WETLAND MITIGATION SITE MONITORING REPORT
FAP 322 (US 51) Jackson County

Introduction

This report details monitoring of the wetland mitigation site created to compensate for impacts associated with FAP 322 (US 51) in Jackson County. The site consists of approximately 2.4 ha (6.0 ac) of wetland creation. The wetland creation site is located south of DeSoto, IL, northwest of the intersection of US 51 and Big Muddy River. The legal location is SW/4, SW/4, SW/4, Section 33, T. 8 S., R. 1 W. The project area lies within the United States Geological Survey Mississippi River hydrologic unit 07140106, Big Muddy River. No historical information was provided despite repeated requests, but the site was probably completed and trees planted sometime between spring 2000 and spring 2002. On-site monitoring was conducted on September 11, 2003.

This report discusses the goals, objectives, and performance criteria for the mitigation project, the methods used for monitoring the site, monitoring results, and discussion and recommendations based on the results. Methods and results are discussed by performance criteria for each goal.

Goals, Objectives, and Performance Standards

Goals, objectives, and performance standards follow those specified in the monitoring plan (J. Klamm, IDOT District 9 Environmental Coordinator, 2002) developed for this site. Performance criteria are based on those specified in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987), *Illinois Wetland Restoration and Creation Guide* (Admiraal et al., 1997), and in *Guidelines for Developing Mitigation Proposals* (USACE 1993). Each goal should be attained by the end of the 5-year monitoring period. Goals, objectives, and performance criteria are listed below.

Project goal 1: The created wetland community should be a jurisdictional wetland as defined by current federal standards.

Objective: The created wetland should compensate for the loss of 2.4 ha (6.0 ac) of scrub-shrub wetland at a 1:1 ratio.

Performance criteria:

a. Predominance of hydrophytic vegetation: More than 50% of the dominant plant species must be hydrophytic.
b. Presence of wetland hydrology: The area must be either permanently or periodically inundated at average depths less than 2 m (6.6 ft) or have soils that are saturated to the surface for at least 12.5% of the growing season.
c. Occurrence of hydric soils: Hydric soil characteristics should be present, or conditions favorable for hydric soil formation should persist at the site.

Project goal 2: The created wetland plant community should meet standards for planted species survival and floristic composition.

Objectives: Planting seedling trees and a wetland grass mixture will create a wet meadow/forested wetland. Other herbaceous vegetation will be allowed to colonize the site naturally.

Performance criteria:

a. Planted species survivorship: At least 80% of the planted trees and shrubs should be established and living.
b. Native species composition: At least 70% of the plant species present should be non-weedy, native, perennial and annual species.
c. Dominance of vegetation: None of the dominant plant species may be non-native or weedy species.

Methods

Project goal 1

a. Predominance of hydrophytic vegetation

The method for determining dominant vegetation at a wetland site is described in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) and further explained in the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (Federal Interagency Committee for Wetland Delineation 1989). It is based on aerial coverage estimates for individual plant species. Each of the dominant plant species is then assigned its wetland indicator status rating (Reed 1988). Any plant rated facultative or wetter, *i.e.*, FAC, FAC+, FACW, and OBL, is considered a hydrophyte. A predominance of wetland vegetation in the plant community exists if more than 50% of the dominant species present are hydrophytic. Since the survival of planted hydrophytic trees and shrubs on non-wetlands (i.e. yards) is well documented, these species were excluded from calculations of percentage of dominant hydrophytic species.

b. Presence of wetland hydrology

Illinois State Geological Survey (ISGS) personnel installed eight soil-zone monitoring wells, a stage gauge, and an RDS data logger at the site in the autumn of 2002 (Fucciolo, et al., 2003). Locations for these sites can be found in the ISGS annual report for 2003 (Fucciolo, et al., 2003). Water-level data was collected beginning in October, 2002.

c. Occurrence of hydric soils

The soil was sampled in order to monitor hydric soil development. Soil profile morphology including horizon color, texture, and structure was described at various points throughout the site. Additionally, the presence, type, size, and abundance of redoximorphic features were noted. Hydric soils may develop slowly, and characteristics may not be apparent during the first several years after project construction. In the absence of hydric soil indicators at the end of the five-year monitoring period, hydrologic data could be used as corroborative evidence that conditions favorable for hydric soil formation persist at the site.

Project goal 2

a. Planted species survivorship

In order to create floodplain forest, tree saplings were planted at the compensation site. According to the program development memorandum for this project (Karl Bartelsmeyer, IDOT District Engineer, memo to Steve Hamer, April 5, 2000), the following number of trees were to be planted at the site:

Table 1. Tree species planted in the created wetland (Planting date unknown).

Species	Common Name	Number
Betula nigra	River birch	1000
Fraxinus pennsylvanica	Green ash	1000
Liquidambar styraciflua	Sweetgum	1000
Platanus occidentalis	Sycamore	1000
Quercus bicolor	Swamp white oak	1000
Quercus palustris	Pin oak	1000
TOTAL		6000

Survivorship and density of planted trees was determined through a census of the created wetland. All live trees and shrubs were counted. Dead or cut-off trees were not counted due to the excessive numbers and the difficulty of identification by species.

Tree survival was calculated as a percentage of the number of stems reported to have been planted: 100 x (Total number of live planted stems counted/total number of planted stems reported).

b. Native Species Composition

A complete list of plant species present was compiled. This was used to determine the number and percentage of species present that are non-weedy, native, perennials and annuals.

In addition, the Floristic Quality Assessment (Taft et al. 1997) was applied to the plant community at the site to evaluate floristic quality and nativity. The assessment methodology is used to identify natural areas and facilitate floristic comparisons among sites. This technique is part of the procedure for the long-term monitoring of natural areas and the monitoring of restored or created wetlands (Swink and Wilhelm 1994). The basis of the method is that each native plant species is assigned a conservatism coefficient (C) ranging from 0 to 10. Individual conservatism coefficients are ranks of species behavior and reflect the committee's (Taft et al. 1997) confidence level for a taxon's correspondence to anthropogenic disturbances. Coefficient values range from 0 to 10, with all adventive species given a coefficient of 0. Plant species assigned 0 have low affinities for natural areas, whereas those assigned 10 have very high affinities. When a complete species list is assembled for a wetland site, the overall average conservatism coefficient ($\bar{c}$) and a site floristic quality index (FQI) can be calculated. These values provide a measure of site floristic quality. Floristic quality index (FQI) values less than 5 indicate that the area is extremely weedy or in an early successional stage (Swink and Wilhelm 1994). FQI values between 20 and 35 ($\bar{c}$ = 3.0) indicate that the area has evidence of native character and can be considered a botanical asset. FQI values between 35 and 50 ($\bar{c}$ = 3.5) indicate that the area has significant native character.

c. Dominance of vegetation

Plant species dominance was determined as in project goal 1, a. Predominance of hydrophytic vegetation. The method for determining dominant vegetation at a wetland site is described in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) and further explained in the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (Federal Interagency Committee for Wetland Delineation, 1989).

In addition, four permanent photography stations were established so that photographs could be used to document changes in plant community structure and composition. The photo stations were located essentially in the four corners of the site and will be indicated on aerial photograph when received.

Results

Project goal 1

a. Predominance of hydrophytic vegetation

Dominant plant species for the mitigation site in 2003 are shown in Table 2. All of the dominant species are rated OBL, FACW, FAC+, or FAC and are hydrophytic.

Table 2. Dominant plant species by stratum and wetland indicator status.

Dominant Plant Species	Stratum	Indicator Status
Echinochloa muricata	Herb	OBL
Iva annua	Herb	FAC
Panicum dichotomiflorum	Herb	FACW-
Campsis radicans	Shrub	FAC

b. Presence of wetland hydrology

The ISGS estimates that "the total area of created wetland that conclusively satisfied wetland hydrology criteria in 2003 is 5.4 ac (2.2 ha)" (Fig. 1, next page)(Fucciolo, et al 2003). More information is available in the *US 51, Jackson County, DeSoto Wetland Compensation Site* report (Fucciolo, et al 2003).

Based on field evidence observed during an on-site visit, this site exhibits wetland drainage patterns, water stained leaves, algal mats, and oxidized root channels, and therefore possesses wetland hydrology.

c. Occurrence of hydric soils

Soils examined at the site were found to be only moderately disturbed. Excavation has been done and the sites lack an undisturbed A horizon. The existing soil at much of the site is a combination of the former A and E horizons. Topsoil was not replaced after excavation.

Even though the soils are disturbed, hydric soil indicators are present. Table 3 on the next page presents a soil description of a typical pedon located within this site:

Figure 1.

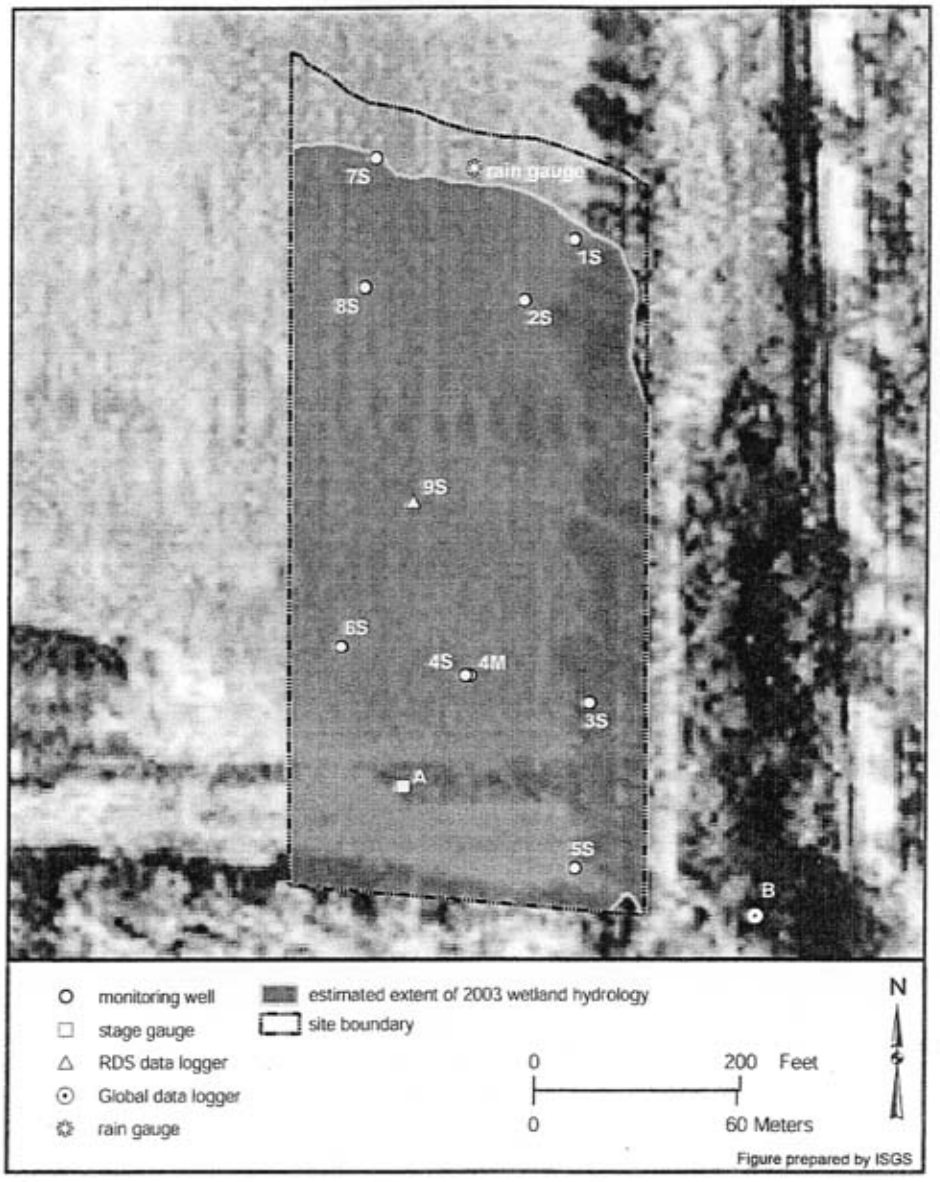

Table 3. Description of the soils at the site.

Depth	Matrix Color	Concentrations	Depletions	Texture	Structure
0-15 cm (0-6 in)	10YR 4/2	7.5YR 5/6	None	Silt loam	Medium granular
15-38 cm (6-15 in)	10YR 5/2	7.5YR 5/6 and 10YR 5/6	None	Silt loam	Medium granular and weak platy
38-66+ cm (15-26+ in)	10YR 5/2	7.5YR 5/6 and 10YR 5/6	None	Silt loam	Weak granular and weak platy

The majority of this site satisfies the wetland criteria; therefore, we believe this site is a wetland. Current wetland acreage at this site is estimated to be 5.4 ac (2.2 ha), corresponding to that area determined by the ISGS to possess wetland hydrology. This estimate will be refined in future years.

Project goal 2

a. Planted species survivorship

Table 4 shows the results of the census. There were serious discrepancies between the numbers of trees reported as planted and the number of live trees counted. Table 4 also shows the percent survival for the trees . These figures were calculated both by species and overall for all species in the entire site. Fewer than 20% of the trees reported planted were counted. While these numbers are up from last year, these data show that this site cannot meet the criteria for planted species survivorship without remedial action being taken. However, natural regeneration of a fairly diverse assemblage of tree species is abundant within the project area.

Table 4. Number of trees counted and percent tree survival (by species).

Species	Common Name	Number live	% of reported
Betula nigra	River birch	29	2.9
Carya illinoensis	Pecan	1	NA
Fraxinus pennsylvanica	Green ash	482	48.2
Liquidambar styraciflua	Sweetgum	36	3.6
Platinus occidentalis	Sycamore	417	41.7
Quercus bicolor	Swamp white oak	14	1.4
Quercus lyrata	Overcup oak	14	NA
Quercus palustris	Pin oak	200	20.0
TOTAL		1193	19.9

b. Native species composition

This site has only 58% non-weedy, native, annual and perennial species. Therefore, it does not meet the requirement for native species composition (70%). It is normal, however, for a site to begin very weedy and develop more native character over time, and this site is already close to the project goals for native species composition.

Two FQI values were calculated for this site from the species lists included in Appendix A. The first FQI value is calculated from only species which became established on the site naturally; the second FQI value includes the planted trees. The FQI value is 20.7 with a $\bar{c}$ value of 2.5 when only naturally established vegetation is considered, and 24.1 and 2.8 respectively when the planted trees are included. Therefore this site is of good natural quality.

c. Dominance of vegetation

This site does not meet the performance criteria for dominance of vegetation. All of the dominant species (Table 2) are native; however, three of the four dominant species are considered weedy. *Echinochloa muricata*, *Iva annua*, and *Panicum dichotomiflorum* are weedy or undesirable, while *Campsis radicans* is not.

Photography stations were established in each corner of the site, with number 1 in the southeast, number 2 in the southwest, number 3 in the northeast, and number 4 in the southwest corner. Photographs were taken from the permanent photography stations established this year and are in Appendix B of this report.

Discussion

After two monitoring seasons, this site shows progress towards wet meadow/forested wetland establishment. As the vegetative succession proceeds, this site will most likely comply with project goals, objectives, and performance standards by the end of the monitoring period.

The vegetation is hydrophytic and nearly meets the dominance criteria for native non-weedy species. The planted tree seedlings experienced excessive mortality and the site will need to be replanted in order to meet the planted species performance criteria. There are a large number of species at each site that have very low coefficients of conservatism (C). This is common on disturbed and early successional sites and is not a cause for concern at this time. It is likely that as succession progresses, more conservative species will become established on the site; this can be seen in the steady increase of FQI values over the monitoring period (Table 5).

Table 5.

	Without planted species		With planted species	
Year	FQI	$\bar{c}$	FQI	$\bar{c}$
2002	15.3	2.1	16.5	2.2
2003	20.7	2.5	22.9	2.7

Currently, the primary concern for this site is establishing adequate tree density. This site already has hydric soil characteristics, hydrophytic vegetation, and wetland hydrology. An estimate of current wetland acreage is 5.4 ac (2.2 ha), corresponding to that area determined by the ISGS to possess wetland hydrology.

Literature Cited

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Appendix A

Wetland Determination Forms

ROUTINE ONSITE WETLAND DETERMINATION

Field Investigators: Wiesbrook, Busemeyer, Plocher, and Larimore
Date: September 11, 2003 **Project Name:** FAP 322 (US 51)
Section No.: 2B-3 **State:** Illinois **County:** Jackson **Applicant:** IDOT Dist. 9
Area Name: Wet meadow
Legal Description: SW/4, SW/4, SW/4, Section 33, T. 8 S., R. 1 W
Location: This wetland occupies nearly the entire mitigation monitoring site.

Do normal environmental conditions exist at this area? Yes: X No:
Has the vegetation, soils, or hydrology been significantly disturbed? Yes: No: X

VEGETATION

Dominant Plant Species	Stratum	Indicator Status
1. *Campsis radicans*	Shrub	FAC
2. *Echinochloa muricata*	Herb	OBL
3. *Iva annua*	Herb	FAC
4. *Panicum dichotomiflorum*	Herb	FACW-

Percentage of dominant species that are OBL, FACW, FAC+, or FAC: 100%
Hydrophytic vegetation: Yes: X No:
Rationale: More than 50% of the dominants are OBL, FACW, FAC+, or FAC.

SOILS

Series and phase: Racoon silt loam (Typic Endoaqualf)

On Jackson County hydric soils list?	Yes: X	No:	
Is the soil a histosol?	Yes:	No: X	
Histic epipedon present?	Yes:	No: X	
Redox Concentrations?	Yes: X	No:	Color: 7.5YR 5/6 and 10YR 5/6
Redox Depletions?	Yes:	No: X	Color: N/A

Matrix color: 10YR 4/2 and 5/2 over 5/2 and 6/2
Other indicators: None.
Hydric soils? Yes: X No:
Rationale: This soil possesses redox concentrations within a low chroma matrix, which indicates saturated or reduced conditions for extended duration. Therefore, the soil at this area meets the hydric soil criterion. This soil meets NRCS hydric soil indicator F3 – Depleted matrix.

ROUTINE ONSITE WETLAND DETERMINATION

Field Investigators: Wiesbrook, Busemeyer, Plocher, and Larimore
Date: September 11, 2003 **Project Name:** FAP 322 (US 51)
Section No.: 2B-3 **State:** Illinois **County:** Jackson **Applicant:** IDOT Dist. 9
Area Name: Wet meadow
Legal Description: SW/4, SW/4, SW/4, Section 33, T. 8 S., R. 1 W
Location: This wetland occupies nearly the entire mitigation monitoring site.

HYDROLOGY

Inundated: Yes: No: X Depth of standing water: N/A
Depth to saturated soil: >0.66 m (26 in)
Overview of hydrological flow through the system: This area is hydrologically influenced by overflow from the Big Muddy River, sheet flow from surrounding uplands, and precipitation. Water leaves the area via evapotranspiration, groundwater recharge, and some surface drainage to the east.
Size of watershed: <1.3 km^2 (0.5 mi^2) for the surrounding area; 277 km^2 (107 mi^2) for the Big Muddy River at Murphysboro
Other field evidence observed: ISGS estimated 5.4 ac (2.2 ha) of this area met the wetland hydrology criteria (Fucciolo et al., 2003). We observed water-stained leaves, algal surface, an abundance of aquatic snail shells, and wetland drainage patterns.

Wetland hydrology: Yes: X No:
Rationale: Field evidence cited above and ISGS data indicate that this area is inundated or saturated for a sufficient duration to satisfy the wetland hydrology criterion.

DETERMINATION AND RATIONALE:

Is the area a wetland? Yes: X No:
Rationale: Dominant hydrophytic vegetation, hydric soils, and wetland hydrology are all present at this area; therefore, we determined that this area is a wetland.

ROUTINE ONSITE WETLAND DETERMINATION

Field Investigators: Wiesbrook, Busemeyer, Plocher, and Larimore
Date: September 11, 2003 **Project Name:** FAP 322 (US 51)
Section No.: 2B-3 **State:** Illinois **County:** Jackson **Applicant:** IDOT Dist. 9
Area Name: Wet meadow
Legal Description: SW/4, SW/4, SW/4, Section 33, T. 8 S., R. 1 W
Location: This wetland occupies nearly the entire mitigation monitoring site.

SPECIES LIST

Scientific name	Common name	Stratum	Wetland indicator status	Coefficient of conservatism
+*Acalypha ostryaefolia*	three-seeded mercury	herb	UPL	1
+*Acalypha rhomboidea*	three-seeded mercury	herb	FACU	0
+*Acer negundo*	box elder	shrub	FACW-	1
Acer rubrum	red maple	tree	FAC	5
+*Agrostis alba*	red top	herb	FACW	0
Alisma plantago-aquatica	broad-leaf water-plantain	herb	OBL	2
+*Amaranthus tuberculatus*	tall waterhemp	herb	OBL	1
+*Ambrosia artemisiifolia*	common ragweed	herb	FACU	0
+*Ambrosia trifida*	giant ragweed	herb	FAC+	0
Ammannia coccinea	long-leaved ammannia	herb	OBL	5
Apocynum cannabinum	dogbane	herb	FAC	2
Aster ontarionis	Ontario aster	herb	FAC	4
+*Aster pilosus*	hairy aster	herb	FACU+	0
Aster simplex	panicled aster	herb	FACW	3
+*Bidens aristosa*	swamp marigold	herb	FACW	1
Bidens connata	beggar-ticks	herb	OBL	2
+*Bidens frondosa*	common beggar-ticks	herb	FACW	1
Betula nigra	river birch	shrub (p)	-	-
Boehmeria cylindrica	false nettle	herb	OBL	3
Boltonia asteroides	false aster	herb	FACW	5
Boltonia diffusa	false aster	herb	FACW	4
Campsis radicans	trumpet creeper	shrub	FAC	2
Carex grayi	bur sedge	herb	FACW+	6
Carex normalis	sedge	herb	FACW	4
Carex squarrosa	sedge	herb	OBL	5
Carex typhina	sedge	herb	OBL	6
Carya illinoensis	pecan	shrub (p)	-	-
Cephalanthus occidentalis	buttonbush	shrub	OBL	4
+*Chamaesyce humistrata*	milk spurge	herb	FACW	1
Chasmanthium latifolium	sea oats	herb	FACW	4
+*Conyza canadensis*	horseweed	herb	FAC-	0
Cyperus acuminatus	taperleaf flat sedge	herb	OBL	2
+*Cyperus strigosus*	long scaled nut sedge	herb	FACW	0
Cyperus pseudovegetus	nut sedge	herb	FACW	5
+*Echinochloa muricata*	barnyard grass	herb	OBL	0
Eclipta prostrata	yerba de tajo	herb	FACW	2

Species list continued on next page.

ROUTINE ONSITE WETLAND DETERMINATION

Site 1 (page 4 of 5)

Field Investigators: Wiesbrook, Busemeyer, Plocher, and Larimore
Date: September 11, 2003 **Project Name:** FAP 322 (US 51)
Section No.: 2B-3 **State:** Illinois **County:** Jackson **Applicant:** IDOT Dist. 9
Area Name: Wet meadow
Legal Description: SW/4, SW/4, SW/4, Section 33, T. 8 S., R. 1 W
Location: This wetland occupies nearly the entire mitigation monitoring site.

SPECIES LIST (cont.)

Scientific name	Common name	Stratum	Wetland indicator status	Coefficient of conservatism
Eleocharis obtusa	blunt spike rush	herb	OBL	2
Elymus virginicus	Virginia wild rye	herb	FACW-	4
Eupatorium coelestinum	blue boneset	herb	FAC+	3
+*Eupatorium serotinum*	late boneset	herb	FAC+	1
Fraxinus pennsylvanica	green ash	shrub (pn)	FACW	2
Hypericum sp.	St. John's-wort	herb	-	-
+*Ipomoea hederacea*	ivy-leaved morning glory	herb	FAC	*
+*Ipomoea lacunosa*	small white morning-glory	herb	FACW	1
+*Iva annua*	marsh elder	herb	FAC	0
Leersia oryzoides	rice cutgrass	herb	OBL	3
+*Lespedeza cuneata*	sericea lespedeza	herb	NI	*
Lindernia dubia	false pimpernel	herb	OBL	5
Liquidambar styraciflua	sweet gum	shrub (pn)	FACW	6
Lobelia siphilitica	blue cardinal-flower	herb	FACW+	4
Ludwigia peploides glabrescens	creeping primrose willow	herb	OBL	5
Lycopus virginicus	bugle weed	herb	OBL	5
Mimulus alatus	winged monkey flower	herb	OBL	6
+*Mollugo verticillata*	carpetweed	herb	FAC	*
+*Morus alba*	white mulberry	herb	FAC	*
+*Oxalis dillenii*	yellow wood sorrel	herb	FACU	0
+*Panicum dichotomiflorum*	fall panicum	herb	FACW-	0
Panicum virgatum	prairie switchgrass	herb	FAC+	4
Penthorum sedoides	ditch stonecrop	herb	OBL	2
+*Phyla lanceolata*	fog-fruit	herb	OBL	1
Platanus occidentalis	sycamore	shrub(pn)	FACW	3
Polygonum hydropiperoides	mild water pepper	herb	OBL	4
+*Polygonum lapathifolium*	pale smartweed	herb	FACW+	0
+*Polygonum pensylvanicum*	giant smartweed	herb	FACW+	1
Quercus bicolor	swamp white oak	shrub (p)	-	-
Quercus lyrata	overcup oak	shrub (p)	-	-
Quercus palustris	pin oak	shrub (pn)	FACW	4
Rotala ramosior	tooth-cup	herb	OBL	4
+*Rumex crispus*	curly dock	herb	FAC+	*
+*Setaria faberi*	giant foxtail	herb	FACU+	*
+*Setaria glauca*	pigeon grass	herb	FAC	*
+*Solanum carolinense*	horse-nettle	herb	FACU-	0

Species list continued on next page.

ROUTINE ONSITE WETLAND DETERMINATION

Site 1 (page 5 of 5)

Field Investigators: Wiesbrook, Busemeyer, Plocher, and Larimore
Date: September 11, 2003 **Project Name:** FAP 322 (US 51)
Section No.: 2B-3 **State:** Illinois **County:** Jackson **Applicant:** IDOT Dist. 9
Area Name: Wet meadow
Legal Description: SW/4, SW/4, SW/4, Section 33, T. 8 S., R. 1 W
Location: This wetland occupies nearly the entire mitigation monitoring site.

SPECIES LIST (cont.)

Scientific name	Common name	Stratum	Wetland indicator status	Coefficient of conservatism
Spermacoce glabra	smooth buttonweed	herb	FACW+	4
+*Toxicodendron radicans*	poison ivy	shrub	FAC+	1
Tradescantia ohiensis	spiderwort	herb	FACU+	3
Ulmus americana	American elm	shrub	FACW-	5
Vitis cinerea	winter grape	vine	FACW-	4
+*Xanthium strumarium*	cockle bur	herb	FAC	0

† Coefficient of Conservatism (Taft et al. 1997) + weedy native or non-native species, (p) planted species, (pn) both planted and naturally occurring species, *non-native species

$FQI = \Sigma C/\sqrt{N} = 168/\sqrt{66} = 20.7$ $\bar{c} = \Sigma C/N = 168/66 = 2.5$

Planted Shrubs (that are not also naturally occurring)

SPECIES LIST

Scientific name	Common name	Stratum	Wetland indicator status	Coefficient of conservatism
Betula nigra	river birch	shrub	FACW	4
Carya illinoensis	pecan	shrub	FACW	6
Quercus bicolor	swamp white oak	shrub	FACW+	7
Quercus lyrata	overcup oak	shrub	OBL	7

$*FQI = \Sigma C/\sqrt{N} = 192/\sqrt{70} = 22.9$ $*\bar{c} = \Sigma C/N = 192/70 = 2.7$

*These calculations include the complete species list above, as well as the planted trees.

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Appendix B

Photographs of Wetland Mitigation Sites

Picture 1A. Facing north from photostation 1.

Picture 1B. Facing northwest from photostation 1.

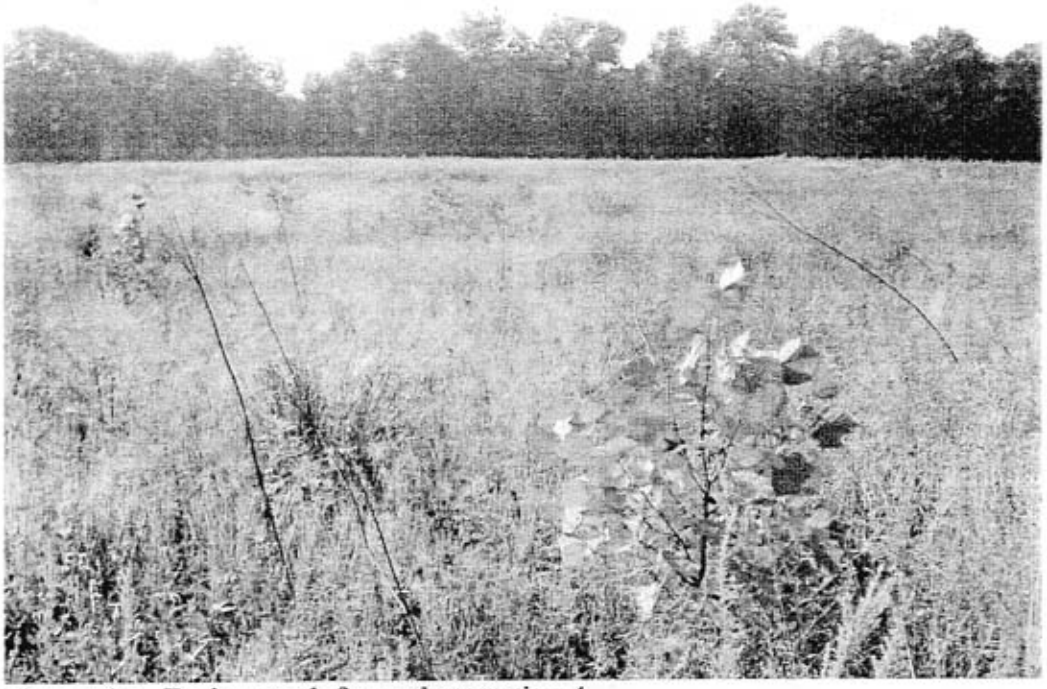
Picture 1C. Facing west from photostation 1.

Picture 2A. Facing northeast from photostation 2.

Picture 3A. Facing southwest from photostation 3.

Picture 4A. Facing east from photostation 4.

Picture 4B. Facing southeast from photostation 4.



Picture 4C. Facing south from photostation 4.