PN-ABQ-433
ISN 85713

WETLANDS ASSESSMENT
Agri-DEV PINEAPPLE NURSERY
KOTABOWA, MONERAGALA

INSTRUCTIONS
FOR IDENTIFYING WETLANDS ON THE
FIRST FIFTY ACRES

By:

Dr. CRAIG DAVIS
Wetland Ecologist

and

ROBERT C. FLICK
Chief of Party

August 1992

COMMERCIAL SMALL FARM DEVELOPMENT PROJECT

Agricultural Cooperative Development International (ACDI)
Colombo, Sri Lanka

and

50 F Street, N.W. #900
Washington, D.C. 20001

Financed with recources provide by USAID/Sri Lanka
Cooperative Agreement No.383-0101-A-00-0062

acdi

Agricultural Cooperative Development International
No 3, McLeod Road
Colombo 4, Sri Lanka

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A WETLAND ASSESSMENT AND DELINEATION OF THE PROPOSED ACDI PINEAPPLE NURSERY PROJECT SITE

Craig B. Davis
Wetland Ecologist
July 1992

1.0 Introduction and Scope of Assessment

An environmental impact assessment (EIA) of the proposed Agricultural Cooperative Development International (ACDI) 120 hectare pineapple nursery in the Bibile/Medagama region of the Moneragala District of Uva Province was carried out from March 16 to April 4, 1992. This EIA noted the presence of wetlands on the site of the proposed nursery and recommended that ACDI "inventory and protect wetlands and springs found within the borders of the proposed nursery site." It further recommended that "the inventory should result in (1) a map indicating the exact locations and area of all spring and wetland areas; (2) estimated seasonal flow rates of water depths; and (3) a description of proposed protection measures."

To address these recommendations, ACDI requested the assistance of a wetland ecologist on temporary assignment to the Mahaweli Agriculture and Rural Development project (MARD) to carry out a one or two day site examination of wetlands on the proposed nursery site. This site examination was carried out on July 8, 1992.

Time limitations did not allow for the mapping of wetland sites, the determination of boundary lines demarcating wetlands from surrounding uplands, or the estimation of seasonal flow rates or water depths. Therefore the scope of work for this assessment is limited to:

1. carrying out an examination of possible wetlands within the proposed 120 ha plantation site,

2. delineating jurisdictional wetlands according to U.S. regulations (APPENDIX A), and

3. making recommendations for the conservation and protection of all jurisdictional wetlands if the site is developed.

2.0 Defining Wetlands

Ecologists define wetlands as ecosystems that are transitional areas between uplands and open water ecosystems such as lakes, ponds, rivers, and oceans. Wetland ecosystems include swamps, marshes, bogs, mires, springs, fens, mud flats, and rocky shores, depending

upon local climatic, hydrologic and soil conditions and vegetation. Wetlands can be large or small, fresh or saline, vegetated or non vegetated. Until recently wetlands were considered to be nonproductive wastelands and sources of poisonous gasses and disease. They were areas to be avoided or drained.

In recent years there has been a growing realization that far from being wastelands of no social or economic value, wetlands are vital and productive components of the landscape that provide services to human society that are invaluable. It turns out that wetlands are among the most, not the least, productive ecosystems on earth, rivalling the productivity of coral reefs and far exceeding the productivity of even the most productive agricultural systems. We now understand that wetlands serve as important water storage areas, absorbing precipitation and flood waters like a sponge and releasing them gradually to distributary streams. Wetlands also serve as filters, removing minerals, nutrients, and pollutants from waters passing through them--indeed, wetlands have been called the "kidneys of the landscape." Constructed wetlands are now being used for treating municipal sewage, acid mine drainage, industrial effluents, and effluents from animal confinement operations in many parts of the U.S. and Europe. Wetlands show particular promise for treating non-point sources of pollution such as runoff from agricultural fields. Beyond these very critical services, wetlands provide essential habitat for a variety of wildlife species, especially waterfowl, and are vital nurseries for shrimp and fish of importance to sports, commercial and subsistence fisheries. And finally there are the less commensurable values of wetlands as aesthetically rewarding environments and places of recreation.

In recognition of the significant importance of wetland ecosystems as components of our landscape and suppliers of services vital to our economies and health, the U.S. government, many state governments, and other governments around the world have taken steps to protect remaining wetlands and revitalize or restore critical wetlands that have been drained or damaged in the past.

3.0 Site Visit Procedures

Because of the proposed plantation site is currently under dense scrub jungle and high grass vegetation, a team of local men were hired to comb the site prior to the site visit to locate all sites exhibiting wetland characteristics, e.g. saturated soils, standing or flowing water, or typical wetland plant species. These areas identified fell into three categories: (1) springs or what are locally called "fountains," (2) abandoned paddy fields, and (3) ravines.

At each site, soil pits were excavated to 18 inches, except at one paddy field site where and existing pit revealed the soil strata, and vegetation was examined for the presence and relative dominance of hydrophytic species.

4.0 Existing Wetlands on the Proposed Nursery Site

4.1 Springs (Fountains)

The Bibile area is known for its numerous springs, indeed the town's name reflects this hydrologic feature of the local landscape. Several springs were found on the proposed project site. These occurred in otherwise dry upland situations and periodically along ravines at lower elevations. Water entering the water table on the upper slopes emerges at the surface at various locations farther down as surface seeps in otherwise dry areas or as springs in the bottom or sides of shallow drainage channels.

Soil pits excavated at the higher springs revealed a profile characterized by 5 to 15 cm of reddish-brown sandy soil underlain by approximately 15 cm of gray sandy soil with no or a few mottles. Below this gray zone the soils were largely orangish red and still sandy. The grey soil layer indicates that this zone is saturated almost continuously, creating anaerobic conditions within the zone. These conditions result in the conversion of ferric iron to ferrous iron which is removed from the soil giving it its grey color. This process is called gleization and these gray soils are called "gley" soils. Gley soils are hydric, satisfying one of the three mandatory criteria for wetland delineation.

Soil pits excavated at sites where springs emerge in drainages or ravines revealed gleization throughout the horizon with no mottling. This soil is continuously saturated to the surface and is therefore, hydric. During the dry season, these areas are kept saturated by seepage from the ground water emerging at the surface.

Vegetation in all of these spring areas was consistently dominated by hydrophytic species, especially species belonging to the genera, Cyperus and Scirpus. In the wettest parts of the sites, the vegetation comprised 100 percent hydrophytic species, satisfying the second mandatory criterion for wetland delineation.

The third and final criterion for wetland delineation is the presence of wetland hydrology, and this is also satisfied at the sites of the

springs. Therefore, the springs on the proposed project site are jurisdictional wetlands according to U.S. regulations and would, therefore, be protected under U.S. law.

4.2 Abandoned Paddy Fields

Many of the abandoned paddy fields lie immediately down slope from springs, indicating that the farmers who attempted paddy cultivation on these sites sought out springs as sources of water. Paddy culture failed because the soils are too sandy to hold water.

Paddy fields adjacent to active springs supported 80 to 100 percent hydrophytic vegetation and soils had gley layers with some yellow mottling. This mottling indicated that the soils are saturated for extended periods during the year but are oxidized at other times. These sites would qualify as jurisdictional wetlands because they satisfy all three criteria.

In contrast to these wet paddy areas, other paddy fields farther down slope supported few or no hydrophytic species, but did have gley layers in their soil horizons. These areas were likely wet at one time as a result either of irrigation, springs that have since disappeared, or both. These areas might return to wetland conditions if wetland hydrology were to be restored, but do not qualify as wetlands under current hydrologic conditions.

Still other paddy fields exhibited neither hydrophytic vegetation nor gley horizons in the soil. These areas are definitely not wetlands.

4.3 Ravines

Soil samples in the bottoms or ravines revealed a deep sandy soil with a consistent grayish brown color with yellow mottles, indicating that these soils are periodically saturated, probably for extended periods of time. But, there was little sign of hydrophytic vegetation in most ravine bottoms, the vegetation being dominated by upland species. These areas are not wetlands under current hydrologic conditions but could become wetlands if drainage flow in these ravines increases as a result of irrigation.

5.0 Recommendation

Because hydrologic conditions are the primary factor determining where wetlands will occur, no development

should take place that interferes with hydrologic conditions that supply water to wetlands in the project area.

5.1 **Plantation development should be designed to conserve and protect the integrity of all active springs, seeps or fountains.**

All springs, seeps or fountains should be mapped prior to infrastructure development and precise boundaries between the jurisdictional wetland and upland should be determined. Care must be taken that planted areas do not intercept, deplete, or divert the flow of subsurface water supplying these wetlands. Therefore, water table depths should be determined for the area surrounding springs, especially above their upslope margins, and a buffer zone should be maintained to insure that infrastructure and cultivation do not interfere with ground water flow to the springs. This protection of ground water supply is critical.

The water table sampling can be done when the wetland boundary determinations are being made, as these will require the digging of numerous soil pits or auger holes around the springs. Buffer zones are probably best left in native vegetation of whatever form exists or develops. That will make them self maintaining.

All areas dominated by hydrophytic plant species such as those belonging to the genre Cyperus, or Scirpus are most certainly wetlands under the hydrologic conditions that prevail in this region. These species are easy to recognize and should be used as indicators of wetlands.

Areas near abandoned paddy fields should be examined for active springs. Paddy fields are easier to find than are small seepages and seem to have been located primarily to take advantage of springs. Elephants are also able to locate seeps where they dig wallows. All such areas qualify as jurisdictional wetlands and should be conserved, buffered, and protected.

5.2 **Ravines**

To the extent possible, natural drainages should be used with minimal hydrologic alteration to carry irrigation outflow from the project site. When saturated, the soils in the bottoms of these ravines will carry out some of the water purification that is common of wetlands. Vegetation removal and channelization of these drainages should be avoided as much as possible.

5.3 Artificial Wetlands for Effluent Water Purification

Project developers should explore the possibility of incorporating small, constructed wetlands on drainage channels leaving the plantation site to improve the water quality of drainage waters before they reach the Dahamal Oya. Strategically located constructed wetlands with a surface area of one percent of the drainage area could remove appreciable quantities of silt, phosphorus, and nitrogen from drainage waters and possibly reduce herbicide and pesticide levels. Costs for constructions of such wetlands would be minimal and maintenance costs would be very low.

5.4 Future Development Upslope from the Nursery

The recommendations made here for the 120 ha nursery site apply also to future development of the full pineapple operation. The 120-ha plantation lies in a narrow band along the Dahamal Oya. The much larger area to be developed later lies almost entirely upslope from the nursery. Care must be taken to insure that development of the larger site does not destroy springs on that site or interfere with ground water supplies to the springs on the nursery site. Small constructed wetlands scattered strategically through the larger development will enhance the quality of drainage water passing through the nursery and into the Dahamal Oya. These conservation measures should be relatively simple and cost effective if implemented at the time of project design and implementation.

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APPENDIX A

CRITERIA FOR WETLAND DELINEATION IN THE U.S.

In the United States wetlands are protected under Section 404 of the Clean Water Act, the "Swampbuster" provision of the Food Security Act of 1985, Section 10 of the Rivers and Harbors Act of 1899, and the Emergency Wetlands Resources Act of 1986. Of these, Section 404 and "Swampbuster" are most important. Under these acts, activities detrimental to jurisdictional wetlands are forbidden. Four federal agencies are responsible for identification and delineation of jurisdictional wetlands: the Army Corps of Engineers (Corps), Environmental Protection Agency (EPA), Fish and Wildlife Service (FWS), and Soil Conservation Service (SCS). Three closely related definitions of the jurisdictional wetlands are used by these agencies in making wetland jurisdictional decisions. These definitions form the basis of Unified Federal Method for Wetland Delineation (Federal Interagency Committee for Wetland Delineation, 1989) that is used by all agencies and supported by a broad consensus of Wetland scientists and social scientists. The following definitions and descriptions of wetland criteria are extracted from that manual.

1. The Corps and EPA define wetlands in administering the 404 program as:

   "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

   (EPA, 4C CFR 230.3 and CE, 33CFR 328.3)

2. The SCS defines wetlands on agricultural land under "Swampbuster" as:

   "Areas that have a predominance of hydric soils and that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions..."

   (National Food Security Act Manual 1988)

3. The FWS has led a cooperative effort to develop an inventory of U.S. wetlands and uses the following definition in their <u>Classification of Wetlands and Deer Water Habitats of the U.S.</u>

   (Cowardine, et al. 1979):

"Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes, (2) the substrate is predominantly undrained hydric soil, and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season each year."

Obviously, these definitions overlap considerably. The first two include only vegetated areas, while the FWS recognizes non-vegetated wetlands.

Using these definitions, the four federal agencies have promulgated a set of mandatory technical criteria for wetland identification and delineation. These mandatory criteria are:

"Wetlands possess three essential characteristics: (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology, which is the driving force creating all wetlands. The three technical criteria specified are mandatory and must be met for an area to be identified as wetland. Therefore, areas that meet these criteria are wetlands."

Hydrophytic vegetation is defined as "macrophytic plant life growing in water, soil or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content." Plants may be obligate hydrophytes, but a majority of plants growing in wetlands are also capable of growing in various degrees in non-wetland situations. The determination that an area has hydrophytic vegetation depends on the percentage cover or frequency of hydrophytic species in the vegetation. But, if a site has hydric soils and wetland hydrology the area is considered to have hydrophytic vegetation even if percentage cover and frequency criteria are not met in the field. Such areas are considered to be disturbed and are treated as especial cases in wetland delineations.

Hydric Soils are defined as "soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part." Hydric soils may be organic or mineral soils (in Sri Lanka most hydric soils are mineral soils). When anaerobic conditions develop in mineral soils a process called glaization occurs. Ferric iron is converted to ferrous iron which can be totally removed from the soil, leaving behind a grey or greenish or bluish grey gley layer. Continuously saturated mineral soils are gleyed to the surface and are always hydric. Mineral soils that are alternately saturated and drained (anaerobic/reduced and aerobic/oxidized) usually develop mottles of different colors within the soil profile. If the soil is predominantly grey with colored mottles, it is saturated for long periods of time

and is considered hydric. Soils that are predominantly red or yellow with grey mottles are saturated for shorter periods of time and may not be hydric. Brightly colored mineral soils are not hydric. If saturated soils are oxygenated or if they contain little or no organic matter, gleization may not occur. Such soils are still considered to be hydric for wetland delineation purposes.

Wetland Hydrology "The driving force creating wetlands is 'wetland hydrology', that is, permanent or periodic inundation, or soil saturation for a significant period (usually a week or more) during the growing season." "Numerous factors influence the wetness of an area, including precipitation, stratigraphy, topography, soil permeability and plant cover. The frequency and duration of inundation or soil saturation are important in separating wetlands from non wetlands" (primarily as they affect the development of anaerobic conditions). It should be noted that "in the absence of visible evidence of significant hydrologic modification, wetland hydrology is presumed to occur in an area having hydrophytic vegetation and hydric soil.

Instructions for wetland survey, mapping on pineapple nursery farm

August 28, 1992

TO : S. A. C. M. Zuhyle and M. Gunasekera - ACDI/CSFD

FROM : Robert Flick - COP/CSFD

SUBJECT : Wetlands survey, mapping, etc. on nursery farm

The following notes and instructions were compiled from a meeting with Dr. Craig Davis, wetlands specialist on 4 August 1992 and constitute instructions for identifying, marking and protecting "jurisdictional" wetlands, determining their water table depth and flow rates where necessary, first in the 50 acres to be cleared for phase I and possibly later in the remaining 250 acres to be cleared for nursery operation. Dr. Davis' report dated July 18, 1992 (copy attached) should be consulted for additional instructions and guidance.

In addition, Appendix A attached, are copies from the Unified Federal Method for Wetland Deliniation.- (Federal Interagency Committee for Waterland Delineation, 1989.) and should be consulted for further questions.

Following are instructions for identifycation, determination of boundaries and protection of the wetlands.

1. Wetlands in the nursery primarily take the form of springs or fountains or paddy fields (active or abandoned). A spring or fountain is formed where water penetrates the water table on the upper slopes and emerges at the surface at various locations further down the slope as "surface seeps" or "springs." Some springs or seeps may be very small without appreciable volume of water while others may actually flow and have flow rates and flow volumes. There may be springs in the riverine forest reservation of 3 chains as well and there may be wetlands in the riverine forests that are caused by the river. But we are concerned with the springs or wetlands first in the 50 acres, as that will be cleared initially, and second in the remaining 250 acres.

The procedure is to identify the wetlands, mark their boundaries and buffer zones, determine the depth of the water table and where "flowing" water appears, measure the flow rate. The exact location of the wetland must be determined and located on the map of the nursery farm. This measurement may have to be done by the Survey Department.

2. Springs have a vertical axis and are usually shaped as follows:

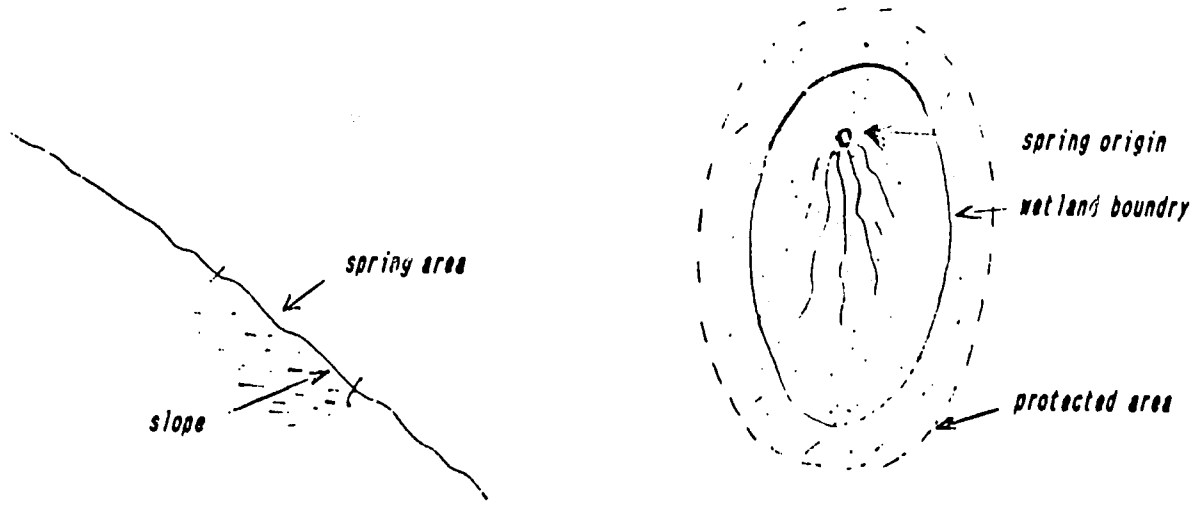


Diagram I

3. To identify if a spring is truly a jurisdictional wetland one needs to examine the soil, the plants present and the spring itself to see if water is present on or slightly below the surface.

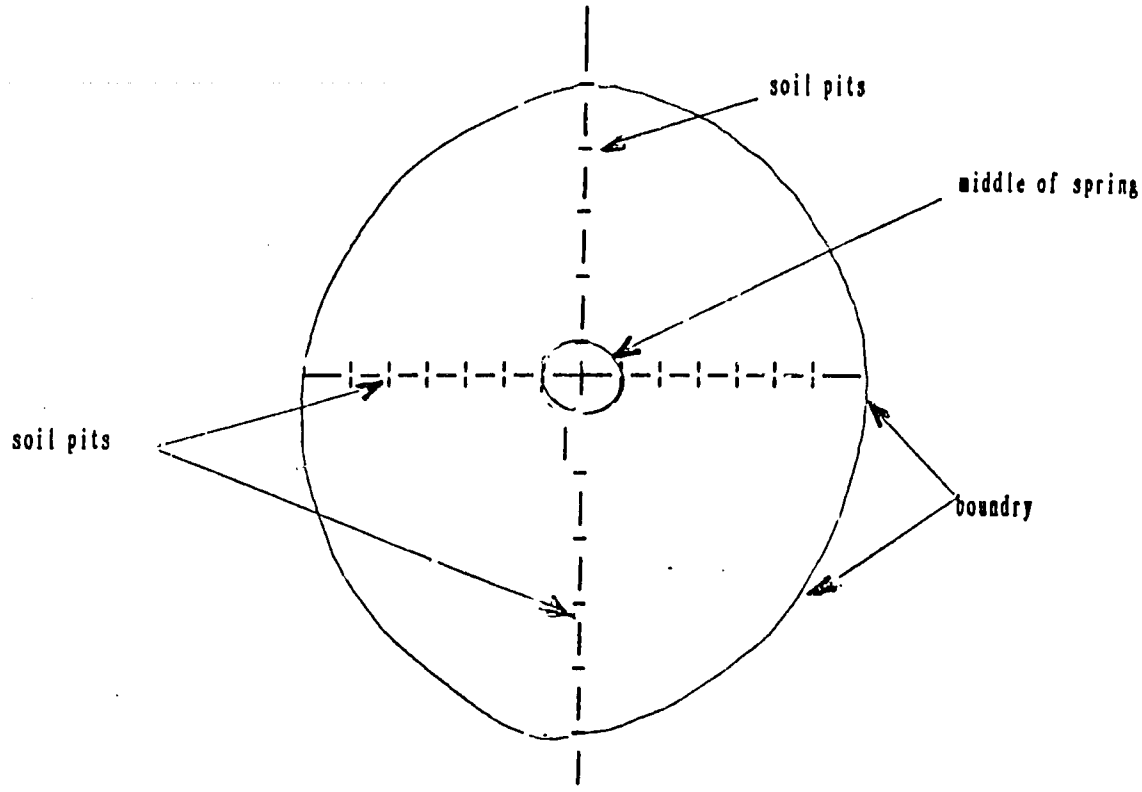
Soil: Dig a soil pit 20" x 20" and at least 18" deep approximately in the middle of the suspected wetland. If grey soil is observed, it is a wetland. The grey soil indicates the soil is saturated continuously. It is called "Gley Soil."

Plants: Observe the plants in and around the suspected wetland. If Hydrophytic species belonging to the genera Cyperus and Scirpus exist in or close to the suspected wetland, it is a wetland.

Wetland Hydrology: If water is present on the surface or if when digging a soil pit it fills with water, then the site is a wetland.

4. The Agri-DEV nursery manager with assistance from laborers can search the 50 acres for what are suspected as wetlands. These must be marked with flags, spray paint or some other means that will not blow away or get lost. If there is Gley soil and wetland hydrology it can be considered a "jurisdictional" wetland, and must be marked, measured and protected.

5. Once the wetlands have been marked, the boundaries must be determined. To determine the boundaries of a jurisdictional wetland one has to dig a series of soil pits according to the following diagram:



Starting at the center on the horizontal axis in approximately the middle of the wetland, dig 400 square inch (20" x 20"), 18" - 24" deep soil pits every meter to see if Gley soils are present. Continue digging the soil pits along the horizontal axis until no additional Gley soils are found. This should be the boundary of the wetland. Do the same in all four directions and mark the boundaries with permanent steel color coded stakes, i.e., bright red, yellow or blue to mark the wetland boundary!

6. Measure and record the water table depth in several of the pits.

7. Once the boundaries have been properly identified, measure at least 10 meters up hill from the highest boundary and 10 meters to either side so there is at least a 10 meter buffer surrounding the marked boundary of the wetland. Put in additional color coded stakes of a different color - at least six - to mark the buffer.

8. The next step is to determine if there is water flow in the wetlands. If water is actually flowing (even if only for a meter or two), the flow rate must be determined. To undertake this, the Agri-DEV nursery manager will obtain assistance from the Irrigation Engineer in Bibile. The flow-rate must be determined and recorded with date and time for each wetland that exhibits any surface water.

8. Once this has been accomplished, the entire marked area must be preserved and no trees are to be cleared nor is the area to be disturbed in any way. Also, the wetlands must be marked on the map of the nursery farm. This may need to be carried-out by the Survey Department so exact locations are recorded.

9. Botanist. As there will be a botanist undertaking a random sample within the nursery to identify the presence of any rare, unique, threatened, endangered or sensitive plant species during September, this person could also visit the marked wetlands to determine if Cype us and Scirpus genera exist in the various sites. This should only be done for those sites where some doubt may exist and identifying the presence of the two indicated plant genera may confirm whether a "jurisdictional" wetland really does exist. If there are Gley soils and no hydrophytic plant species it is still a wetland and it should be protect it. Likewise, if there are plant species but no Gley soils, it still is a wetland and it should be protected.

APPENDIX A

Step 5. Determine the field determination method to be used. Considering the size and complexity of the area, determine whether a routine, intermediate-level, or comprehensive field determination method should be used. When the area is equal to or less than five acres in size or is larger and appears to be relatively homogeneous with respect to vegetation, soils, and/or hydrology, use the routine procedure (p. 46). When the area is greater than five acres in size, or is smaller but appears to be highly diverse with respect to vegetation, use the intermediate-level procedure (p. 54). When detailed quantification of plant communities and more extensive documentation of other factors (soils and hydrology) are required, use the comprehensive procedure regardless of the wetland's size (p. 64). Significantly disturbed sites (e.g., sites that have been filled, hydrologically modified, cleared of vegetation, or had their soils altered) will generally require intermediate-level or comprehensive procedures. In these disturbed areas, it usually will be necessary to follow a set of subroutines to determine whether the altered characteristic met the applicable criterion prior to its modification; in the case of altered wetland hydrology, it may be necessary to determine whether the area is effectively drained. Because a large area may include a diversity of smaller areas ranging from simple wetlands to vegetatively complex areas, one may use a combination of the onsite determination methods, as appropriate.

Routine Onsite Determination Method

4.9 For most cases, wetland determinations can be made in the field without rigorous sampling of vegetation and soils. Two approaches for routine determinations are presented: (1) hydric soil assessment procedure, and (2) plant community assessment procedure. In the former approach, areas that meet or may meet the hydric soil criterion are first delineated and then dominant vegetation is visually estimated to determine if hydrophytic vegetation is obvious. If so, the area is designated as wetland. If not, then the site must undergo a more rigorous evaluation following one of the other onsite determination methods presented in the manual. The second routine approach requires initial identification of representative plant community types in

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the subject area and then characterization of vegetation, soils, and hydrology for each type. After identifying wetland and nonwetland communities, the wetland boundary is delineated. All pertinent observations on the three mandatory wetland criteria should be recorded on an appropriate data sheet.

4.10 Hydric Soil Assessment Procedures

Step 1. Identify the approximate limits of areas that may meet the hydric soil criterion within the area of concern and sketch limits on an aerial photograph. To help identify these limits use sources of information such as Agricultural Stabilization and Conservation slides, soil surveys, NWI maps, and other maps and photographs. (Note: This step is more convenient to perform offsite, but may be done onsite.) Proceed to Step 2.

Step 2. Scan the areas that may meet the hydric soil criterion and determine if disturbed conditions exist. Are any significantly disturbed areas present? If YES, identify their limits for they should be evaluated separately for wetland determination purposes (usually after evaluating undisturbed areas). Refer to the section on disturbed areas (p. 87), if necessary, to evaluate the altered characteristic(s) (vegetation, soils, or hydrology); then return to this method and continue evaluating characteristics not altered. (Note: Prior experience with disturbed sites may allow one to easily evaluate an altered characteristic, such as when vegetation is not present in a farmed wetland due to cultivation.) Keep in mind that if at any time during this determination, one or more of these three characteristics is found to have been significantly altered, the disturbed area wetland determination procedures should be followed. If the area is not significantly disturbed, proceed to Step 3.

Step 3. Scan the areas that may meet the hydric soil

criterion and determine if obvious signs of wetland hydrology are present. The wetland hydrology criterion is met for any area or portion thereof where it is obvious or known that the area is frequently inundated or saturated to the surface observed during the growing season. If the above condition exists, the hydric soil criterion is met for the subject area and the area is considered wetland. If necessary, confirm the presence of hydric soil by examining the soil for appropriate field indicators. (NOTE: Hydrophytic vegetation is assumed to be present under these conditions, i.e., undrained hydric soil, so vegetation does not need to be examined. Moreover, hydrophytic vegetation should be obvious in these situations.) Areas lacking obvious indicators of wetland hydrology must be further examined, so proceed to Step 4.

Step 4. Refine the boundary of areas that meet the hydric soil criterion. (Note: Some hydric soils, especially organic soils, have not been given a series name and are referred to by common names, such as peat, muck, swamp, marsh, wet alluvial land, tidal marsh, sulfaquents, and sulfihemists. These areas are also considered hydric soil map units. Certain hydric soils are mapped with nonhydric soils as an association or complex, while other hydric soils occur as inclusions in nonhydric map units. Only the hydric soil portion of these map units should be evaluated for hydrophytic vegetation in Step 7.) Verify the presence of hydric soil within the appropriate map units by digging a number of holes at least 18 inches deep along the boundary (interface) between hydric soil units and nonhydric soil units. Compare soil samples with descriptions in the soil survey report to see if they are properly mapped and look for hydric soil characteristics or indicators. In this way, the boundary of areas meeting the hydric soil criterion is further refined by field observations. In map units where only part of the unit is hydric (e.g., complexes, associations, and inclusion), locate hydric soil areas on the ground by considering landscape position and evaluating soil characteristics for hydric soil properties (indica-

tors). If the area meets the hydric soil criterion, proceed to Step 5. (Note: These areas are also considered to have met the wetland hydrology criterion.)

Step 5. Determine whether normal environmental conditions are present. Determine whether normal environmental conditions are present by considering the following:

1) Is the area presently lacking hydrophytic vegetation or hydrologic indicators due to annual, seasonal or long term fluctuations in precipitation, surface water, or groundwater levels?
2) Are hydrophytic vegetation indicators lacking due to seasonal fluctuation in temperature (e.g., seasonality of plant growth)?

If the answer to either of these questions is YES or uncertain, proceed to the section on problem area wetland determinations (p. 99). If the answer to both questions is NO, normal conditions are assumed to be present, so proceed to Step 6.

Step 6. Select representative observation area(s). Identify one or more observation areas that represent the area(s) meeting the hydric soil criterion. A representative observation area is one in which the apparent characteristics (determined visually) best represent characteristics of the entire community. Mark the approximate location of the observation area(s) on the aerial photo. Proceed to Step 7.

Step 7. Characterize the plant community within the area(s) meeting the hydric soil criterion. Visually estimate the percent areal cover of dominant species for the entire plant community. (Note:. Dominant species are the most abundant species in each stratum, see p.14). If dominant species are not obvious, use one of the other onsite methods. Proceed to Step 8 or to another method, as appropriate.

Step 8. Record the indicator status of dominant species within each area meeting the hydric soil criterion. Indicator status is obtained from the interagency Federal

list of plants occurring in wetlands for the appropriate geographic region. Record information on an appropriate data form. Proceed to Step 9.

Step 9. Determine whether wetland is present or additional analysis is required. If the estimated percent areal cover of OBL and FACW species exceeds that of FACU and UPL species, the area is considered wetland and the wetland-nonwetland boundary is the line delineated in step 3. If not, then the point intercept or other sampling procedures should be performed to do a more rigorous analysis of site characteristics.

4.11 Plant Community Assessment Procedure

Step 1. Scan the entire project area, if possible, or walk, if necessary, and identify plant community types present. In identifying communities, pay particular attention to changes in elevation throughout the site. (CAUTION: In highly variable sites, such as ridge and swale complexes, be sure to stratify properly). If possible, sketch the approximate location of each plant community on a base map, an aerial photo of the project area, or a county soil survey map and label each community with an appropriate name. (Note: For large, homogeneous wetlands, especially marshes dominated by herbaceous plants and shrub bogs dominated by low-growing shrubs, it is usually not necessary to walk the entire project area. In these cases, one can often see for long distances and many have organic mucky soils that can be extremely difficult to walk on. Forested areas, however, will usually require a walk through the entire project area.

In examining the project area, are any significantly disturbed areas observed? If YES, identify their limits for they should be evaluated separately for wetland determination purpose (usually after evaluating undisturbed areas). Refer to the section on disturbed areas (p. 87) to evaluate the altered characteristic(s) (i.e., vegetation, soils, or hydrology); then return to this method to continue evaluating characteristics not altered. Keep in mind that if at any time during this determination one or more of these three characteristics is found to have been significantly altered, the disturbed area wetland delineation

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procedures should be followed. If the area is not significantly disturbed, proceed to Step 2.

Step 2. Determine whether normal environmental conditions are present. Determine whether normal environmental conditions are present for each plant community by considering the following:

1) Is the area presently lacking hydrophytic vegetation or hydrologic indicators due to annual, seasonal or longterm fluctuations in precipitation, surface water, or groundwater levels?
2) Are hydrophytic vegetation indicators lacking due to seasonal fluctuations in temperature (e.g., seasonality of plant growth)?

If the answer to either of these questions is YES or uncertain, proceed to the section on problem area wetland determination section (p. 99). If the answer to both questions is NO, normal conditions are assumed to be present, so proceed to Step 3.

Step 3. Select representative observation area(s). Select one or more representative observation areas within each community type. A representative observation area is one in which the apparent characteristics (determined visually) best represent characteristics of the entire community. Mark the approximate location of the observation areas on the base map or photo. Proceed to Step 4.

Step 4. Characterize each plant community in the project area. Within each plant community identified in Step 1, visually estimate the dominant plant species for each vegetative stratum in the representative observation areas and record them on an appropriate data form. Vegetative strata may include tree, sapling, shrub, herb, woody vine, and bryophyte strata (see glossary for definitions). A separate form must be completed for each plant community identified for wetland determination purposes. (Note: Dominant species are those species in each stratum that, when ranked in decreasing order of abundance and cumulatively totaled, immediately exceed 50 percent of the total dominance measure for that stratum, plus any additional plant species

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comprising 20 percent or more of the total dominance measure for the stratum.) After identifying dominants within each vegetative stratum, proceed to Step 5.

Step 5. Record the indicator status of dominant species in all strata. Indicator status is obtained from the interagency Federal list of plants occurring in wetlands for the appropriate geographic region. Record indicator status for all dominant plant species on a data form. Proceed to Step 6.

Step 6. Determine whether the hydrophytic vegetation criterion is met. When more than 50 percent of the dominant species in each community type have an indicator status of OBL, FACW, and/or FAC, the vegetation is hydrophytic. Complete the vegetation section of the data form. Portions of the project area failing this test are usually not wetlands, although under certain circumstances they may have hydrophytic vegetation (follow the problem area wetland determination procedures on p. 99). If hydrophytic vegetation is present, proceed to Step 7.

Step 7. Determine whether soils must be examined. Examine vegetative data collected for each plant community (in Steps 5 and 6) and identify any plant community where: (1) all dominant species have an indicator status of OBL, or (2) all dominant species have an indicator status of OBL and FACW and the wetland boundary is abrupt. For these communities, hydric soils are assumed to be present and do not need to be examined; proceed to Step 9. Plant communities lacking the above characteristics must have soils examined; proceed to Step 8.

Step 8. Determine whether the hydric soil criterion is met. Locate the observation area on a county soil survey map, if possible, and determine the soil map unit delineation for the area. Using a soil auger, probe, or spade, make a hole at least 18 inches deep at the representative location in each plant community type. Examine soil characteristics and compare if possible to soil descriptions in the county soil survey report. If soil colors match those described for hydric soil, then record data and proceed to Step 10. If not, then check for hydric soil indicators be-

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low the A-horizon (surface layer) and within 18 inches for organic soils and for mineral soils with low permeability rates (<6.0 inches/hour), within 12 inches for coarse-textured (sandy) mineral soils with high permeability rates (>6.0 inches/hour), and within 6 inches for somewhat poorly drained soils. Are hydric soil indicators present (see p. 23)? If so, list indicators present on an appropriate data form and proceed to Step 9. If soil has been plowed or otherwise altered, which may have eliminated these indicators, proceed to the section on disturbed areas (p. 87). If field indicators are not present, but available information verifies that the hydric soil criterion is met, then the soil is hydric. Complete the soils section on the appropriate data sheet. (CAUTION: Become familiar with problematic hydric soils that do not possess good hydric field indicators, such as red parent material soils, some sandy soils, and some floodplain soils, so that these hydric soils are not misidentified as nonhydric soils; see the problem area wetlands discussion on pp. 99-109).

Step 9. Determine whether the wetland hydrology criterion is met. Examine the area of each plant community type for indicators of wetland hydrology (see p. 30). The wetland hydrology criterion is met when:

1) One or more field indicators are present; or
2) Available hydrologic records provide sufficient evidence; or
3) The plant community is dominated by OBL, FACW and/or FAC species or has a prevalence index of less than 3.0, and the area has not been hydrologically disturbed.

If the area is hydrologically disturbed, proceed to the section on disturbed areas (p. 93). Record observations and other evidence on the appropriate data form. Proceed to Step 10.

Step 10. Make the wetland determination. Examine data forms for each plant community identified in the project area. Each community meeting the hydrophytic vegetation, hydric soil, and wetland hydrology criteria is considered wetland. If all communities meet these three criteria,

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then the entire project area is a wetland. If only a portion of the project area is wetland, then the wetland-nonwetland boundary must be established. Proceed to Step 11.

Step 11. Determine the wetland-nonwetland boundary. Where a base map or annotated photo was prepared, mark each plant community type on the map or photo with a "W" if wetland or an "N" if nonwetland. Combine all "W" types into a single mapping unit, if possible, and all "N" types into another mapping unit. On the map or photo, the wetland boundary will be represented by the interface of these mapping units. If flagging the boundary on the ground, the boundary is established by determining the location where hydrophytic vegetation and hydric soils give way to nonhydrophytic vegetation and nonhydric soils. This will often require sampling a few more holes to better define the limits of the hydric soils and thereby establishing the limits of hydrophytic vegetation.

Intermediate-Level Onsite Determination Method

4.12 On occasion, a more rigorous sampling of vegetation is required than the routine method to determine whether hydrophytic vegetation is present at a given site, especially where the boundary between wetland and nonwetland is gradual or indistinct. This circumstance requires more intensive sampling of vegetation and soils than presented in the routine determination method. This method also may be used for areas greater then five acres in size or other areas that are highly diverse in vegetation.

4.13 The intermediate-level onsite determination method has been developed to provide for more intensive vegetation sampling than the routine method. Two optional approaches are presented: (1) quadrat transect sampling procedure, and (2) vegetation unit sampling procedure. The former procedure involves establishing transects within the project area and sampling plant communities along the transect within

sample quadrants, with soils and hydrology also assessed as needed in each sample plot. In contrast, the vegetation unit sampling procedure offers a different approach for analyzing the vegetation. First, vegetation units are designated in the project area and then a meander survey is conducted in each unit where visual estimates of percent areal coverage by plant species are made. Soil and hydrology observations also are made as necessary. Boundaries between wetland and nonwetland are established by examining the transitional gradient between them.

4.14 The following steps should be completed:

Step 1. Locate the limits of the project area in the field and conduct a general reconnaissance of the area. Previously the project boundary should have been determined on aerial photos or maps. Now appropriate ground reference points need to be located to insure that sampling will be conducted in the proper area. In examining the project area, were any significantly disturbed areas observed? If YES, identify their limits for they should be evaluated separately for wetland determination purposes (usually after evaluating undisturbed areas). Refer to the section on disturbed areas (p. 87) to evaluate the altered characteristic(s) (i.e. vegetation, soils, or hydrology); then return to this method to continue evaluating the characteristics not altered. Keep in mind that if at any time during this determination, one or more of these three characteristics is found to have been significantly altered, the disturbed areas procedures should be followed. If the area is not significantly disturbed, proceed with Step 2.

Step 2. Decide how to analyze plant communities within the project area: (1) by selecting representative plant communities (vegetation units) or (2) by sampling along a transect. Discrete vegetation units may be identified on aerial photographs, topographic and other maps, and/or by field inspection. These units will be evaluated for hydrophytic vegetation and also for hydric soils and wetland hydrology, as necessary. If the vegetation unit approach is selected, proceed to Step 3. An alternative approach is to establish transects for identifying plant communities, sampling vegetation and evaluating other criteria, as appro-