give consideration to the following: the potential for success; lag time required for a site to become fully functional; acreage of wetland disturbed; higher replacement ratios for areas of special concern; current state of the science; public acceptance; economics; exceptional circumstances. In lieu of scientific methodologies to assess wetland functions, replacement ratios will be used to determine mitigation requirements.

II. Ratio Guidelines

Acreage replacement ratios listed below are based upon the wetland functions and values (as may be assessed by best professional judgement and current assessment methodologies), acreage, and cover type of the wetland to be altered. Also incorporated into the ratio formula is the timing, type, and location of mitigation to be performed. See attached flowchart for the preference of mitigation strategies. These ratios are the recommended minimum requirement. The guidance put forth here does not supersede existing Federal or State laws or regulations. Where Federal and State requirements differ, the ratios which are most stringent will be applied.

A. Replacement Ratios

		Wetland Class FO/SS*	EM*
CREATION	advance =	1.5:1	1:1
	concurrent =	2:1	1.5:1

		FO/SS	EM
RESTORATION	advance =	1.5:1	1:1
	concurrent =	2:1	1.5:1
ENHANCEMENT	advance =	3:1	2:1
	concurrent =	4:1	3:1

* Wetlands are classified according to the U.S. Fish and Wildlife classification system as developed by Cowardin et al., 1979.
FO = forested wetland
SS = scrub-shrub wetland
EM = emergent wetland

Wetland classes occur in palustrine, estuarine, riverine, lacustrine, and marine environments. The above acreage replacement ratios apply to all of these wetland systems. The functional value replacement will be considered as the science is developed.

B. Exceptional Circumstances

1. State Areas of Special Concern or Maryland Heritage Areas

advance =	2.5:1
concurrent =	3:1

2. Maryland Non-tidal Wetlands Compensation Fund -- the non-tidal wetlands regulations for the State of Maryland allow the Department of Natural Resources to accept monetary compensation in lieu of compensatory mitigation, if it determines that compensatory mitigation is not a feasible alternative. As a special condition of a Section 404 permit, the Maryland Compensation Fund may be used to satisfy mitigation requirement. Monetary compensation may be accepted by the State under one or more of the following circumstances:

   a. the size of the non-tidal wetland loss is less than one-half acre and mitigation is not feasible on site.
   b. in-kind mitigation of non-tidal wetland losses is technically infeasible (springs, bogs, etc.).
   c. an acceptable mitigation site cannot be located within the sub-basin or county of the non-tidal wetland loss.

C. Case-by-Case Mitigation Strategies -- Alternative strategies will be considered by the regulatory and resource agencies once the applicant/permittee has demonstrated that in-kind compensatory mitigation options

have been exhausted. (Refer to the flowchart in Section III for sequencing of mitigation strategies.)

1. Waterway Rehabilitation and Improvement (WR/I) -- Combination of a minimum 1:1 ratio of creation or restoration plus implementation of WR/I mitigation. The scope of the WR/I will be determined during a consultative process among the regulatory and resource agencies and the applicant.

2. Preservation -- Minimum 1:1 ratio of creation or restoration in addition to 10:1 ratio for lands protected in perpetuity for the purpose of increasing or protecting the functional value of the mitigated wetlands.

3. Invasive Plant Eradication (IPE) -- The eradication of existing invasive plant species may be proposed only after the minimum 1:1 ratio of creation or restoration has been satisfied. A minimum 10:1 acreage ratio is recommended for IPE. The scope of the IPE will be determined during a consultative process among the regulatory and resource agencies and the applicant.

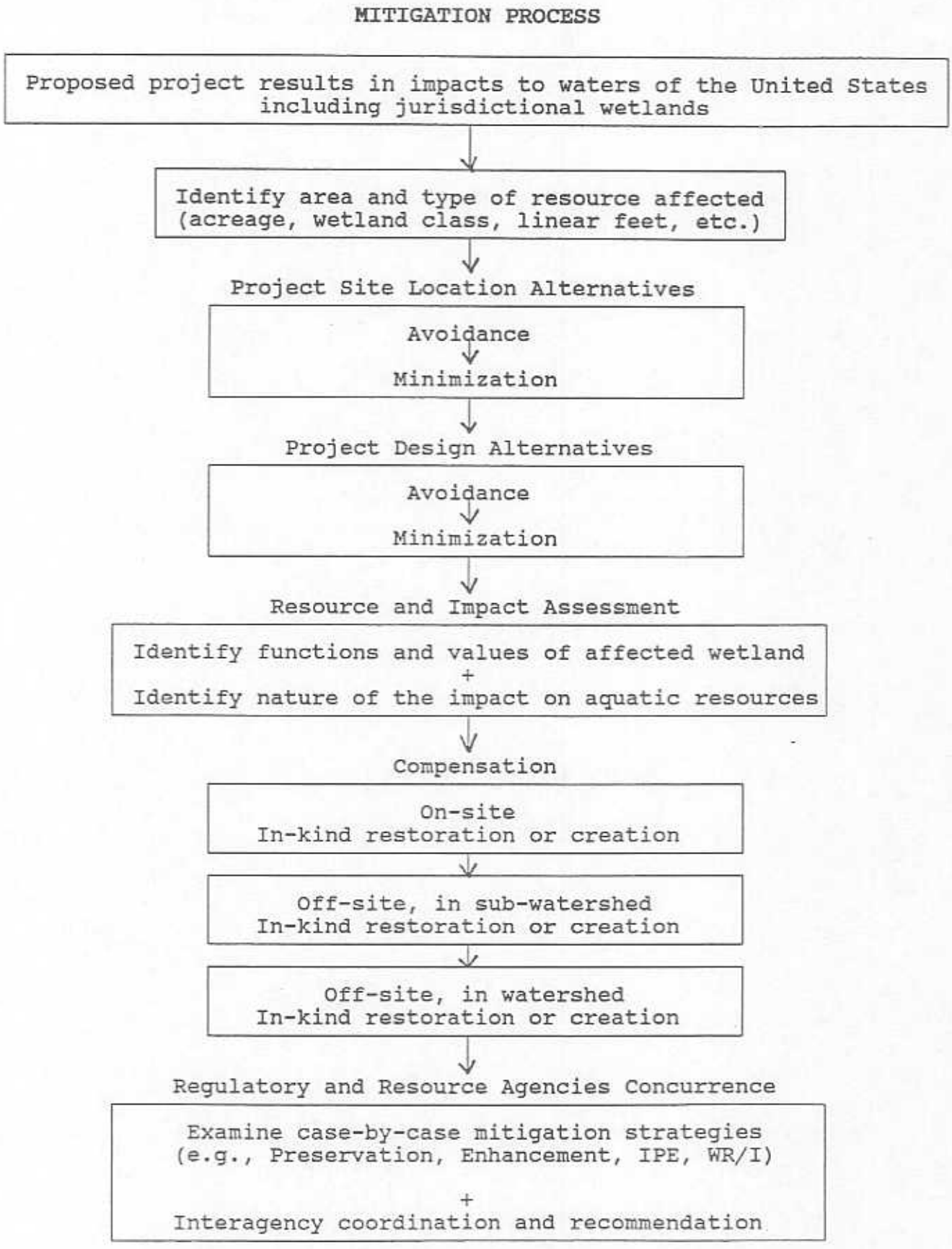
   The following examples demonstrate use of the IPE:

   Example #1:
   Impact = 5 acres PFO.
   Mitigation rqmt. w/o IPE ratio = 10 acres PFO (2:1).
   Mitigation rqmt. with IPE ratio =
   5 acres PFO creation + 50 acres
   [5 (acres owed) x 10)]

   Example #2:
   Impact = 5 acres PFO.
   Mitigation rqmt. w/o IPE ratio = 10 acres PFO (2:1)
   Mitigation rqmt. with IPE ratio =
   6 acres PFO creation + 40 acres
   [4 (acres owed) x 10)]

D. Mitigation Banking -- Use of established mitigation banks or approved mitigation bank sites may be considered as applicable.

III. Mitigation Flowchart



COMPENSATORY MITIGATION GUIDANCE

Chapter 2

Mitigation Site Selection

The following guidance establishes a sequence for compensatory mitigation site selection. After avoidance and minimization alternatives have been examined, the characteristics of the impact site must be considered to determine the goals of the compensatory mitigation site. This sequence for selecting mitigation sites is demonstrated in the mitigation process flow chart in Section III. As the preferred sequence is followed, mitigation opportunities are identified as suitable or not suitable based upon a number of relevant factors. These factors are presented in this paper.

I. Factors for Consideration for Mitigation Site Selection

A. Impact Site Assessment

1. Ecological and Physical Characteristics

a. function
b. size
c. position in landscape (e.g., riparian, headwater, perched, etc.)
d. adjacent land use
e. hydrology
f. vegetation
g. soil characteristics

2. Establish Goals for Mitigation

a. wetland type
b. wetland functions
b. acreage replacement ratios (see Chapter 1)

B. Mitigation Site Selection

1. Wetland mitigation goals (i.e., wetland type and replacement ratio) provide a foundation for the mitigation site selection process.

2. The mitigation process (see flowchart in Section III) requires the avoidance or minimization of the wetlands impact prior to the examination of compensation. Sequencing for compensatory mitigation site selection is initiated with a search for sites that are suitable for "in-kind" replacement of wetland functions and are located on-site or within the same sub-watershed in which the impacts occur. However, each mitigation undertaking is dependent on the characteristics and circumstances of the construction site and deviation

in the sequencing process will be considered on a case-by-case basis. (Note: For non-tidal wetland impacts within the State of Maryland, the Maryland Non-tidal Wetland Compensation Fund may be determined acceptable for compensatory mitigation on a case-by-case basis. Specific criteria established by the State govern the use of this fund.)

3. Existing land use determines whether the area is appropriate as a mitigation site. The site should be assessed for its ecological and physical characteristics to determine its acceptability as a mitigation site. The following lists are general guidance; they are not in order of preference. Final decisions will be made on a case-by-case basis.

   a. acceptable

      - disturbed lands
      - early successional communities such as old field
      - barren/open land
      - landscaped managed areas
      - agricultural land
      - abandoned mining sites
      - dredged material placement sites

   b. unacceptable

      - wetlands
      - endangered species habitat
      - known toxic sites
      - listed historic properties
      - mature forest
      - special areas such as critical habitat, heritage areas, State areas of Special Concern
      - stormwater management areas

4. Hydrology of the Proposed Mitigation Site

   a. surface water adjacent to or within the site
   b. groundwater at or near the surface
   c. within or contiguous to the 100-year floodplain
   d. adjacent to existing wetlands

5. Position in landscape (e.g., riparian, headwater, adjacent to existing wetlands) will affect the success in achieving the mitigation goals (e.g., wetland replacement type, replacement of wetland function , and size of replacement wetland.)

6. The slope for proposed non-tidal mitigation sites should be less than 5%. Proposed tidal sites should have less than a 10% slope.

7. Other Factors to be Considered

   a. adjacent land use (existing and projected)
   b. size (acreage)
   c. soil characteristics
   d. availability for use
   e. archeological/cultural/historic
   f. economic factors
   g. deed restrictions or easements for parcel
   h. degree of manipulation required
   i. watershed planning - goals of an existing sub-watershed management plan as identified by a state or local government should be considered when planning for compensatory mitigation required within a particular sub-watershed. Examples of targeted sub-watershed management plans in Maryland:

      Sawmill Creek, Anne Arundel County
      German Branch, Tuckahoe River, Queen Anne's County
      Bird River, Baltimore County
      Piney/Alloway Creek, Carroll County

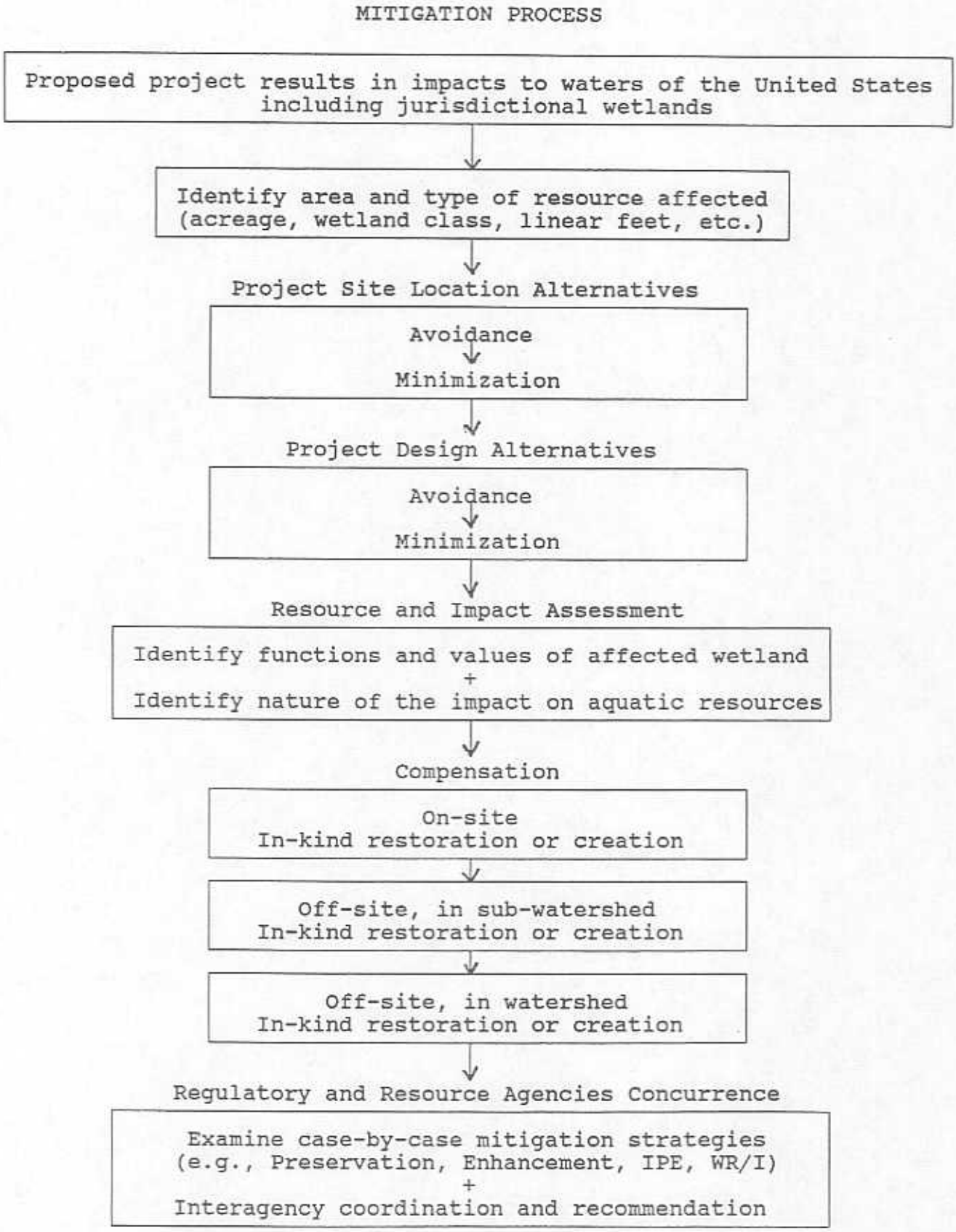
II. Definition of Watershed Designations (as used herein):

Hydrologic Units:

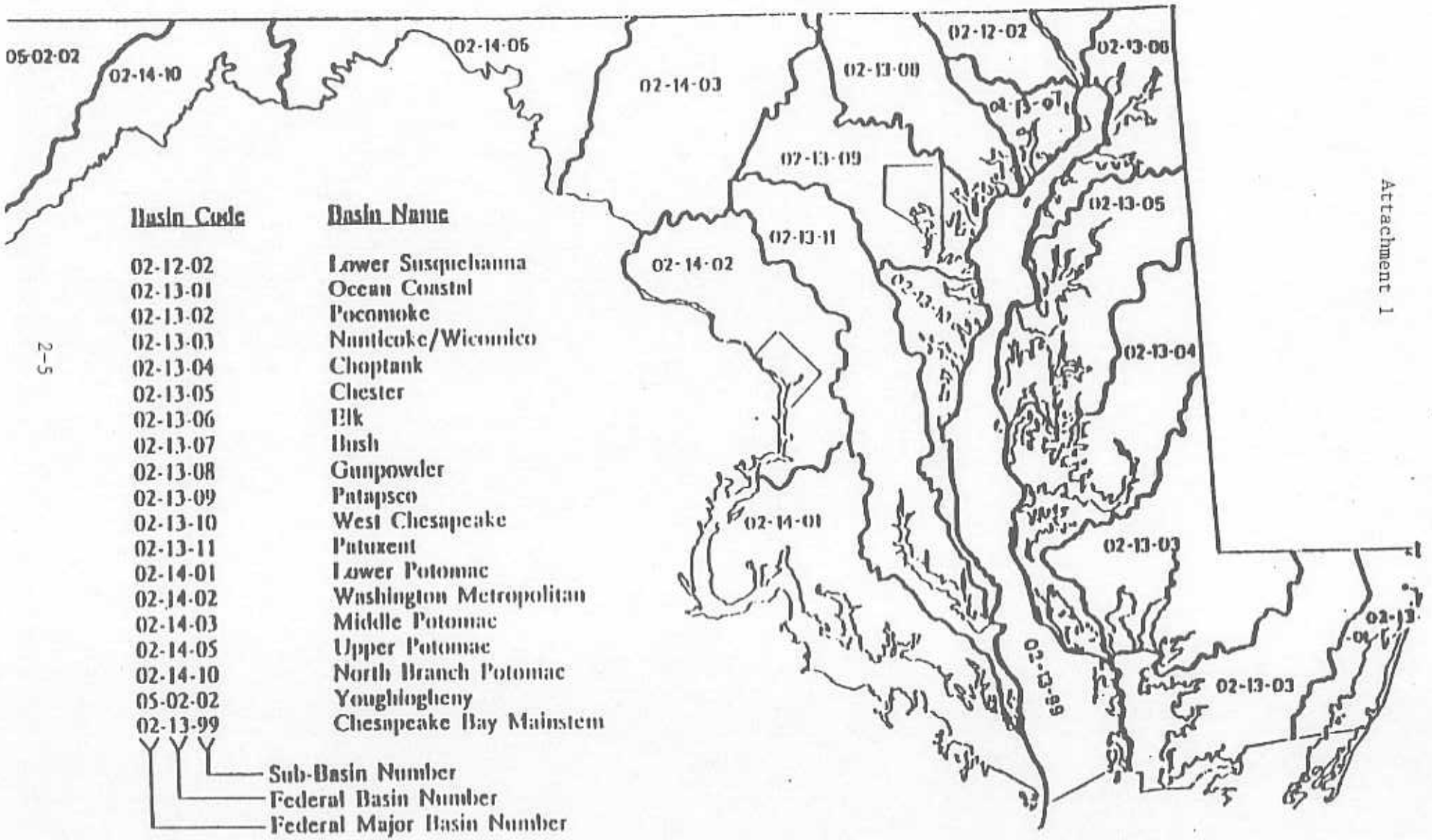
Generic		Maryland*
sub-watershed	=	segment
watershed	=	sub-basin
sub-basin	=	minor basin
drainage basin	=	major basin

* See Attachment 1 - key for Maryland watershed designations.

III. Mitigation Flowchart



MARYLAND WATERSHED DESIGNATIONS



Basin Code	Basin Name
02-12-02	Lower Susquehanna
02-13-01	Ocean Coastal
02-13-02	Pocomoke
02-13-03	Nanticoke/Wicomico
02-13-04	Choptank
02-13-05	Chester
02-13-06	Elk
02-13-07	Bush
02-13-08	Gunpowder
02-13-09	Patapsco
02-13-10	West Chesapeake
02-13-11	Patuxent
02-14-01	Lower Potomac
02-14-02	Washington Metropolitan
02-14-03	Middle Potomac
02-14-05	Upper Potomac
02-14-10	North Branch Potomac
05-02-02	Youghiogheny
02-13-99	Chesapeake Bay Mainstem

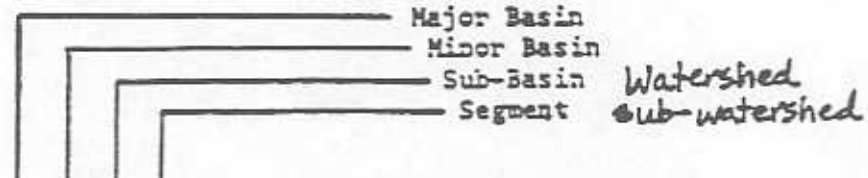
02-13-99
- Sub-Basin Number
- Federal Basin Number
- Federal Major Basin Number

July 12, 1976

STATE OF MARYLAND

WATER RESOURCES ADMINISTRATION

Watershed Designations



02-13-99	Chesapeake Bay (proper)
-96	Upper Chesapeake Bay (Mouth of Susquehanna River to a line between Robins Point - Handys Point)
-97	Middle Chesapeake Bay (Line between Robins Point - Handys Point to north side original Bay Bridge)
-98	Lower Chesapeake Bay (below north side original Bay Bridge)
02-12-02	Lower Susquehanna River Area
-01	Lower Susquehanna River area drainage
-02	Deer Creek drainage
-03	Octoraro Creek drainage
-04	Conowingo Dam Susquehanna River area drainage
-05	Broad Creek drainage
02-13-01	Coastal Area
-01	Atlantic Ocean
-02	Assawoman Bay drainage
-03	Isle of Wight Bay drainage
-04	Sinepuxent Bay drainage
-05	Newport Bay drainage
-06	Chincoteague Bay drainage
02-13-02	Pocomoke River Area
-01	Pocomoke Sound area drainage
-02	Lower Pocomoke River area drainage
-03	Upper Pocomoke River area drainage
-04	Dividing Creek drainage
-05	Nassawango Creek drainage
-06	Tangier Sound area drainage
-07	Big Annemessex River drainage
-08	Manokin River drainage

02-13-03 Nanticoke River Area

-01 Lower Wicomico River area drainage
-02 Monie Bay drainage
-03 Wicomico Creek drainage
-04 Wicomico River headwaters area drainage
-05 Nanticoke River area drainage
-06 Marshyhope Creek drainage
-07 Fishing Bay area drainage
-08 Transquaking River area drainage

02-13-04 Choptank River Area

-01 Honga River drainage
-02 Little Choptank River drainage
-03 Lower Choptank River area drainage
-04 Upper Choptank River area drainage
-05 Tuckahoe Creek drainage

02-13-05 Chester River Area

-01 Eastern Bay area drainage
-02 Miles River drainage
-03 Wye River drainage
-04 Kent Narrows - Prospect Bay area drainage
-05 Lower Chester River area drainage
-06 Langford Creek drainage
-07 Corsica River drainage
-08 Southeast Creek drainage
-09 Middle Chester River area drainage
-10 Upper Chester River area drainage
-11 Kent Island Bay area drainage

02-13-06 Elk River Area

-01 Lower Elk River area drainage
-02 Bohemia River drainage
-03 Upper Elk River area drainage
-04 Back Creek drainage
-05 Little Elk Creek drainage (above Route 279)
-06 Big Elk Creek drainage (above Route 281)
-07 Christina River drainage
-08 Northeast River drainage
-09 Furnace Bay drainage
-10 Sassafras River drainage
-11 Stillpond - Fairlee area drainage

02-13-07 Bush River Area

-01 Bush River drainage
-02 Lower Winters Run drainage (below Atkisson Reservoir)
-03 Atkisson Reservoir drainage
-04 Bynum Run drainage
-05 Aberdeen Proving Ground area drainage
-06 Swan Creek drainage

02-13-0~~X~~ 0 8 Gunpowder River Area

-01 Gunpowder River area drainage
-02 Lower Gunpowder Falls drainage
-03 Bird River drainage
-04 Little Gunpowder Falls drainage
-05 Loch Raven Reservoir drainage
-06 Prettyboy Reservoir drainage
-07 Middle River - Browns Creek area drainage

02-13-09 Patapsco River Area

-01 Back River drainage
-02 Bodkin Creek drainage
-03 Baltimore Harbor area drainage
-04 Jones Falls drainage
-05 Gwynns Falls drainage
-06 Patapsco River - Lower North Branch area drainage
-07 Liberty Reservoir drainage
-08 South Branch Patapsco River drainage

02-13-10 West Chesapeake Bay Area

-01 Magothy River area drainage
-02 Severn River area drainage
-03 South River area drainage
-04 West River area drainage
-05 Other drainage West Chesapeake Bay Area

02-13-11 Patuxent River Area

-01 Patuxent River lower area drainage (mouth to Ferry Landing)
-02 Patuxent River middle area drainage (Ferry Landing to Route 214)
-03 Western Branch drainage
-04 Patuxent River upper area drainage (Route 214 to Rocky Gorge Dam)
-05 Little Patuxent River drainage
-06 Middle Patuxent River drainage
-07 Rocky Gorge Dam area drainage
-08 Brighton Dam area drainage

02-14-01 Lower Potomac River Area

-01 Potomac River lower tidal area drainage (mouth to Smith Point - Simms Point)
-02 Potomac River middle tidal area drainage (Smith Point - Simms Point to Marshall Hall)
-03 St. Mary's River area drainage
-04 Breton Bay drainage
-05 St. Clement Bay drainage

02-14-01 Lower Potomac River Area (cont.)

-06 Wicomico River drainage
-07 Gilbert Swamp drainage
-08 Zekiah Swamp drainage
-09 Port Tobacco River drainage
-10 Nanjemoy Creek drainage
-11 Mattawoman Creek drainage
-12 Lower Potomac River area Virginia drainage

02-14-02 Washington Metropolitan Area

-01 Potomac River upper tidal area drainage (Marshall Hall to Chain Bridge)
-02 Potomac River Montegomery County area drainage (Chain Bridge to Fred./Mont. County Line)
-03 Piscataway Creek drainage
-04 Oxon Creek drainage
-05 Anacostia River drainage
-06 Rock Creek drainage
-07 Cabin John Creek drainage
-08 Seneca Creek drainage
-09 Washington Metropolitan area Virginia drainage

02-14-03 Middle Potomac River Area

-01 Potomac River Frederick County area drainage
-02 Lower Monocacy River drainage (mouth to Route 26)
-03 Upper Monocacy River drainage (Route 26 to Md./Pa. Line)
-04 Double Pipe Creek drainage
-05 Catoctin Creek drainage
-06 Middle Potomac area Virginia drainage

02-14-05 Upper Potomac River Area

-01 Potomac River Washington County area drainage (Shenendoah River to Little Tonoloway Creek)
-02 Antietam Creek drainage
-03 Marsh Run drainage
-04 Conococheague Creek drainage
-05 Little Conococheague Creek drainage
-06 Licking Creek drainage
-07 Tonoloway Creek drainage
-08 Potomac River Allegany County area drainage (Little Tonoloway Creek to confluence of North and South Branches)
-09 Little Tonoloway Creek drainage
-10 Sideling Hill Creek drainage
-11 Fifteen Mile Creek drainage
-12 Town Creek drainage
-13 Upper Potomac River area West Virginia drainage

02-14-10 North Branch Potomac River Area

-01 Lower North Branch Potomac River area drainage (below Westernport Bridge)
-02 Evitts Creek drainage
-03 Wills Creek drainage
-04 Georges Creek drainage
-05 Upper North Branch Potomac River area drainage (above Westernport Bridge)
-06 Savage River drainage
-07 North Branch Potomac River area West Virginia drainage

05-02-02 Youghiogheny River Area

-01 Youghiogheny River drainage
-02 Little Youghiogheny River drainage
-03 Deep Creek Lake drainage
-04 Casselman River drainage

COMPENSATORY MITIGATION GUIDANCE

Chapter 3

Required Information for Mitigation Site Development Plan

Sufficient information on the mitigation proposal and eventual plans is necessary to enable the efficient and rational evaluation of a mitigation project. Compensatory mitigation requires the applicant/permittee to submit a Mitigation Site Development Plan for review and approval by the regulatory agencies. The Mitigation Site Development Plan consists of three separate components: (1) a Preliminary Plan, (2) a Final Plan (Plans and Specifications), and (3) a Performance Plan. The outline below presents each component and lists the required information. The preliminary mitigation plan will be required during the permit application review process. In some cases, submission of the final plan may be specified at a due date prior to permit issuance. In other cases, the due date for submittal of the final plan may be a special condition listed in the permit.

I. Preliminary Plan and Narrative Description

A. Describe wetland classes, functions, acreage, and length of any stream at the impact sites. Describe wetland impact and length of stream(s) to be affected by the proposed action.

B. Describe goals of proposed plan, addressing on-site, off-site, in-kind, or out-of-kind replacement; wetland classes and functions; acreage to be created, restored, or enhanced at the mitigation site.

C. Describe Proposed Mitigation Site

1. Include a site location map depicting geographic relationship between the impact site and proposed mitigation site, and a vicinity map of greater than or equal to a scale of 1 inch equals 2,000 feet.

2. Describe existing land use and ownership, adjacent land use, position in landscape, topography, vegetation, soils series and class. Include soil survey map.

3. Describe existing hydrology, including presence of surface water (ponded or fluvial), tidal elevations, on-site or off-site stormwater drainage, and other available existing information such as gauging station data or groundwater data.

D. Information to be Provided in the Preliminary Plan

1. Conceptual plan view of site

2. Source of hydrology

   a. frequency/duration
   b. depth to groundwater
   c. timing (seasonal)

3. Description of proposed earthwork activity

   a. grading
   b. excavation
   c. clearing and grubbing

4. Description of proposed strategies used to obtain hydrology at the site

   a. earthwork/grading
   b. water control structures, if required

      (1) berms, dikes
      (2) weirs
      (3) risers
      (4) drainage channels, swales

5. Description of proposed plant communities in terms of Cowardin's Classification System (e.g., palustrine, emergent)

E. Provide assurance of the legal right to use the proposed property for the purpose of compensatory mitigation (e.g., letter of intent, option to purchase or other documentation).

F. Photographs of proposed mitigation site are helpful, if available.

1. Photographs should be labelled with the date the photographs were taken. Indicate the cardinal points (N, S, E, W) for direction. Include map to identify photograph location.

2. Panoramic views of the site may be useful for interpretation of site potential.

3. Recent aerial photographs of impact area and mitigation site may be included, if available.

II. Final Plan (Plans & Specifications)

A. Plan view drawings at one of the following scales: 1"=30' or 1"=40' or 1"=50'. Contour lines should be delineated at one foot intervals.

B. Elevation view drawings: prepare cross sections to detail significant features such as stream channels, spillways, or pool areas.

C. Specific Details Necessary for Proposed Mitigation Site

1. Earthwork activities

a. grading elevations, excavation quantities, fill quantities, slopes

b. soil or substrate

(1) stockpiling and reuse of soil on-site
(2) salvaged topsoil from impact site
(3) soil amendments (organic matter, lime, etc.)

2. The hydrologic source and the necessary alterations/modifications must be identified prior to construction. The following information, if applicable to the site, is necessary.

a. existing site hydrology

(1) waterways, waterbodies, or wetlands on or adjacent to the site
(2) tidal elevations
(3) groundwater elevations: a minimum of one growing season's worth of data should be collected

b. source of hydrology (duration and frequency of inundation or saturation)

c. water control structures, if necessary

(1) berms, dikes
(2) weirs
(3) risers
(4) drainage channels, swales

3. Specifications on the vegetative plantings will reflect the type of wetland replacement proposed and provide sufficient detail for evaluation.

a. species by scientific and common name, indicator status, and substitute species when species are not available or not available in quantities required

b. proposed planting elevations, densities, and water regimes for individual species

c. source of vegetation (e.g., impact site, nursery stock, or other)

d. nature of plant propagules (container grown, peat pots, tuber, rhizome, seed, seedlings, saplings; dormant, "wet-cultured")

e. fertilizer: composition, application rate, type (tablet, granular, liquid)

f. control measures for invasive species (e.g., Phragmites and Purple loosestrife), if necessary

g. measures to protect from wildlife grazing and wildlife exclusion measures, if necessary

4. Specify areas on the mitigation site that will be allowed to regenerate naturally or where volunteer species are expected to grow. List dominant species in adjacent wetlands.

5. Erosion and sediment control plan for site development approved by appropriate government agency.

6. A construction timetable which provides sequencing of activities

   a. concurrent compensatory mitigation will reference the construction project timetable

   b. advance compensatory mitigation will have a separate schedule

7. Provide documentation for right to enter property and perform mitigation [e.g., fee simple acquisition (deed), conservation easement, documentation authorizing Rights-of Entry, or other documentation].

III. Performance Plan

The performance plan addresses the evaluation of the success of the mitigation site in the post-construction phase. Elements of the plan consist of monitoring, long-term maintenance, and as-built drawings.

A. An assessment of the mitigation site will determine if the performance standards developed for the mitigation were achieved, indicating the success of the site. (See Chapter 4 for the establishment of performance standards.)

   1. The performance plan prepared by the applicant/ permittee will reflect the goals and objectives of the mitigation project.

2. Performance standards for assessing the success of the site will be listed as part of the special conditions of the permit and reflect the mitigation goals and objectives.

3. If the performance standards are not achieved within the stipulated timeframes, remedial measures may be required (see Section IV).

B. Monitoring the Success of the Mitigation Site

1. The permittee will monitor the mitigation site for a minimum of five (5) full consecutive growing seasons (wherein one growing season occurs per year). In cases where remedial measures are implemented to improve or ensure the success of the site, the monitoring period may be extended.

2. The applicant/permittee will prepare a narrative description of proposed monitoring efforts to evaluate the success of the mitigation site over consecutive growing seasons. Methodology proposed in Chapters 6 and 7 may be utilized to monitor the success of the site. Monitoring efforts may include, but are not limited to: vegetation densities; frequency of site inspections; photographic documentation; monitoring of groundwater wells or piezometers. The permittee will submit annual reports on the results of the monitoring efforts at the mitigation site to the regulatory and resource agencies.

C. Long-term protection for compensatory mitigation sites will be a condition of the permit affiliated with the mitigation.

1. Deed restrictions for compensatory mitigation sites will be required by the Corps of Engineers and State regulatory agencies. Deed restrictions may be in the form of a conservation easement or covenant running with the land and recorded with the deed, conveyance, or transfer. The easement or covenant should include a prohibition against any filling, flooding, draining, excavation, tree cutting, removal of vegetation, or alteration of any trees on the site, except when authorized by the Corps of Engineers and State regulatory agencies having authority to do so. Upon submittal of any offers for purchase, transfer, or grant of the mitigation site, or portion thereof, the purchaser, offerer, or grantee must receive notification that an easement or covenant is included in the deed.

2. Sites should be designed to be self-sustaining. This

would preclude the need for maintenance of water control structures following the monitoring period. If design features such as water control structures which sustain hydrology are necessary, then the applicant/permittee will identify in writing a management entity which is responsible for maintaining these structures.

D. As-built drawings will provide details of the completed mitigation site.

1. As-built drawings of constructed wetlands will serve to indicate where potential problems may arise once the mitigation site is constructed.

2. Plan view drawings to scale depicting actual grading elevations and vegetation zones (a.k.a. as-builts) once construction has been completed at the mitigation site.

3. As-built drawings will be submitted to the Corps of Engineers and State regulatory agencies within 120 days of completion of grading. Resource agencies will be furnished copies of as-builts, upon the request of the agency.

E. Performance bonds may be required of some applicants/ permittees, and will be handled on a case-by-case basis.

IV. Remedial Measures

A. The applicant/permittee will prepare a narrative description of remedial measures to be taken at the mitigation site should the performance standards not be achieved. Measures taken to restore or improve the site include, but are not limited to: replanting; regrading, excavation, placement of fill; soil amendments; sediment removal; hydrological alteration; pest control for exotic species, weeds, wildlife, and insect damage.

B. Remedial measures will be implemented if the goals specified within the performance standards are not achieved.

C. The permittee will coordinate with the regulatory agencies concerning problem identification and applicable remedial measures at an unsuccessful mitigation site. A schedule for implementation of remedial measures will be submitted to the regulatory agencies for review. Similarly, the permittee will keep the regulatory agencies apprised of implementation of such remedial measures.

COMPENSATORY MITIGATION GUIDANCE

Chapter 4

Recommended Approaches to Achieve Successful Wetlands Mitigation and Performance Standards to Measure Success

The following guidance provides recommendations for achieving successful wetlands mitigation and the performance standards used to measure success. This chapter is divided into three major sections: vegetation, hydrology, and soils. Each section is subdivided by wetland types. Under each wetland type, the text is divided into two segments: (1) recommendations on methods to achieve success in establishing a wetland community and (2) performance standards which establish a minimum standard for success.

The performance standards outlined in this chapter are established to set minimum objectives for vegetation, hydrology, and soils. These standards provide applicants with clear goals for vegetation diversity and density, depth of top soil or tons of organic matter needed, as well as duration and range of acceptable elevations of surface water and depths to groundwater. Since both the permit evaluator and applicant know what standards to meet, misunderstanding and arbitrary determinations are kept to a minimum.

These performance standards are the minimum required standards for mitigation sites; any deviation from these standards will need to be reviewed and approved by the regulatory and resource agencies. The permitting agency retains the right to modify these standards based on site specific conditions and best professional judgement.

Developing recommendations and standards for wetland restoration and creation are important. However, the overall importance of mitigation site selection cannot be over emphasized. This is the single most important decision a mitigator has to make in determining the successful outcome of a wetland restoration or creation project.

NOTE: All references to "growing season" are based upon the occurrence of one growing season per year, beginning in spring and ending in autumn of a given calendar year.

I. Vegetation

Vegetation diversity and density has been chosen as a primary performance standard because sites without sufficient plant biomass support low populations of fish and wildlife and provide insignificant water quality functions. In addition, techniques to measure vegetation are accomplished economically and require minimum training and equipment.

A. Tidal Emergent Wetlands

1. Recommendations for Achieving Performance Standards

a. Planting is recommended to ensure the performance standards are met.

b. Initial planting should consist of a minimum of two (2) emergent wetland species, unless monotypic populations are desired, i.e., Spartina alterniflora.

c. Plant emergent wetland species on a 12"x12" to 24"x24" grid spacing, depending on site conditions.

d. Allow for natural colonization of native emergent wetland species to proceed.

2. Performance Standards

a. Second Growing Season -- Achieve 45% coverage of the emergent zone with emergent wetland species at a minimum density of 43,560 living stems per acre (12"x12"spacing).

b. Third Growing Season -- Achieve 70% coverage of the emergent zone with emergent wetland species at a minimum density of 43,560 living stems per acre (12"x12" spacing).

c. Fifth growing season -- Achieve 85% coverage of the emergent zone with emergent wetland species at a minimum density of 43,560 living stems per acre (12"x12" spacing).

B. Non-tidal Emergent Wetlands

1. Recommendations for Achieving Performance Standards

a. Planting of a minimum of three species is recommended to ensure that performance standards are met. Selected species should have an indicator status of Obligate or Facultative Wet.

b. Plant emergent wetland species on a 12"x12" to 24"x24" grid spacing, depending on site conditions.

c. Allow for natural colonization of native emergent wetland species to proceed at sites with a minimum of 6 inches of topsoil.

d. Spread all salvaged topsoil or organic muck from the wetland impact site on the graded mitigation site. Allow for natural colonization of native emergent wetland species to proceed.

e. Broadcast seed the emergent zone with a wetlands seed mix.

2. Performance Standards

a. Second Growing Season -- Achieve 45% coverage of the emergent zone with emergent wetland species at a minimum density of 43,560 living stems per acre (12"x12" spacing), consisting of a minimum of three (3) wetland species.

b. Third Growing Season -- Achieve 70% coverage of the emergent zone with emergent wetland species at a minimum density of 43,560 living stems per acre (12"x12" spacing), consisting of a minimum of three (3) wetland species.

c. Fifth growing season -- Achieve 85% coverage of the emergent zone with emergent wetland species at a minimum density of 43,560 living stems per acre (12"x12" spacing), consisting of a minimum of three (3) wetland species.

C. Non-tidal Scrub-Shrub Wetlands

1. Recommendations for Achieving Performance Standards

a. Planting is recommended to ensure that performance standards are met. Selected scrub-shrub species to be planted for mitigation should have an indicator status of Obligate, Facultative Wet, or Facultative.

b. A minimum of 435 wetland shrub species per acre should be planted on an average 10-foot spacing.

2. Performance Standards

a. Establish a minimum of two (2) species of wetland shrubs with an indicator status of Obligate, Facultative Wet, or Facultative. No more than 50% shall be Facultative.

b. Second Growing Season -- In the scrub/shrub zone, achieve a minimum density of approximately 435 living wetland shrubs, at a minimum height of 10 inches, per acre.

c. Third Growing Season -- In the scrub/shrub zone, achieve a minimum density of approximately 538 living wetland shrubs, at a minimum height of 10 inches, per acre.

d. Fifth Growing Season -- In the scrub/shrub zone achieve a minimum density of approximately 600 living wetland shrubs at a minimum height of 10 inches, per acre.

D. Non-tidal Forested Wetlands

1. Recommendations for Achieving Performance Standards

a. Planting is recommended to ensure that performance standards are met. Selected wetland tree and shrub species should have an indicator status of Obligate, Facultative Wet, or Facultative.

b. A minimum of 538 wetland tree and shrub species per acre should be planted on an average 9-foot spacing. Shrub and tree species should be interspersed.

2. Performance Standards

a. Establish a minimum of two (2) species of wetland trees and two (2) species of wetland shrubs with an indicator status of Obligate, Facultative Wet, or Facultative. No more than 50% shall be Facultative.

b. Second Growing Season --In the forested zone, achieve a minimum density of approximately 538 living wetland trees and shrubs, at a minimum height of 10 inches, per acre.

c. Third Growing Season --In the forested zone, achieve a minimum density of approximately 538 living wetland trees and shrubs, at a minimum height of 10 inches, per acre.

e. Fifth Growing Season --In the forested zone, achieve a minimum density of approximately 600 living wetland trees and shrubs, at a minimum height of 10 inches, per acre.

II. Hydrology

Establishing wetland hydrologic conditions is essential for successful wetlands plant growth and hydric soil development. Considerations in establishing hydrology for tidal and non-tidal wetland types are discussed below.

A. Tidal Wetlands

Tidal wetlands have hydrologic regimes which are determined by the frequency of tidal inundation. To be tidally influenced, the created wetland must be flooded at least once a month and as often as twice a day.

1. Recommendations for Achieving Performance Standards

a. Determine the elevations of mean high tide, mean low tide, and spring high tide at the mitigation site or at an adjacent tidal area.

b. Grade or fill the mitigation site (if necessary) to establish the final grade at the elevations determined in step a.

2. Performance Standards

a. Regularly flooded - tides must alternately flood and expose the land surface at least once daily. This created wetland type would replace impacts to wetlands dominated by species such as saltmarsh cordgrass (Spartina alterniflora), saltmarsh bulrush (Scirpus robustus), or arrow arum (Peltandra virginica). The surface elevations of this wetland type will be between the mean high and mean low tide elevations.

b. Irregularly flooded - tides should flood the land surface less often than once daily. This created wetland type would replace wetlands dominated by species such as salt meadow grass (Spartina patens), marsh elder (Iva frutescens), black needlerush (Juncus roemerianus), or narrow-leaved cattail (Typha angustifolia). The surface elevations of this wetland type will be between the mean high tide and spring high tide elevations.

B. Non-tidal Wetlands

1. Recommendations for Achieving Performance Standards

a. Consult the county soil survey to determine the general hydrologic conditions for the soil types that underlie the proposed mitigation site.

b. Determine the surface elevations of any adjacent wetlands, if present.

c. Collect other site specific information such as depth to confining layers, soil permeability, water, and the availability of off-site sources of surface water.

d. Collect groundwater elevation data for at least one complete growing season. When interpreting the groundwater data, always compare the rainfall for that growing season to the 10 year average rainfall data (formatted on a monthly basis). Data should be collected from the rainfall gauge station closest to the mitigation site.

e. Excavate or inundate the site to obtain the proper hydrology.

f. Collect groundwater elevation data for two growing seasons once the wetland restoration or creation work has been completed. This will verify if the hydrology performance standards listed below have been met.

2. Performance Standards

a. Emergent - the soil is saturated to the surface or there is water on the surface or a combination of surface water and saturated soils for at least 21 consecutive days of the growing season to a maximum depth of 2.0 feet of standing water.

b. Forested and Scrub/Shrub - the soil is saturated to the surface and the ground water table is within 10 inches of the surface for at least 21 consecutive days of the growing season.

3. Growing seasons within Maryland (these are regional averages; growing season may be shorter or longer depending upon the county's location):

a. East of Washington County - 1 April through 31 October (214 days)

b. West of and including Washington County - 30 April through 30 September (154 days)

III. Soils and Soil Amendments

For a mitigation site to support a viable plant community, the soil substrate must be suitable for plant growth. The following recommendations provide several approaches for establishing a suitable soil substrate at wetland mitigation sites. If the soil at the mitigation site is left in place (i.e., farmed wetlands),plant the site or allow for natural revegetation to occur. If site plans call for excavation to the subsoil, top soil will have to be stockpiled, imported, or the subsoil will have to be amended with organic material.

A. Tidal Wetlands

1. Recommendations for Achieving Performance Standards

As this type of wetland is subject to tidal energy, fine grain soils are easily eroded from these areas. It is recommended that either sandy or coarse grained soils be used as a substrate at these mitigation sites. In highly erosive areas, energy dissipator devices may be required to protect the newly placed soil from erosion.

2. Performance Standard

The substrate must be of suitable depth and composition to ensure the survival and growth of wetland plants. The substrate must be stabilized to prevent erosion.

B. Non-tidal Wetlands

1. Recommendations for Achieving Performance Standards

Several options are available for establishing a suitable soil substrate for non-tidal wetland mitigation sites. The following are several methods to choose from depending on site conditions.

a. Sites with undisturbed soils--Plant the site with appropriate wetland species or allow natural revegetation to occur.

b. Excavated or highly disturbed sites--these sites demand treatment to ensure the establishment of a suitable soil substrate for plant survival. Testing the soil prior to determining the approach is recommended. (Contact your county Agricultural Extension Agent for soil testing procedure.) Testing should include proportions of sand, silt and clay, percentage organic matter, and pH. The following approaches may be used at graded or highly disturbed sites.

(1) Site with existing topsoil - Remove and stockpile the upper 6 to 10 inches of soil on site. Grade the site 6 to 10 inches below the specified grade on the construction plans. Spread topsoil evenly over the site to a depth of 6 to 10 inches.

(2) Site without topsoil - Topsoil or organic muck can be imported into mitigation sites which have little or no topsoil. The topsoil or organic muck should be obtained from uplands or wetlands which will be altered during construction. Remove the upper 6 to 12 inches of topsoil from the construction site. Stockpile this material at the mitigation site. (Do not stockpile the organic muck for more than two weeks because it decomposes rapidly when exposed to air.) Grade the mitigation site 6 to 10 inches below the specified grade on the construction plans. Spread the topsoil or organic muck evenly over the site to a depth of 6 to 10 inches.

(3) Amending the substrate with organic material - If topsoil or organic muck is not available, the subsoil may be amended with organic material. The organic material will add nutrients, porosity, and water retention capabilities. The organic material must be worked into the subsoil over the entire site by mechanical means (i.e., tillers, plows, discs, rakes).

c. Organic material may consist of any of the following.

(1) composted organic matter which may include manure, wood chips, plant clippings, or straw.

(2) commercially available mulches (e.g., "Compro").

(3) lime, if the site is acidic and the vegetation requires alkaline conditions.

2. Performance Standards

a. Emergent Wetlands

(1) stockpiled or imported topsoil or organic muck - spread evenly over the site to a minimum depth of six inches.

(2) organic material - incorporate a minimum of 25 tons per acre of organic matter or commercially available mulches evenly throughout the subsoil to a depth of 10 inches.

b. Scrub/Shrub and Forested Wetlands

(1) stockpiled or imported topsoil or organic muck - spread evenly over the site to a minimum depth of eight inches.

(2) organic material- incorporate a minimum of 40 tons per acre of organic matter or commercially available mulches evenly throughout the subsoil to a depth of 10 inches.

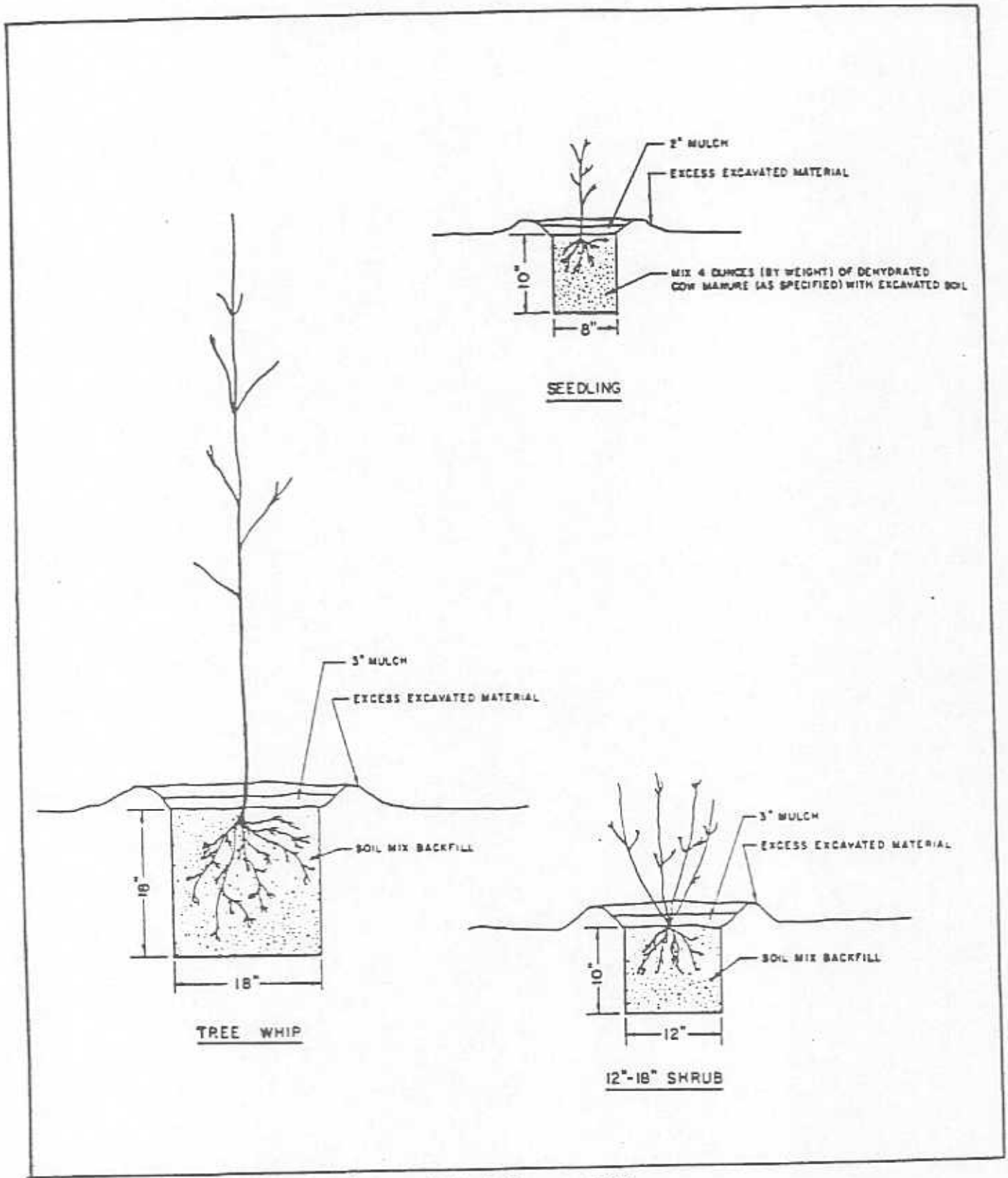
Planting Pits

The following table gives recommended plant pit dimensions (i.e., diameter and depth) based on the nature of the planting stock.

PLANTING STOCK	PLANT PIT	
	DIAMETER (inches)	DEPTH (in.)
Seedlings		
6 - 12 inches in height	8	min. 10
Deciduous Trees		
5 - 6 inches caliber	30 in. greater than rootball	min. 36
2.5 - 5 in. caliber	24 in. greater than rootball	min. 24
< 5 ft. in height	30	min. 20
Evergreen Trees		
> 5 ft. in height	18 in. greater than rootball	min. 24
< 5 ft. in height	18 in. greater than rootball	min. 20
12 - 18 in. container grown	18	min. 18
Shrubs		
12 - 18 in. in height and potted vines	12	min. 10
18 - 24 in. in height	18	min. 18
2 - 4 ft. in height	24	min. 16
4 - 6 ft. in height	30	min. 20
Tree Whips		
Bare root, 5 - 6 ft. in height	18	min. 18
Balled & burlapped, 5 - 6 ft. in height	30	20

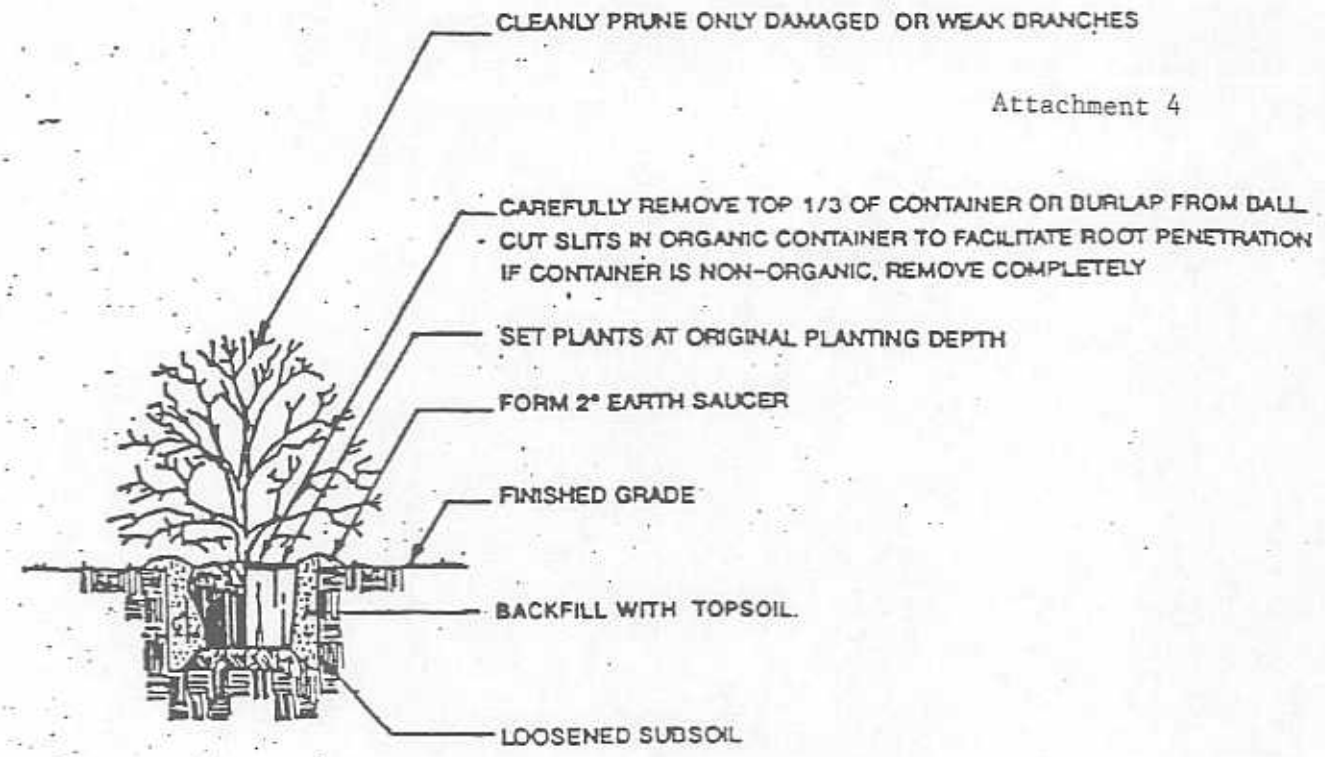
Source: Adapted from MD State Highway Admin., Stds & Specs, 1992

PLANTING DIAGRAMS



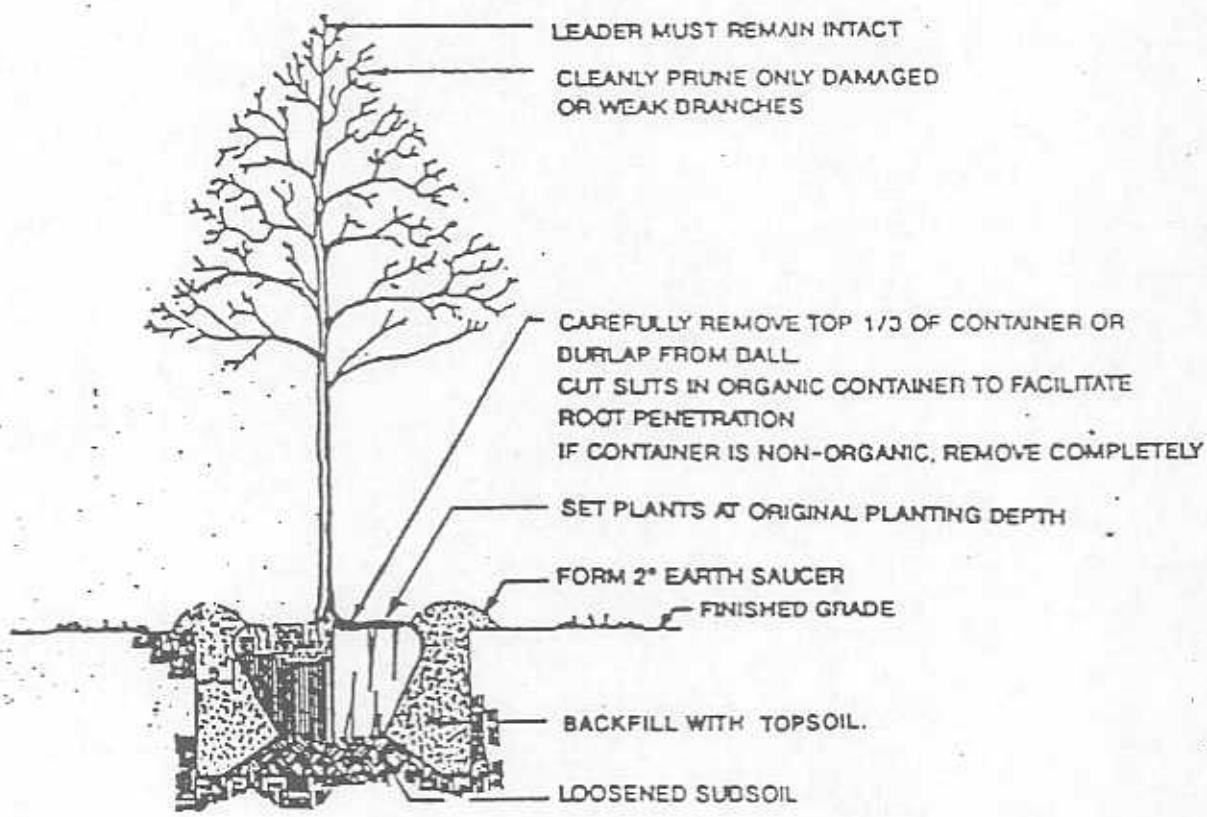
Source: MD State Highway Admin., Stds & Specs, 1992.

Attachment 4



MITIGATION SHRUB PLANTING

NOT TO SCALE



Source: MD State Highway Admin. Stds & Specs, 1992

MITIGATION TREE PLANTING

COMPENSATORY MITIGATION GUIDANCE

Chapter 5

Compensatory Mitigation Monitoring Reports

The applicant/permittee will prepare a narrative description of proposed monitoring efforts to determine the success of the mitigation site over five consecutive growing seasons. (Note: All references to growing season are based upon one growing season per year, beginning in spring and ending in autumn of a given calendar year.) "Year #1" of the 5-year monitoring period commences with the first growing season following completion of construction and planting of the mitigation site.

I. Information to be Included in the Monitoring Reports

A. Narrative

1. Brief description of existing conditions, site location map, and methods used to assess success of mitigation site in achieving the performance standards.

2. Description of any problems observed within the mitigation site. For example:

   a. excessive inundation
   b. insufficient hydrology
   c. seasonal drought conditions
   d. invasion by undesirable plant species or wildlife
   e. disease conditions for plants
   f. adverse water quality impacts (i.e., excessive sediment loading, water pollution)
   g. slope failures or erosion problems

3. A description of proposed remedial measures to correct problems noted in item # 2 above.

B. Data (refer to Chapters 6 and 7 for assessment methodology)

1. Measurements of vegetation densities based upon performance standard criteria

2. Frequency of site inspections

3. Photographic documentation-one set of photographs taken at established photographic plots, any time during May through August of each monitoring year (pictures should be taken at the same time of year, when possible)

4. Monitoring data from shallow groundwater wells for diagnostic purposes--groundwater wells shall be placed at a minimum depth of 3 feet to a maximum depth of 10 feet

5. Soil sampling

6. Mapping to depict areas naturally colonized by wetland vegetation

7. Listing of wetland species in order of dominance and by vegetation stratum

8. Copies of field data sheets (include completed data forms)

9. Monitoring year and date mitigation construction was completed

10. Permit (RAMS) number

II. Frequency and Duration of Reports

Annual monitoring reports are submitted to the regulatory agencies by December 31 of the calendar year; a total of five reports are submitted over the 5-year monitoring period.

III. Remedial Measures

A. Remedial measures proposed by the permittee are subject to review and approval by the regulatory and resource agencies, prior to implementation.

B. In the event remedial measures are implemented at the mitigation site, the monitoring period may be extended by the regulatory agencies. The extension will be determined on a case-by-case basis.

COMPENSATORY MITIGATION GUIDANCE

Chapter 6

Recommended Sampling Methodologies for Wetland Mitigation Projects Greater Than 0.5 Acre

Sampling methodologies are required to determine that the hydrology, hydrophytic vegetation, and hydric soils are present and a wetland is being established. The information from the sampling methodologies will be reviewed in context of the monitoring report to evaluate the success of the site based upon established performance standards. This information (e.g., raw data sheets, mapping) is part of the monitoring report, which is submitted by December 31 of each monitoring year.

The following sampling methodologies were developed by the Interagency Mitigation Task Force and are recommended to the permittee to assess the success of the mitigation site. Although success is measured at time increments prescribed by the performance standards, the mitigation site should be monitored throughout each growing season of the 5-year monitoring period.

For the methodologies which follow, example data sheets and drawings are attached as a reference.

I. Vegetation Density Measurements

The following sampling method may be applied for grid, random, or clumped planting schemes.

A. Tidal and Non-tidal Wetlands - Emergent Vegetation

The following method for measuring success of herbaceous plant colonization should be conducted once between May and September of the second, third, and fifth growing seasons subsequent to completion of construction of the wetland.

1. Emergent vegetation should be measured along transect lines at a compass bearing perpendicular to the longitudinal axis of the created wetland. Two categories: "Vegetated" and "Open Water" will be identified using this method.

2. Transect #1 starts 20 feet from one of the longitudinal ends of the wetland. The transects are spaced parallel to each other at 50-foot intervals; each transect crosses the entire width of the wetland.

3. Emergent vegetation exhibiting a minimum density of 12" x 12" spacing (43,560 living stems per acre) is measured along each numbered transect. The

distance covered by emergent vegetation is measured using a tape measure and recorded to the nearest 0.5 foot for each transect. This measurement constitutes the length of the transect that is categorized as "Vegetated." (Refer to Data Sheet #1)

4. Open water and emergent vegetation which has fewer plants per acre than specified above is categorized as "Open Water." This distance is measured along each transect in a similar manner as "3" above; the distance is recorded to the nearest 0.5 foot for each transect. (Refer to Data Sheet #1)

5. The numbered transects and distance measurements of "Vegetated" and "Open Water" categories are plotted on a map of the wetland mitigation site at a minimum scale of 1 inch = 100 feet (refer to "Example No. 1"). Each distance measurement taken along a given transect for either category is denoted as a single point on each transect. A line is drawn crossing the transects to connect the points for emergent vegetative cover. Connecting the points will serve to delineate the area(s) of the wetland which are "Vegetated" as opposed to the wetland area of "Open Water."

6. The area(s) of emergent vegetation should be planimetered to calculate the square footage (or acreage) of the wetland site occupied by emergent vegetation which achieves the specified standard.

B. Non-tidal Wetlands - Forested and Scrub/Shrub Vegetation {greater than or equal to 5 acres total}

The following method for measuring the success of woody plant colonization should be conducted once between May and September of the second, third, and fifth growing seasons subsequent to completion of construction of the wetland.

1. Woody vegetation is measured along transect lines at a compass bearing perpendicular to the longitudinal axis of the created wetland.

2. Transect #1 starts 20 feet from one of the longitudinal ends of the wetland. The transects are spaced parallel to each other at 75-foot intervals; each transect crosses the entire width of the wetland.

3. Six-foot radius circular plots are spaced at 50-foot intervals along each numbered transect. The presence or absence of living facultative, facultative wet or obligate wetland trees or shrubs, achieving the specified height standard and growing within the circular plot is recorded. {NOTE: The first circular plot for the even-numbered transects is taken on the

same side of the wetland (i.e., the same cardinal direction). The first circular plot for the odd-numbered transects is taken on the opposite side of the wetland. For Example: even numbers begin on south side of wetland site, therefore odd numbers begin on north side.}

4. The numbered transects and circular plots are depicted on a map of the wetland mitigation site, scale is 1 inch = 100 feet (refer to "Example No. 2"). Circular plot data is recorded on the map and data sheets (refer to Data Sheet #2) as follows:

"0" = no living tree or shrub over 10" in height is within the plot.
"1" = one living tree or shrub over 10" in height is within the plot.
"2" = two or more living trees or shrubs over 10" in height are within the plot.

C. Non-tidal Wetlands - Forested and Scrub/Shrub Vegetation {greater than 0.5 acre and less than 5 acres}

The following method for measuring the success of woody plant colonization should be conducted once between May and September of the second, third, and fifth growing seasons subsequent to completion of construction of the wetland.

1. The methodology described in B.1. through 4. above is implemented, with the following modification: the transects are spaced parallel at 50-foot intervals; each transect crosses the entire width of the wetland. (Refer to Data Sheet #2)

II. Hydrology

A. Tidal Emergent Wetlands

1. Prior to planting the tidal wetland site, the elevations should be verified. A summary describing how the elevations were verified, which includes a map depicting the site elevations, should be submitted to the regulatory agencies within three (3) weeks prior to planting.

B. Non-tidal Emergent Wetlands

1. Groundwater Wells

a. One groundwater well should be installed for every four acres of emergent wetland. The groundwater wells should be installed in the

driest zones of the emergent wetland. If the emergent wetland is less than four acres, at least one groundwater well should be installed.

b. Guidance for installation of groundwater monitoring wells, prepared by the U.S. Soil Conservation Service, is attached.

c. The collection of groundwater well data is initiated within 14 days of the start of the start of the growing season and continues for the first two (full) consecutive growing seasons subsequent to the completion of grading.

d. Groundwater well readings are taken once every 14 days for the first two months (60 days) of the growing season, and every 30 days for the remainder of the growing season. Groundwater well readings are recorded to the nearest one inch on data sheets. (Refer to Data Sheet # 4).

2. Surface Water

a. Water depth measurements are taken along transect lines at a compass bearing perpendicular to the longitudinal axis of the created wetland.

b. Transect #1 starts 20 feet from one of the longitudinal ends of the wetland. The transects are spaced parallel to each other at 50-foot intervals; each transect crosses the entire width of the wetland.

c. Surface water depth measurements are taken at 25-foot intervals along each numbered transect, using a five-foot measuring pole that is labelled at one inch increments. The bottom of the measuring pole is equipped with a flat one-foot diameter mesh or plastic disc support, to prevent the pole from sinking into the wetland substrate. {NOTE: The first measurement for the even-numbered transects is taken on the same side of the wetland (i.e., the same cardinal direction). The first measurement for the odd-numbered transects is taken on the opposite side of the wetland. For example, even numbers begin on south side of wetland site, therefore odd numbers begin on north side.}

d. Water depth measurements are recorded once every 14 days throughout the first two months (60 days) of the growing season subsequent to completion of grading and once every 30 days for the remainder of the growing season. Measurements are recorded

to the nearest one inch on data sheets. (Refer to Data Sheet #3)

3. Additional Information to be Submitted

   a. Mapping which depicts the locations of the groundwater monitoring wells and locations of water depth measurements reading

   b. Summary of the information regarding groundwater and surface water elevations

   c. Monthly rainfall data for the area to address its influence on the hydrology

   d. Copies of the data sheets

C. Non-tidal Wetlands - Forested and Scrub/Shrub

1. Groundwater Wells

   a. Hydrologic zones differentiated by a 2-foot change in elevation should have a minimum of one groundwater monitoring well installed. In addition, a hydrologic zone should have a minimum of 1 groundwater well per 4 acres. (In other words, if a given hydrologic zone occupies a total of 8 acres, at least 2 groundwater wells should be installed.)

   b. Guidance for installation of groundwater monitoring wells, prepared by the U.S. Soil Conservation Service, is attached.

   c. The collection of groundwater well data is initiated within 14 days of the start of the growing season and will continue for the first two (full) consecutive growing seasons subsequent to the completion of grading.

   d. Groundwater well readings are taken once every 14 days for the first two months (60 days) of the growing season, and every 30 days for the remainder of the growing season. Groundwater well readings are recorded to the nearest one inch on data sheets. (Refer to Data Sheet #4)

2. Surface Water - If surface water is evident on the surface of a scrub-shrub or forested wetland during the days the groundwater data is being collected, surface water measurements should be taken. If no surface water is present, note that on the data sheet.

   a. Water depth measurements are taken along transect

lines at a compass bearing perpendicular to the longitudinal axis of the created wetland.

b. Transect #1 starts 20 feet from one of the longitudinal ends of the wetland. The transects are spaced parallel to each other at 50-foot intervals; each transect crosses the entire width of the wetland.

c. Surface water depth measurements are taken at 25-foot intervals along each numbered transect, using a five-foot measuring pole that is marked in one inch increments. The bottom of the measuring pole is equipped with a flat one-foot diameter mesh or plastic disc support, to prevent the pole from sinking into the wetland substrate. {NOTE: The first measurement for the even-numbered transects shall be taken on the same side of the wetland (i.e., the same cardinal direction). The first measurement for the odd-numbered transects is taken on the opposite side of the wetland. For example, even numbers begin on south side of wetland site, therefore odd numbers begin on north side.}

d. Surface water depth measurements are recorded every 14 days throughout the first 2 months (60 days) of the growing seasons subsequent to completion of grading and once every 30 days for the remainder of the growing season. (Refer to Data Sheet #3)

3. Additional Information to be Submitted

a. Mapping which depicts the locations of the groundwater monitoring wells and locations of water depth measurements reading

b. Summary of the information regarding groundwater and surface water elevations

c. Monthly rainfall data for the area to address its influence on the hydrology

d. Copies of the data sheets

III. Soils

A. Non-tidal Wetlands

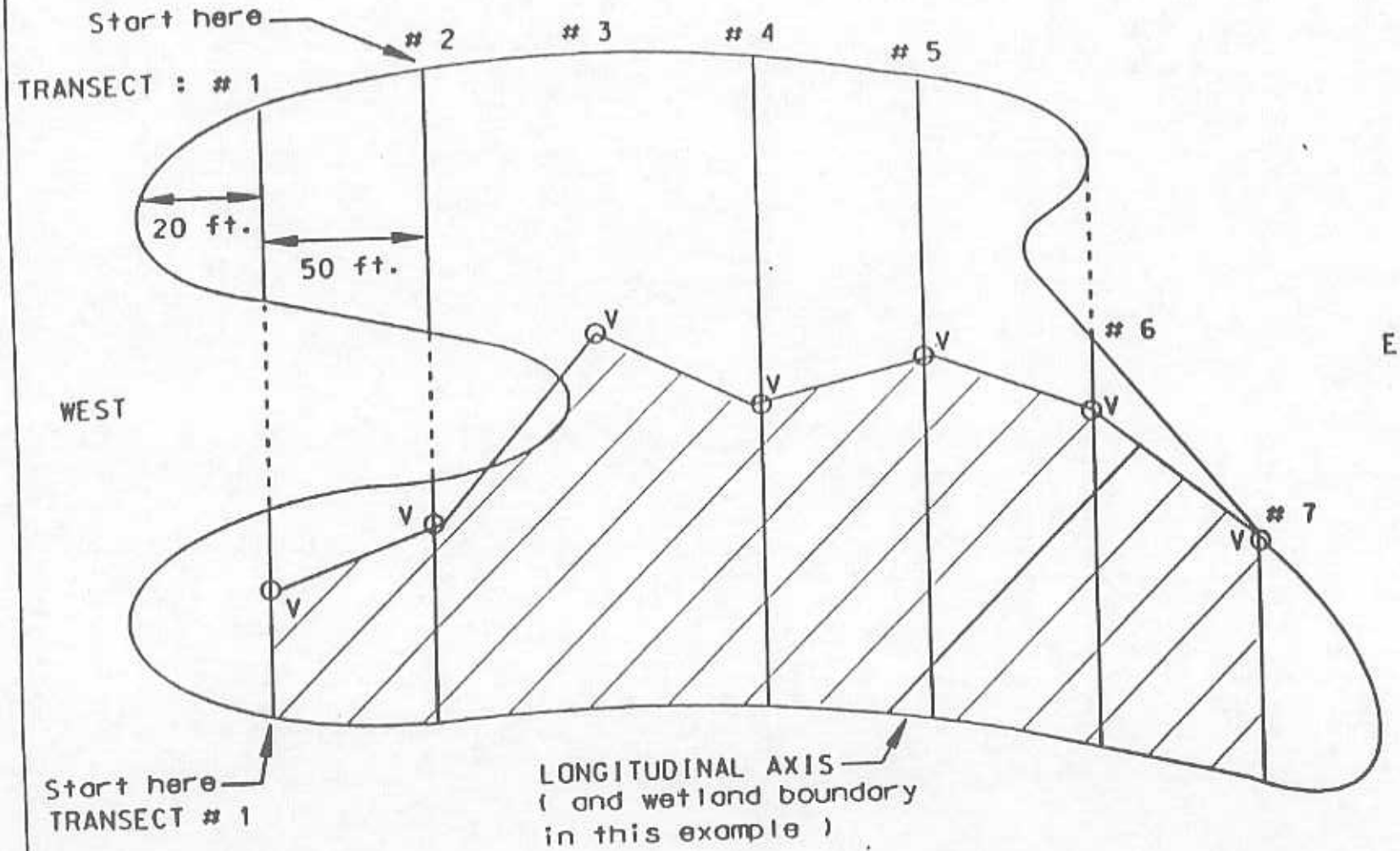
Subsequent to the placement of topsoil, organic compost material, or organic muck and within two (2) weeks of the completion of grading at the site, soils are randomly sampled. Three (3) holes per acre are excavated to a depth of 15 inches to determine the depth of topsoil, muck, and organic compost. The results of the sampling, including a map depicting sampling locations are submitted in the first year monitoring report, and are not required thereafter. (Refer to Data Sheet #5)

REFERENCES

Husch, B., Miller, C.I. and Beers, T.W. Forest Mensuration 2nd Edition, 1972. The Ronald Press Company, New York.

MacConnell, William P. and Mawson, Joseph C. "Basic Forest Measurements - A Laboratory Manual." circa 1972. Forestry and Wildlife Management Department, University of Massachusetts.

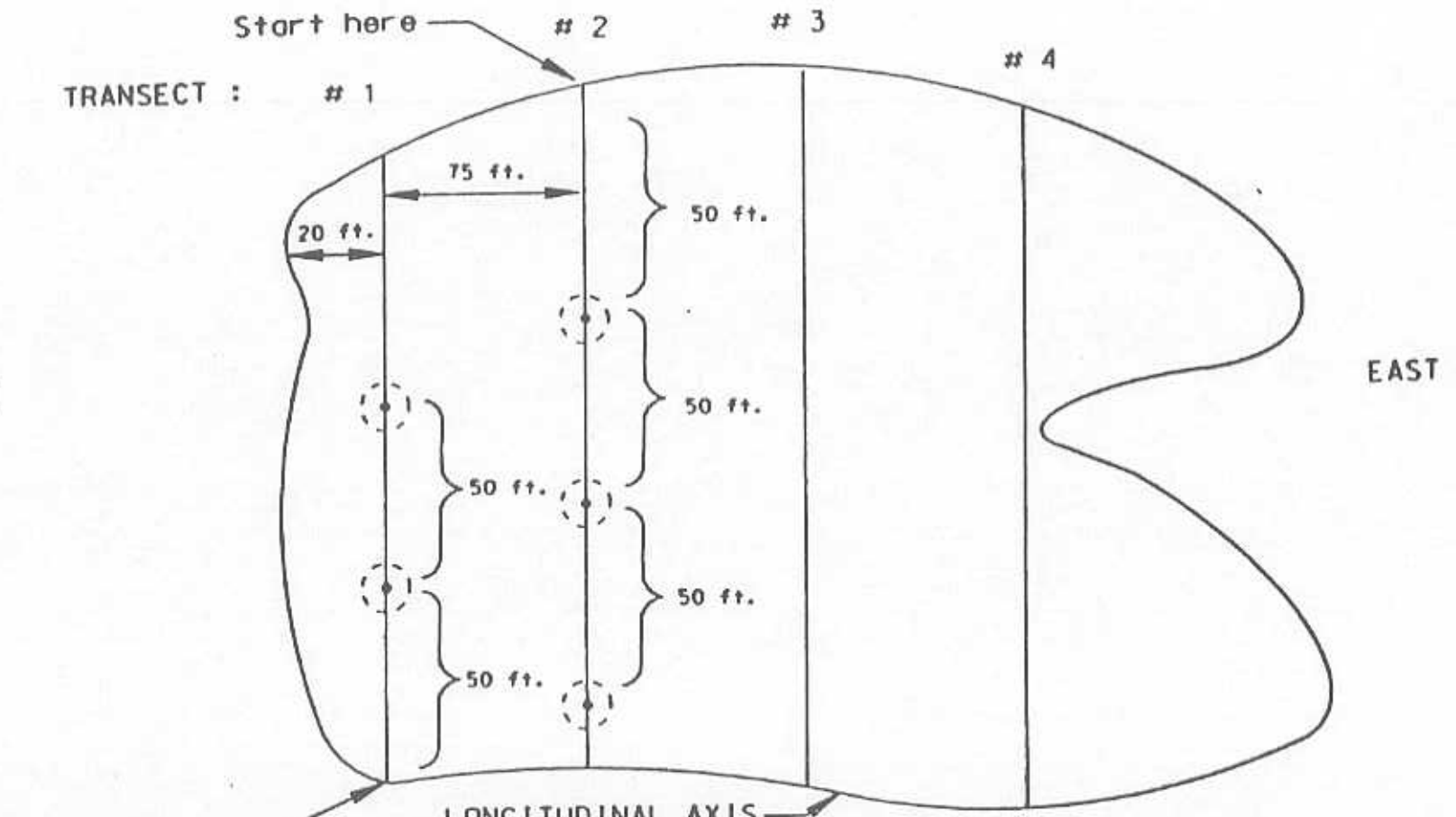
EXAMPLE NO. 1
EMERGENT WETLAND



EXAMPLE NO. 2
FORESTED WETLAND

NORTH

Depicts circular plots along odd and even numbered transects.



SOUTH

NOT TO SCALE

VEGETATION

DATA SHEET #1
EMERGENT WETLANDS

The following is a sample data sheet for recording transect data for tidal and non-tidal emergent wetlands.

	VEGETATION DATA SHEET #1 -- EMERGENT WETLANDS	Monitoring Year _____

Permit #_____ Project Name_____

Mitigation Site: _____

Total Acreage: _____ County: _____ State: ___

Sampling Date: _____ Person(s) Sampling: _____

_____

Compass Bearing for Transects (Degrees)_____

Transect #	Vegetated (Distance in Feet)	Open Water (Distance in Feet)	List Dominant Plant Species
1	15.5	30.0	
2	18.0	32.0	
3	19.0	36.5	
4	14.5	32.5	
5	14.0	33.0	
6	13.0	28.5	

VEGETATION

DATA SHEET #2
SCRUB/SHRUB & FORESTED WETLANDS

The following is a sample data sheet for recording plot data for forested and scrub/shrub wetlands.

	VEGETATION DATA SHEET #2 SCRUB/SHRUB & FORESTED WETLANDS	

Mitigation Site: _____

Total Acreage: _____ County: _____ State: ____

Sampling Date: _____ Person(s) Sampling: _____

Plot Number	Number of Living Trees or Shrubs at Least 10 Inches in Height *	Plant Species
1	1	
2	1	
3	1	
4	1	
5	2	
6	0	
7	1	
8	1	
9	1	
10	2	

* "0" = no living tree or shrub over 10" in height is within the plot
"1" = one living tree or shrub over 10" in height is within the plot
"2" = two or more living trees or shrubs over 10" in height are within the plot

HYDROLOGY

DATA SHEET #3
SURFACE WATER DEPTH

The following is a sample data sheet for recording surface water depths in emergent, scrub/shrub, and forested wetlands.

	HYDROLOGY DATA SHEET #3 SURFACE WATER DEPTH	

Mitigation Site: _____

Total Acreage: _____ County: _____ State: ____

Sampling Date: _____ Person(s) Sampling: _____

_____

Transect #	Plot #	Depth of Water (inches)	Observations
1	1	3	
1	2	4	
1	3	14	
1	4	17	
1	5	6	
2	6	7	
2	7	12	
2	8	17	
2	9	30	
2	10	24	
2	11	8	
3	12	12	
3	13	14	
3	14	27	
3	15	28	
3	16	24	
3	17	12	
4	18	3	
4	19	20	
4	20	26	
4	21	8	
4	22	2	
5	23	6	
5	24	6	
5	25	8	
5	26	1	
6	27	3	
6	28	4	
6	29	5	
6	30	3	

HYDROLOGY

DATA SHEET #4
GROUNDWATER ELEVATION

The following is a sample data sheet for recording groundwater elevations in scrub/shrub and forested wetlands.

	HYDROLOGY DATA SHEET #4 GROUNDWATER ELEVATION	

Mitigation Site: _____

Total Acreage: _____ County: _____ State: ____

Sampling Date: _____ Person(s) Sampling: _____

_____

Well #	Elevation at Well (feet)	Depth to Groundwater (feet)	Elevation of Groundwater (feet)
1	15.0	1.3	13.7
2	16.0	3.5	12.5
3	22.0	8.9	13.1
4	30.0	13.3	16.7
5	28.0	11.9	16.1

The following provides an example, in tabular form, for summarizing groundwater well data readings accumulated over time. This format is recommended to facilitate comprehension of the accumulated data.

Tabular Summary of Groundwater Well Data for Accumulated Readings

Mitigation Site: _____

Total Acreage: _____ County: _____ State: ____

Sampling Dates: from _____ through _____

Person(s) Sampling. _____

Sample Date	Elevation of Groundwater (GW) in Feet				
	GW #1	GW #2	GW #3	GW #4	GW #5
4/1/93	13.7	12.5			
4/8	13.7	12.5			
4/15	13.7	12.5			
4/22	13.7	12.5			
4/29	13.6	12.5			
5/6	13.6	12.4			
5/13	13.5	12.3			
5/20	13.5	12.3			
5/27	13.5	12.3			
6/2	13.4	12.1			
6/23	13.4	12.1			
7/14	13.3	12.1			
8/4	13.3	12.0			
8/25	13.3	12.0			
9/15	13.3	11.9			

SOILS

DATA SHEET #5
DEPTH OF TOPSOIL

The following is a sample data sheet for recording topsoil data.

	SOILS DATA SHEET #5 DEPTH OF TOPSOIL	

Mitigation Site: _____

Total Acreage: _____ County: _____ State: ____

Sampling Date: _____ Person(s) Sampling: _____

_____

Soil Sample #	Depth of Topsoil (inches)	Observations
1	6	dark brown, clay loam
2	8	silt loam, bright colored
3	7	moist, sandy loam
4	10	
5	6	
6	6	
7	6	
8	6	
9	8	
10	7	

SOIL CONSERVATION SERVICE
MARYLAND

SHALLOW GROUNDWATER MONITORING WELLS

PURPOSE

To provide a stable opening in the soil for observing the vertical fluctuations of the free water table in known wetlands, potential wetlands, and adjacent areas.

CONDITIONS WHERE THIS METHODOLOGY APPLIES

This methodology is applicable to wells which are installed for observing the depth and duration of the free water table in the surface layers of a soil profile. It should be applied to sites where direct observations of the free water table are needed in order to determine whether or not wetland hydrology criteria are met. It is not applicable to wells installed for water quality monitoring or other purposes.

Well installation is accomplished by digging a hole of suitable depth with a bucket auger, and lining the hole with PVC pipe to prevent the walls from caving in during the monitoring period. A measuring tape, "dip stick," or graduated float is used to determine the depth to the water table.

PLANNING CONSIDERATIONS

Wetland hydrology involves permanent or periodic surface inundation, or soil saturation, by water during the growing season. Specific criteria have been established concerning the frequency, duration, and timing of flooding and ponding. For soil saturation, criteria include depth to the free water table, duration, and timing.

The water table in a wetland can vary significantly during the course of one growing season, and from one growing season to the next. Water table observations collected during the early spring (the wetter part of the growing season) are most useful for determining the presence or absence of wetland hydrology. These direct observations, when collected during a normal precipitation year, should show whether the wetland hydrology criterion is met. However, it is advisable to take measurements over a multi year period, because observations made only during a dry year or a wet year may lead to erroneous conclusions about the hydrology of a site. The precipitation record for each year of monitoring must be taken into consideration when interpreting the groundwater table data.

Plans for installation of monitoring wells should take into account the quantity and cost of materials needed (including maintenance); the frequency of monitoring; the number of years needed for monitoring; and who will install the wells, perform the monitoring, perform maintenance, analyze the data, and prepare the reports.

Site accessibility should also be considered during the site selection process. If several sites of varying accessibility could be used. A choice of sites may not be feasible, however, if water table information is needed for a specific property.

DESIGN CRITERIA

Shallow groundwater wells, consisting primarily of PVC pipe, have been used successfully in monitoring water tables. The advantages of PVC pipe include availability, cost, and ease of use. Other materials may also be suitable.

The diameter of the well should be at least 1 inch and not greater than 5 inches. A 3-inch diameter pipe is recommended because of the size of the augers typically used for soil investigations, and the availability of 3-inch pipe.

Slots should be cut into the pipe for a minimum of three quarters of the pipe's length to allow groundwater to flow freely (see Figure 1). Slots should be 1/16-inch to 1/8 inch wide, and should be cut around the pipe in staggered fashion, one slot per inch. Use of a circular saw with a plywood blade is recommended for cutting the slots because of the ease of cutting the pipe with a table saw. Other methods for cutting the pipe may also be suitable. Slots should not be cut wider than 1/8-inch because they may allow too much soil to flow into the pipe.

The length of pipe used should be based on the characteristics of the soil(s) on the site and the amount of water table information needed. A 24-inch pipe is usually sufficient for situations where the primary concern is the depth of the water table within a few nches of the soil surface. A 60-inch pipe is recommended when additional information s desired concerning the range of water table fluctuations in the soil profile. For stratified soils, two wells may be appropriate—one shallow and one deep (see Figure 4). f only one well is used in a stratified soil, it should be installed so as not to extend hrough a fine textured layer.

A loose-fitting cap should be installed on top of the well to prevent rainwater and debris rom entering the pipe.

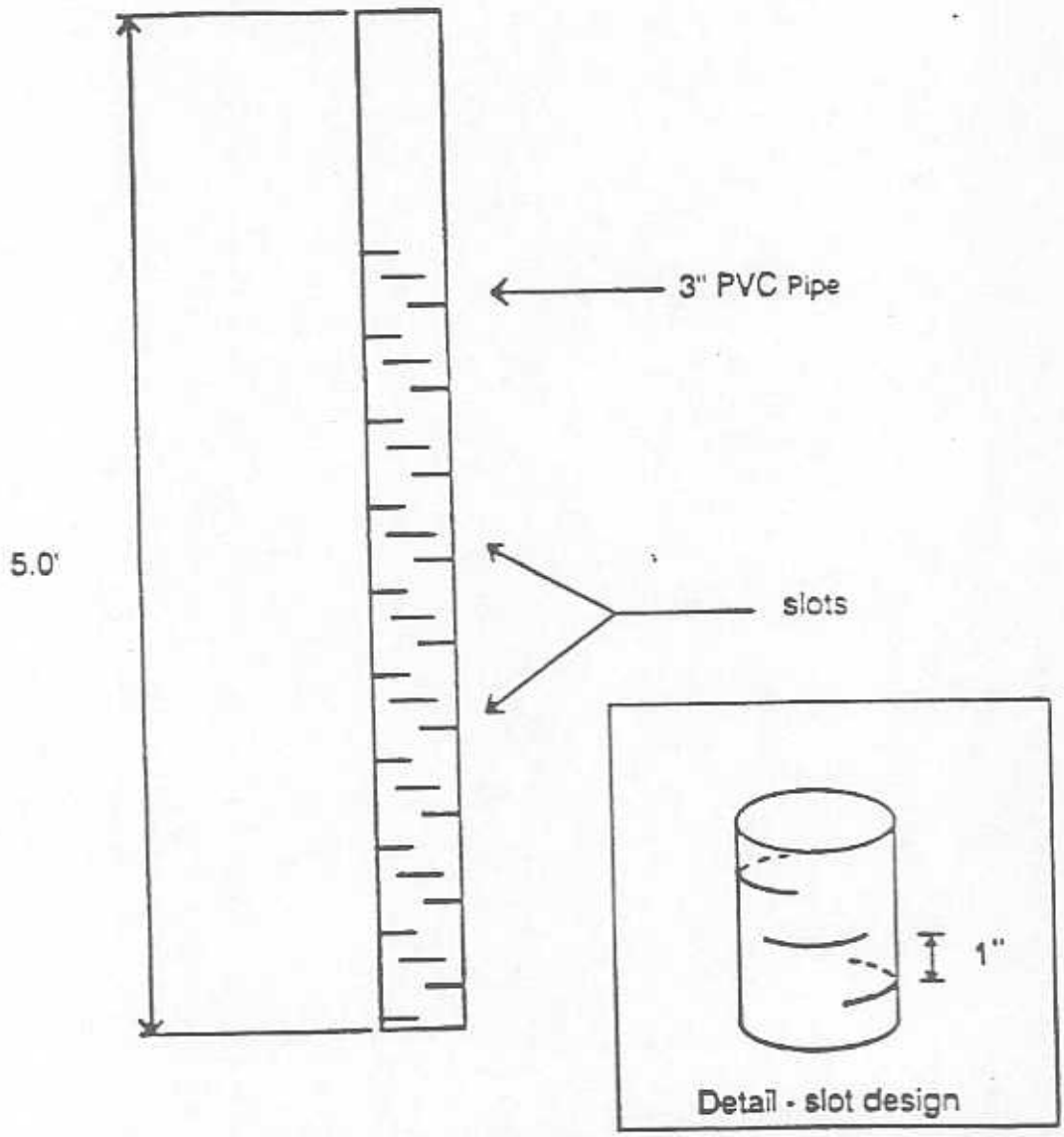
A tight-fitting cap or plug may be installed on the bottom of the pipe to prevent soil from eing pushed up into the pipe during installation. In coarse-textured soils, use of the ottom cap is strongly recommended because of the tendency of coarse materials to lump into the hole when the pipe is being installed. In fine-textured soils where lumping is less of a problem, either a cap may be used or 3 to 5 inches of gravel may e added to the bottom of the well hole before the pipe is installed.

A graduated float may be installed in the well for ease of reading the water table (see igure 2). Alternatively, the well cap can be removed and a tape measure may be serted into the well to determine the depth to the water table.

well casing is not needed. Bending and/or collapse of the well pipe is not a problem hen using the type of shallow well described in these criteria.

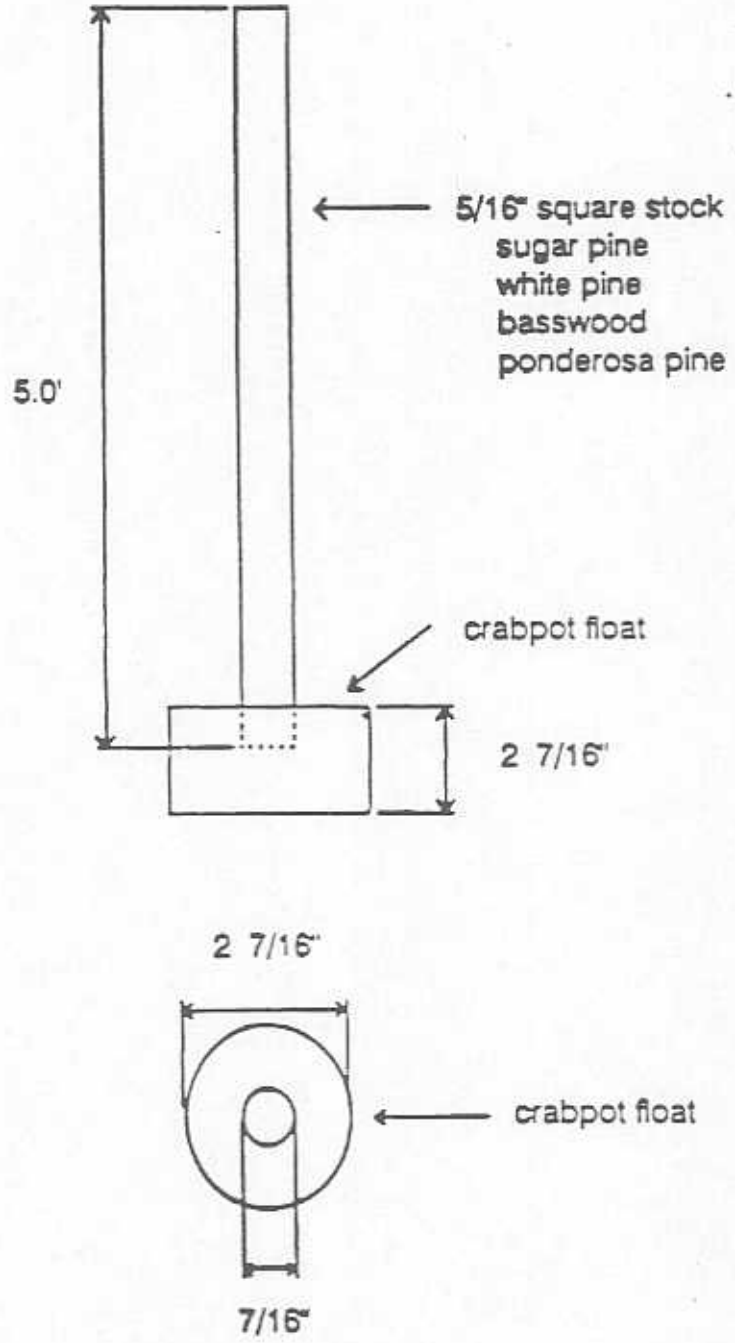
MATERIALS NEEDED

Figure 1. Typical Wellpipe



1. 5 foot section - 3" diameter Schedule 40 PVC pipe or thin-wall pipe.
2. Slots should extend a minimum of three-quarters of the way up the pipe, but not so far as to extend above the ground surface. Use a circular saw with a plywood blade to cut slots. Cut slots on three sides of the pipe in staggered fashion, one slot per inch. (See inset.)

Figure 2. Graduated Float



1. Cement 5/16" square stock into float with epoxy cement. Make sure bottom hole is sealed.
2. Mark square stock in feet and tenths graduations. Using five feet of 5/16" square stock of the recommended type, the top of the float should be even with the water surface. Check water level on measuring device before graduations are marked.
3. Drill or punch hole in well cap to accommodate square stock.

INSTALLATION PROCEDURES

1. Establish a transect parallel to the hydrologic gradient of the site. Use a rod and level, as appropriate, to determine relative elevations along the transect.

2. Determine the well locations along the transect on the basis of slope and other topographic features. A spacing of 50 - 100 feet between wells is usually sufficient.

3. Record the elevation of the soil surface at each well site.

4. Use a bucket auger to auger a hole 4.5 feet deep, or other appropriate depth for the length of pipe used. (See Figure 3.) Note: for stratified soils, two wells may be needed - one shallow, and one deep (See Figure 4.).

5. Scarify the sides of the hole with a long-handled wire brush to counteract the effects of the auger. (In fine-textured soils, the auger will tend to smear the sides of the hole and "seal" it, to some extent.)

6. Place a cap on the bottom of the pipe, or add 3 - 5 inches of gravel to the bottom of the hole.

7. Slide the PVC well pipe into the hole.

8. Use material augered from the hole to backfill around the pipe. This will prevent surface water from flowing into the well.

9. (OPTIONAL) Install a graduated float into the well.

10. Cover the well with a loose-fitting cap to prevent rainwater and debris from entering the well. If a graduated float is used, drill or cut a hole at least 1/2-inch diameter in the center of the cap to allow the graduated rod on the float to pass through.

SCS-MD-6

Figure 3. Typical Installation of Monitoring Well

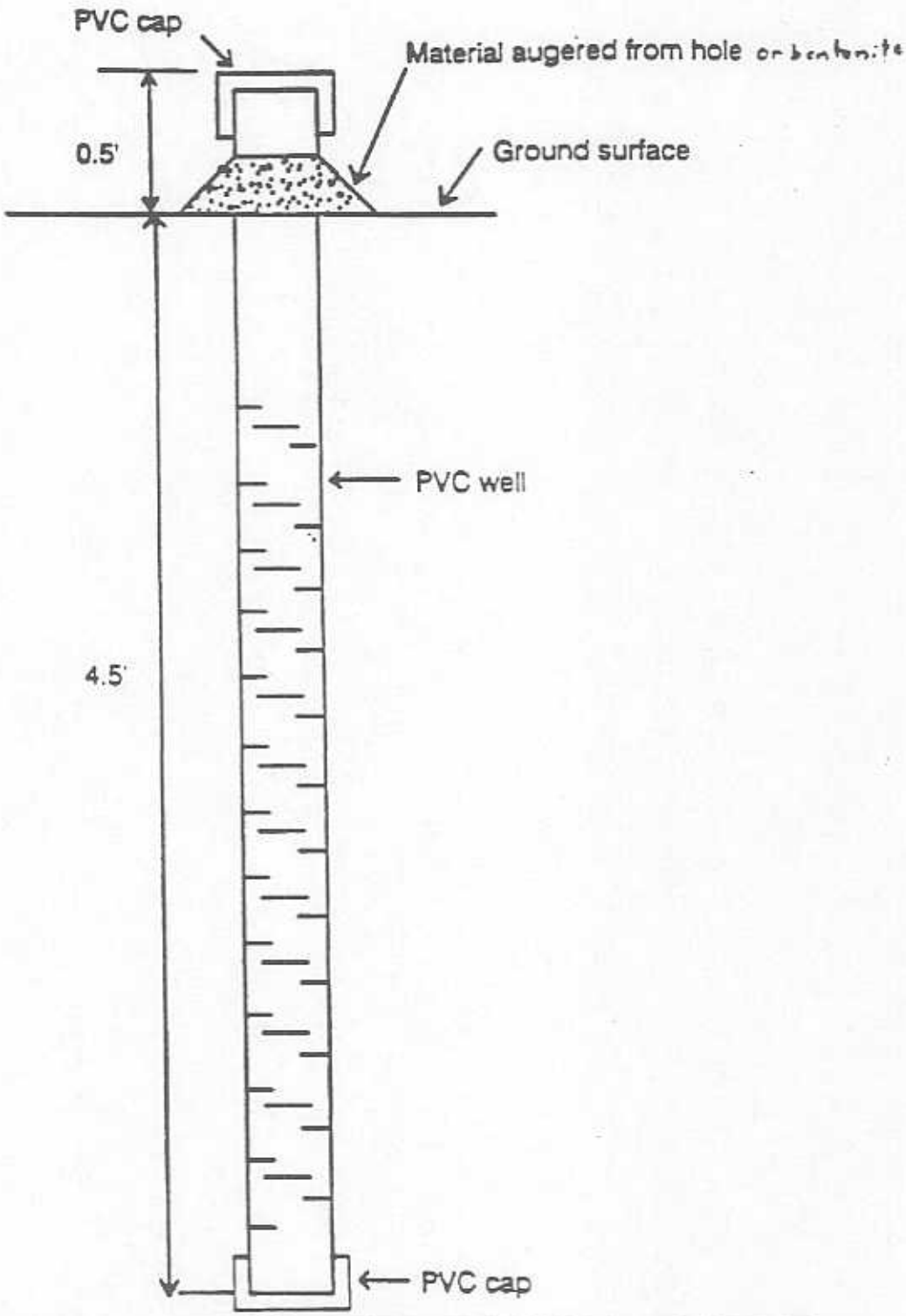
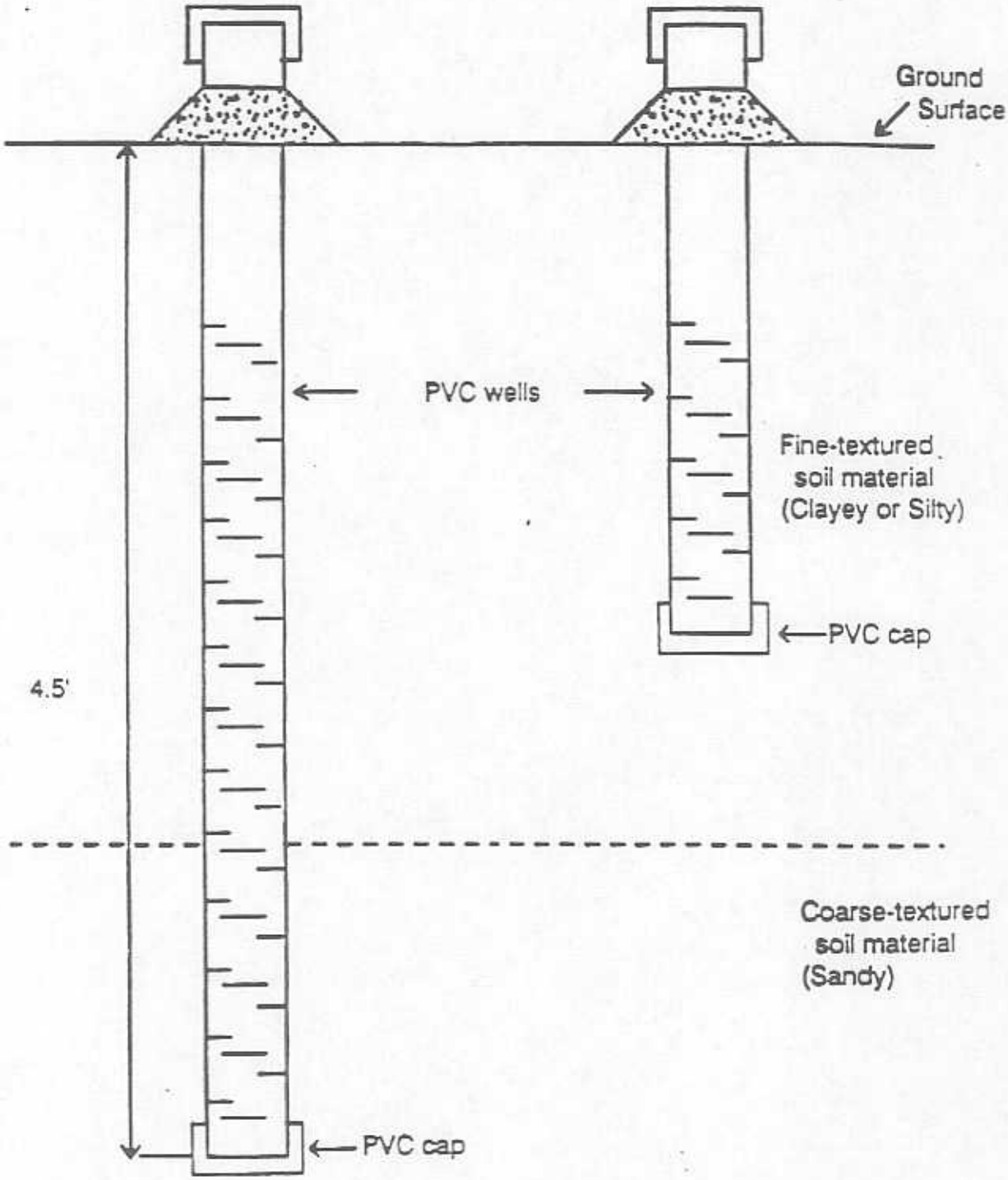


Figure 4. Typical Installation of Wells in a Stratified Soil



MONITORING SCHEDULE

The water table depth of each well should be measured daily (or a minimum of twice per week) during the early part of the growing season (March - May), and at least once per week thereafter.

MAINTENANCE

While conducting monitoring, take note of any damage to the well, including the graduated float (if used). Repair or replace parts if they fail to function properly.

On an annual basis, use a bucket auger, 1/2 inch smaller than the well diameter, to remove any soil, roots, and debris that have accumulated in the well. For the sake of convenience, perform the annual clean-out when the water table is low.

SELECTED REFERENCES

1. Fanning, D.S., and William U. Reybold. 1968. Water Table Fluctuations in Poorly Drained Coastal Plain Soils. Maryland Agricultural Experiment Station, Department of Agronomy, University of Maryland, Publication No. 662, pages 2-3.

2. Kerfoot, W. B. 1986. Monitoring Well Construction, and Recommended Procedures for Direct Ground-water Flow Measurements Using a Heat Pulsing Flowmeter. Published in Ground-water Contamination: Field Methods: A Symposium; sponsored by ASTM Committees D-19 on Water and D-18 on Soil and Rock, Cocoa Beach, Florida, 2-7 February, 1986; A. G. Collins and A.I. Johnson, editors; Philadelphia, Pennsylvania; pages 146-161.

3. Riggs, C.O. and A. W. Hathaway. 1986. Ground-water Monitoring Field Practice: An Overview. Published in Ground-water Contamination: Field Methods: A Symposium; sponsored by ASTM Committees D-19 on Water and D-18 on Soil and Rock, Cocoa Beach, Florida, 2-7 February, 1986; A. G. Collins and A.I. Johnson, editors; Philadelphia, Pennsylvania; pages 121-136.

4. USDA, Soil Conservation Service. (No date). Handbook of Soil Survey Investigations: Field Procedures.

September, 1991
Annapolis, Maryland

COMPENSATORY MITIGATION GUIDANCE

Chapter 7

Wetland Mitigation Projects Less Than or Equal to 0.5 Acre

I. Performance Standards

Compensatory mitigation projects required by Federal or State permits for wetland impacts should achieve the goals and objectives established in the performance plan. Mitigation projects for less than or equal to 0.5 acre should conform to one of the following criteria, unless otherwise agreed to by the regulatory agencies.

A. After 2 years, greater than 50% of the site shall be vegetated by planted species and/or naturally regenerated vegetation approved by the regulatory agencies.

B. After 5 years, greater than 85% of the site shall be vegetated by the planted species and/or naturally regenerated vegetation approved by the regulatory agencies.

II. Monitoring

The permittee will be responsible for submitting annual monitoring reports to the regulatory agencies, for a period of five consecutive years from the completion of construction of the mitigation site. Annual monitoring reports are submitted to the regulatory agencies by 31 December of that calendar year. The following information should be included with the annual monitoring report.

A. A narrative description of the mitigation site addressing its position in the landscape, adjacent waterbodies, and adjacent landuse.

B. A narrative description of how the mitigation site has achieved the goals, objectives, and performance standards established for the project.

C. A listing of the plant species occurring at the mitigation site. List the most dominant to the least dominant plant species.

D. One set of Photographs of the mitigation site should be taken anytime during the months of May through September of each monitoring year. Every attempt should be made to provide a panoramic view of the site.

E. Where Phragmites australis (common reed) or other undesirable species becomes an invasive problem, it may be necessary to undertake eradication measures. The permittee

should submit a detailed plan outlining the method to be used, to the regulatory agencies for review and approval.

F. Groundwater monitoring wells may be installed at the mitigation site (see attached Soil Conservation Service guidance for installation directions). Water level data should be collected during the first two growing seasons subsequent to the completion of grading. Water levels within the well should be measured bimonthly during the first 60 days of the growing season, and on a monthly basis for the remainder of the growing season. List these data (i.e., water levels and date measured) in the monitoring report.

G. Plan drawings to scale depicting actual grading elevations and vegetation zones (a.k.a. as-builts) once construction of the mitigation site has been completed. Drawings are be submitted to the Corps of Engineers and State regulatory agencies within 120 days of completion of construction.