MITIGATION BANKING INSTRUMENT
LAWRENCE WETLAND MITIGATION BANK

Illinois Department of Transportation
Bureau of Design and Environment
2300 S. Dirksen Parkway
Springfield, IL 62764-0002

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TABLE OF CONTENTS

I. Introduction 1
- A. Bank Goals and Objectives 1
- B. Ownership, Establishment and Operation 1
- C. Service Area and Impacts Suitable for Compensation 3

II. Baseline Conditions 5
- A. Existing Habitat 5
- B. Threatened and Endangered Species 7
- C. Site Soils and Geomorphology 9
- D. Site Hydrology and Hydrologic Alterations 9
- E. Water Rights 11
- F. Cultural Resources 11

III. Site Development Plan 11
- A. Banks Size and Classes of Wetland Resources 11
- B. Work Timeline 17
- C. As-built Report 18
- D. Specifications 18

IV. Accounting, Performance Standards, and Monitoring Methods 23
- A. Accounting Procedures 23
- B. Performance Standards 23
- C. Reporting Protocol and Monitoring Plan 24
- D. Maintenance and Adaptive Management Plans 28
- E. Schedule of Credit Availability 29

V. Financial Assurances and Long-term Bank Management 30

VI. Signatories 32

VII. References 39

VIII. Appendix 41
- A. INHS Site Assessment and Delineation
- B. NRCS Wetland Determination
- C. ISGS Hydrogeologic Characterization Report
- D. Work Specifications
- E. Sample Deed Restriction
- F. Cultural Resource Coordination

FIGURES

Figure 1. Site location 2
Figure 2. Service area 4
Figure 3. Existing habitats 6
Figure 4. NWI wetlands 8
Figure 5. Soil map 10
Figure 6. Existing hydrologic alterations 12
Figure 7. Site Development Plan – Proposed habitat areas 13
Figure 8. Site Development Plan – Proposed implementation schedule 19
Figure 9. Site Development Plan – Planned hydrologic modifications 22
Figure 10. Planned hydrologic monitoring 26

TABLES

Table 1. Existing and proposed classes of wetlands 14
Table 2. Native species of grasses for seeding in planned wetlands 15
Table 3. Native species of trees and shrubs for planting in planned wetlands 16
Table 4. Planned planting specifications 16
Table 5. Non-weedy, native herbaceous plants likely to colonize planned wetlands .. 17
Table 6. Proposed work items and time line 18
Table 7. USACE required performance standards 24
Table 8. Illinois IWPA required performance standards 24
Table 9. Monitoring schedule and requirements 25

I. Introduction

This wetland mitigation banking instrument has been prepared in accordance with the Final Rule for 33 CFR 332 and 40 CFR 230 Compensatory Mitigation for Losses of Aquatic Resources (Federal Register 2008). This document describes the feasibility and suitability as well as the objectives, establishment, and operation of the Lawrence Wetland Mitigation Bank proposed by the Illinois Department of Transportation (IDOT). The proposed bank site would be a single-user one. All credits would be used only by the IDOT and no credits from the bank site would be transferred or sold to another entity. The IDOT would retain responsibility for the mitigation requirements associated with the debited credits. The proposed 73.1-acre mitigation bank is located along the Embarras River in Lawrence Township, Lawrence County, IL, approximately 4 miles southeast of the city of Lawrenceville (Figure 1). The property is partially bounded by the Russell-Allison Levee (Road 1500E) to the west and by adjacent floodplain property, under separate ownership, to the north, south and east. The wetland mitigation bank site will be referred to subsequently as the bank site, or the mitigation bank.

The IDOT proposes that all activities regulated under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act will be eligible for compensation at the bank site if impacts to wetlands and/or aquatic resources are unavoidable. Credits from the mitigation bank may also be used to compensate for environmental impacts authorized under the Interagency Wetland Policy Act of 1989 (IWPA). In no case will the same credits be used to compensate for more than one activity; however, the same credits may be used to compensate for an activity which requires authorization under more than one program.

Under the existing requirements of Sections 10 and 404, all appropriate and practicable steps will be undertaken by the IDOT to first avoid and then minimize adverse impacts to aquatic resources prior to authorization of credit use from the mitigation bank.

A. Bank Goals and Objectives

The goals of the mitigation bank are to re-establish and establish wetlands, to preserve or enhance existing wetland areas, and to preserve or establish mesic plant communities in non-wetland buffer areas. To achieve these goals, the IDOT will discontinue the use of the site for agriculture, naturalize the local hydrologic regime, and establish native plant communities. The result will be a contiguous tract of various habitats consisting mainly of forested wetlands. The mitigation bank will provide habitat for wildlife and recreational opportunities for people.

The objectives of the mitigation bank are to: 1) reforest agricultural land with native hydrophytic trees, 2) establish native hydrophytic plants on land not suited for tree survival, and 3) provide flood, sediment, and nutrient storage for the Embarras River watershed. Site improvements for human use will be low-impact and may include items such as paths for site access and interpretive signs.

B. Ownership, Establishment, and Operation

The IDOT has acquired the property and holds fee-simple interest to the land. The proposed bank will be designed for low-maintenance. As long as the bank site is owned by the IDOT, it will be maintained for its designated use. After the mitigation bank is established and the final credit allocation is released, the IDOT will transfer the site to the Illinois Department of Natural

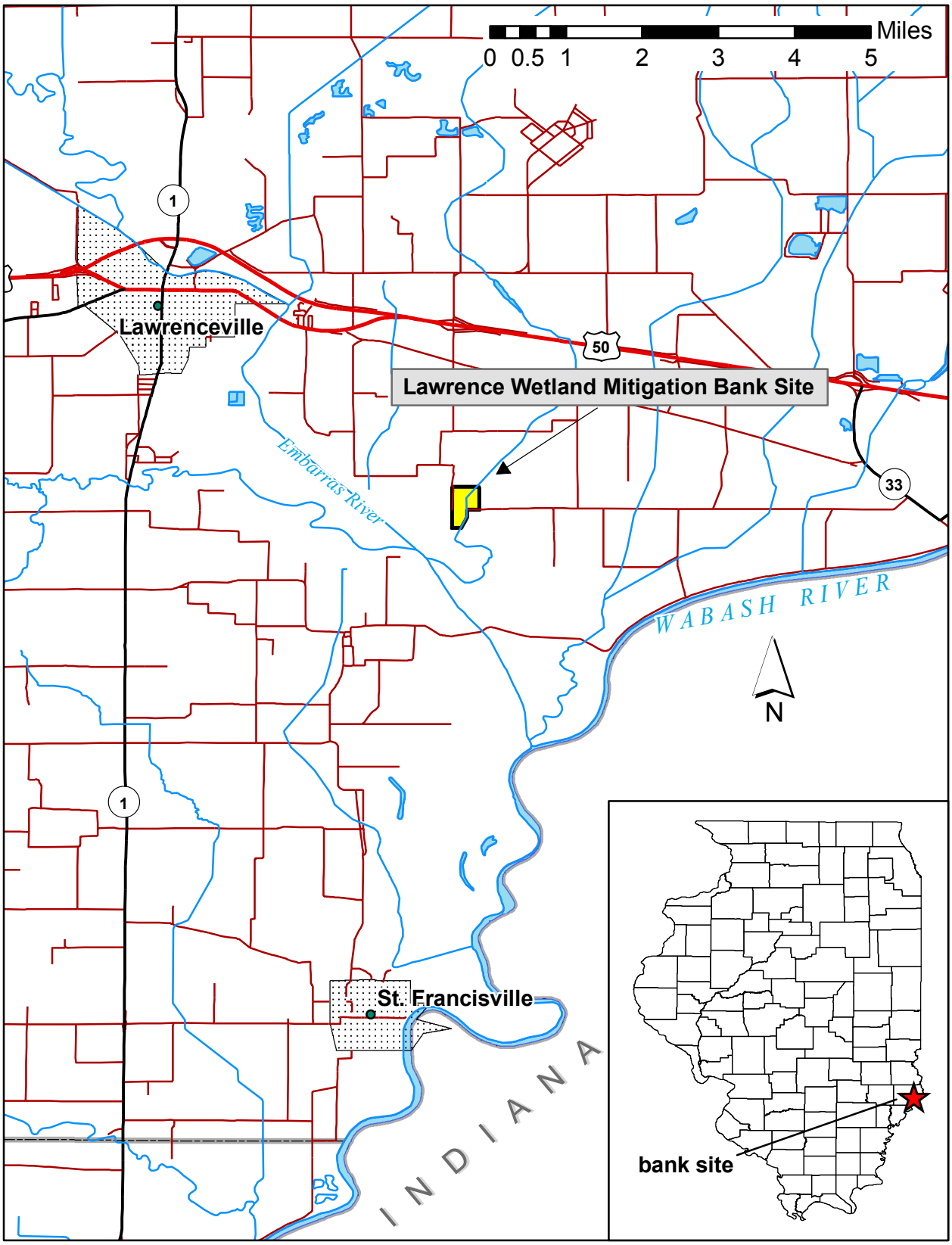

Figure 1. Location of the proposed Lawrence Wetland Mitigation Bank site (highlighted in yellow). The site is located southeast of the city of Lawrenceville and is within the Embarras River watershed in southeastern Lawrence County, IL.

Resources (IDNR) for long-term stewardship. Such transfer shall not require a commitment from IDOT to provide funds to IDNR to support the management activities. These provisions for the transfer and long-term management of compensatory wetlands and wetland bank sites are contained in the IDOT's Wetlands Action Plan—co-signed in 1998 by the Director of the IDNR and the Secretary of the IDOT. The IDNR is not able to program in perpetuity funds for the maintenance and management of targeted IDNR lands including wetland bank sites transferred from the IDOT. Each year the state legislature appropriates funds for the management of IDNR lands and from that, funds are programmed for site management. The distribution of funds is based on need.

The IDOT will program state funds for the establishment, monitoring, and maintenance of the bank site. State funds will also be programmed to perform remediation on planned wetlands that do not appear on track to attaining one or more of the established performance standards. The IDOT will not post performance bonds, hold escrow accounts, or dedicate legislatively enacted funds to cover contingency measures.

Site engineering will be provided by engineers with the IDOT in District Seven, in Effingham, Illinois. Legal services will be provided by lawyers with the IDOT Office of Chief Counsel in Springfield, Illinois.

The bank site will be constructed in one phase. Within three years after the bank site instrument is signed, the IDOT District Seven will program funds to construct the mitigation bank. Completion of development will require up to two years.

Site monitoring will be provided by the IDOT Bureau of Design and Environment (BDE) through their Intergovernmental Agreement for Illinois Transportation Biological and Wetland Survey Program between the State of Illinois, Department of Transportation and the Board of Trustees of the University of Illinois. The agreement was first executed September 12, 1980 and then updated October 25, 2006. The agreement is effective until June 30, 2016. Each fiscal year for 28 fiscal years, the IDOT has programmed funds to implement this agreement. Under the agreement, either the Illinois Natural History Survey (INHS) or Illinois State Geological Survey (ISGS) or both conduct field surveys for threatened and endangered species, wetlands, and compensatory mitigation projects, and prepare reports that support departmental compliance with the Endangered Species Act, Clean Water Act, Illinois Endangered Species Act, Interagency Wetland Policy Act of 1989, and the National Environmental Policy Act. The central office of Planning and Programming programs funds each fiscal year for the Statewide Biological Survey and Assessment Program between the State of Illinois, Department of Transportation and the Board of Trustees of the University of Illinois. The FY11 Program provided $3.56 million for this program.

One year following completion of bank site development, monitoring for attainment of performance standards will begin. If monitoring reports suggest remediation and the IRT Chair concurs, the IDOT District Seven Programming Engineer will program funds for such. Remedial measures will be implemented between 9 and 18 months after identification of non-attainment. Up to $25,000 of district discretionary funds could be used to implement corrective measures which would shorten the time period between identification of non-attainment and implementation of remedial action.

C. Service Area and Impacts Suitable for Compensation

The bank sponsor proposes primary and secondary bank site service areas (Figure 2). The

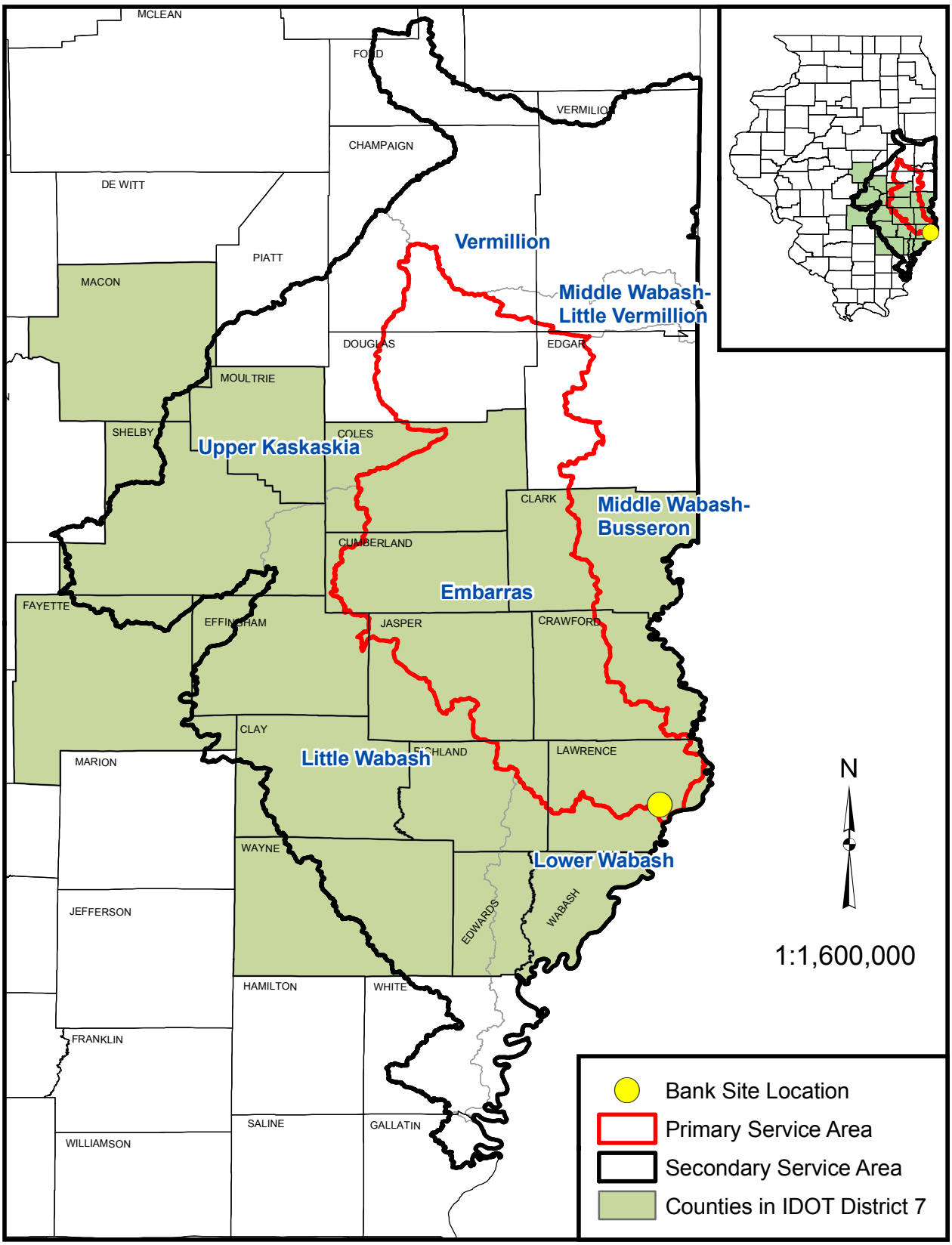

Figure 2. Primary (red) and secondary (black) geographic service areas of the proposed Lawrence Wetland Mitigation Bank site.

primary service area would be the Embarras River watershed, the 8-digit HUC (05120112) in which the bank site is located. The secondary service area would be the six 8-digit HUCs adjacent to the primary service area. These include Middle Wabash-Busseron (05120111), Middle Wabash-Little Vermillion (05120108), Vermillion (05120109), Upper Kaskaskia (07140201), Little Wabash (05120114), and Lower Wabash (05120113) basins. In most cases, the following wetland replacement ratios would apply for impacts located within and outside the primary service area, respectively:

Primary service area

- 1.5:1

Secondary service area

- 2.0:1 for an impact within highway right-of-way or within proposed new right-of-way adjacent to existing
- 3.0:1 for an impact 0.5 acres in size or less
- 5.5:1 for an impact 0.5 acres in size or greater

In the foreseeable future, the IDOT District Seven will need wetland mitigation for the IL Route 1 improvement at the Embarrass River (within primary service area of bank) and the US Route 45 improvements south of Effingham, IL (secondary service area of bank). For IL Route 1 and US Route 45, wetland impacts are 1.56 acres and 3.22 acres and required compensation (per state requirements) is 7.56 acres and 9.51 acres, respectively. At IL Route 1, impacts are to forested wetlands; at US Route 45 impacts are split between forested and emergent wetlands. These two projects combined would consume approximately 47% of the proposed mitigation credits to be generated at the bank site.

The bank site would also be used to provide compensation for proposed highway improvements with impacts to wetlands of less than one-tenth acre. Currently, in the IDOT District Seven, we have 22 projects with impacts ranging from 0.003 acres to 0.72 acres. Total required mitigation is approximately 5 acres.

II. Baseline Conditions

A. Existing Habitat

Routine on-site wetland determinations were conducted by the INHS on all lands at the bank site on May 21 and June 2, 2009 (Wiesbrook et al. 2009). Wetlands were delineated according to the Corps of Engineers Wetland Delineation Manual and the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region (Environmental Laboratory 1987, U.S. Army Corps of Engineers 2010). Figure 3 shows wetland areas delineated and assessed within the parcel by the INHS (Wiesbrook et al. 2009; see Appendix A). Sites 1, 2, and 3 comprise a total of 32.8 acres of delineated wetlands within the project limits. However, during Fall 2009 Lawrence County cleared a portion of Site 3 (approximately 5.9 acres) that lies within the county road right of way to allow access for levee repairs. The delineated wetland areas generally correspond to the area mapped by the National Wetlands

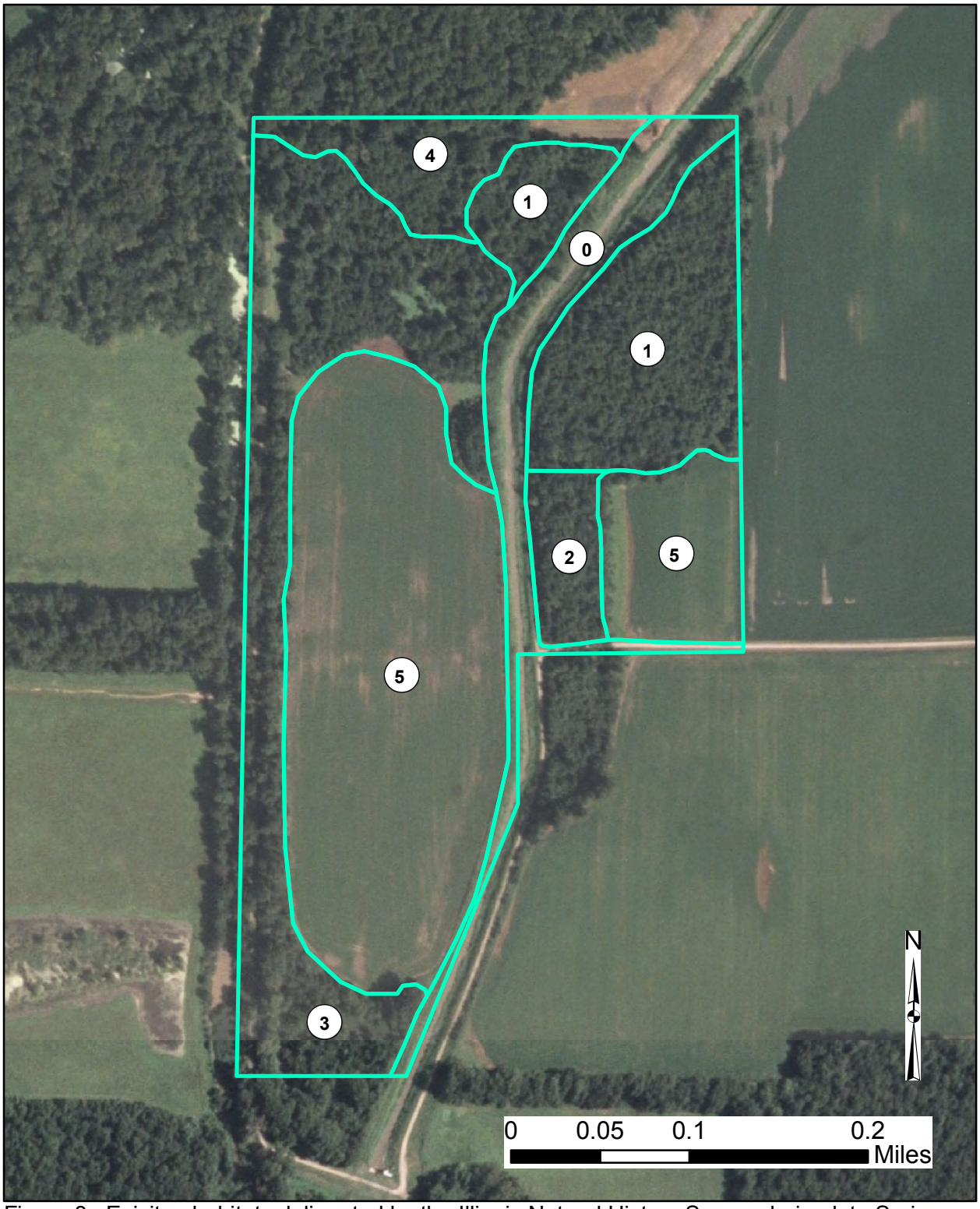

Figure 3. Exisitng habitats delineated by the Illinois Natural History Survey during late Spring 2009 at the proposed Lawrence Wetland Mitigation Bank (Weisbrook et al. 2009). Sites labeled 1,2, and 3 are delineated wetlands; sites 4 and 5 are not wetland areas. Further discription of existing habitats are given beginning on page 5 of the text. Map based on 2009 National Agricultural Imagery Program aerial photography (U.S. Department of Agriculture 2010).

Inventory as shown in Figure 4 (U.S. Fish and Wildlife Service 2009). Site 1 consists of hackberry-oak-hickory dominant floodplain forests with good natural quality (FQI=27.8). Site 2 consists of a silver maple-buttonbush dominant floodplain forest with good natural quality (FQI=19.2). Site 3 consists of silver maple-poison ivy dominant floodplain forest of moderate natural quality (FQI=12.1). Given that Sites 1 and 2 each exhibit good natural quality, these wetland areas represent suitable ecological targets for wetland re-establishment and establishment at the proposed wetland bank.

The non-wetland areas identified by the INHS include roads, levees, and Beaver Pond Ditch (Site 0), mesic floodplain forest (Site 4) and agricultural land (Site 5). The levees and ditch within Site 0 cannot be re-established to wetland because the Russell-Allison Levee and Beaver Pond Ditch will be maintained for flood control and drainage by the local drainage district and the discontinuous levee along Beaver Pond ditch will be modified by the IDOT to facilitate wetland re-establishment and establishment in other portions of the site. The mesic floodplain forest in Site 4 does not have hydric soil and therefore cannot be re-established to wetland. The agricultural land in Site 5 has hydric soil and dominant hydrophytic vegetation; however, it is currently drained and used for crop production. The certified wetland determination by NRCS indicates that the wetland status of the approximately 28.9 acres of cropland is prior converted, indicated as 'PC' in Appendix B. Therefore, the agricultural land as represented by Site 5 is the target area for potential wetland re-establishment and establishment. The general site development plan will focus on re-establishment and establishment of forested wetland on the areas that are currently in crop production.

B. Threatened and Endangered Species

A preliminary review of the proposed mitigation bank for the potential impact on threatened or endangered species was performed pursuant to Section 7 of the Endangered Species Act as amended. The U.S. Fish and Wildlife Service Midwest Region list of threatened or endangered species in Illinois lists the Indiana bat (*Myotis sodalis*), fat pocketbook mussel (*Potamilis capax*), eastern prairie fringed orchid (*Platanthera leucophaea*) as potentially occurring in Lawrence County (U.S. Fish and Wildlife Service 2010).

The Indiana bat hibernates in caves and mines during the winter months. When they are not hibernating, bats forage along small stream corridors with well-developed riparian woods. Summer roosts usually are located beneath the exfoliated bark of dead trees, although roosts within cavities and under the bark of living trees also have been recorded (Gardner et al. 1990 *in* Herkert 1992). Since there are no known caves or mines within the proposed wetland mitigation bank site and tree removal will not be proposed, we determined no effect on the Indiana bat.

The fat pocketbook is a large river species, occurring on both sand and mud substrates, in flowing water, and at depths of only a few cm to 3 m or more (Parmalee 1967 *in* Herkert 1992). Since there are no large rivers within the proposed wetland mitigation bank site, we determined no effect on the fat pocketbook mussel.

The eastern prairie fringed orchid inhabits mesic to wet prairie. Since there is no mesic to wet prairie within the proposed wetland mitigation bank site, we determined no effect on the eastern prairie fringed orchid. The Illinois Endangered Species Protection Board (2009) lists 11 threatened and 14 endangered species occurring in Lawrence County. We determined that within the 28.9 acres of cropland that are prior converted wetlands, there is no suitable habitat for any state-listed species. The IDNR Natural Heritage Database has no records of

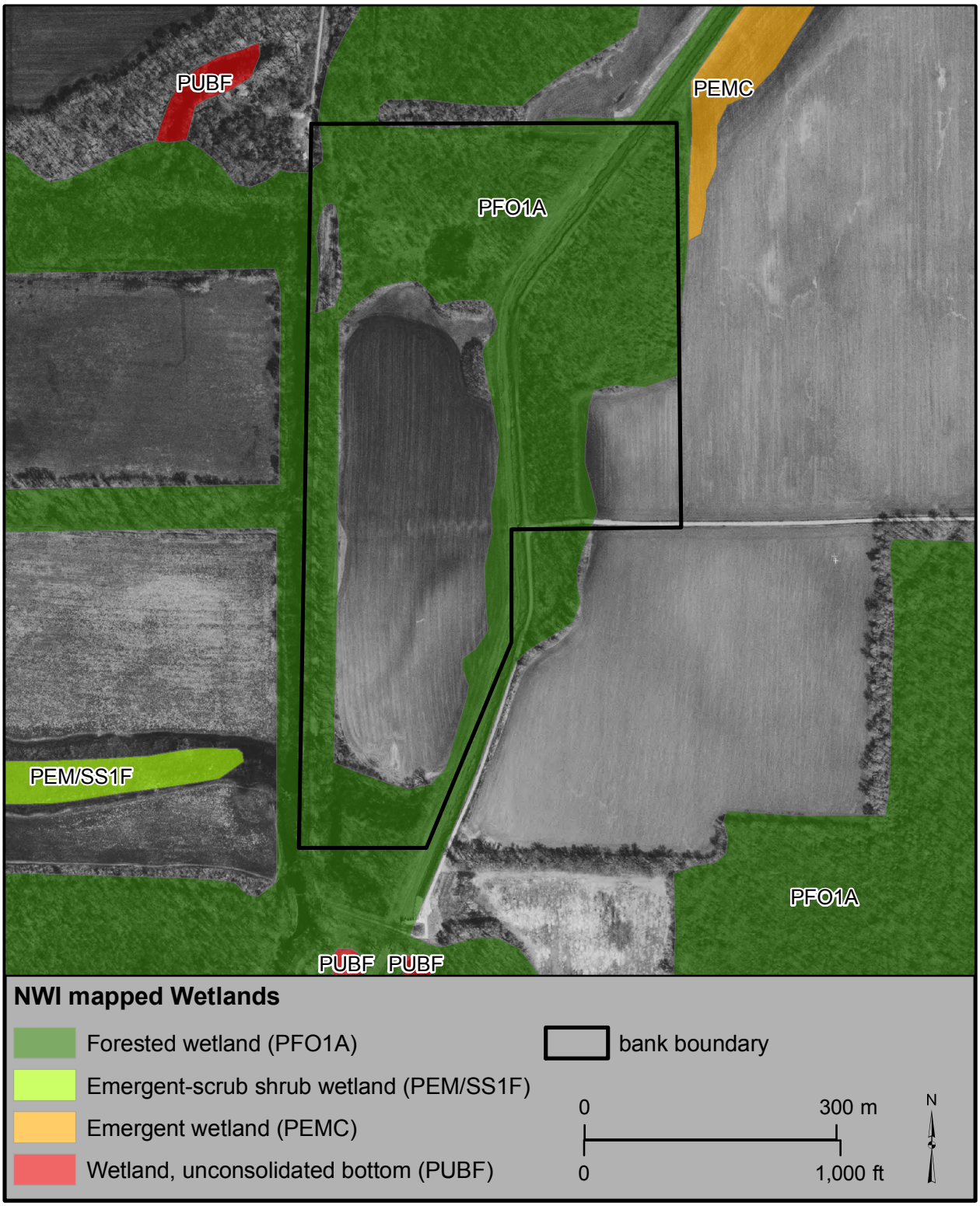

Figure 4. NWI Wetlands map showing the extent and classes of wetlands at the proposed Lawrence Wetland Mitigation Bank and vicinity (U.S. Fish and Wildlife Service 2009). Map based on Lawrence, NE and SE digital orthophoto quarter quadrangles (Illinois State Geological Survey 2006).

occurrences for listed species, natural areas or nature preserves within or near the bank site (IDNR Wetland Impact Review Tool, report dated January 26, 2009).

C. Site Soils and Geomorphology

The Soil Survey mapped four hydric soils at the site that comprise 94% of the site area (Figure 5). The hydric soil map units include the Westland clay loam, and occasionally flooded phases of the Darwin silty clay, Petrolia silty clay loam, and Wabash silty clay (U.S. Department of Agriculture 2009). The remainder of the site consists of a former gravel pit which was identified as Psamments by the INHS due to the development of a soil horizon since disturbance by mining activity; this area is at least moderately well drained and has an unknown hydric rating (Wiesbrook et al. 2009). Except the former gravel pit, each soil map unit at the site is rated as poorly drained. However, the Westland clay loam and the Petrolia silty clay loam are reported to have moderately high saturated hydraulic conductivity in the surface layer whereas the Darwin silty clay and the Wabash silty clay are each reported to have moderately low saturated hydraulic conductivity (U.S. Department of Agriculture 2009). The Darwin, Petrolia, and Westland map units are reported to have a seasonal high water table at land surface and the Wabash map unit is reported to exhibit a seasonal high water table at 6 inches above land surface, indicating at least seasonal surface saturation. The native vegetation under which the soils at the site formed was a combination of wet prairie, hardwood wetland forest, and herbaceous wetland (U.S. Department of Agriculture 2009). The extent of hydric soils at the site indicates that most of the site was wetland in the past. Therefore, the areas that are currently in agricultural production can be targeted for wetland re-establishment.

The topography in the vicinity of the bank site is characterized by ridge and swale topography typical of floodplains along large rivers in the Midwest. The general landscape of the area consists of low-relief floodplain (0 to 2% slopes) containing higher relief areas (up to 7% slopes) formed by sand dunes or point bar deposits. At the bank site, the land surface is generally low-relief floodplain (<2% slopes). Higher areas (~410 ft a.m.s.l. and higher) occur in the northwest and east part of the site as portions of low, broad ridges. Beaver Pond Ditch runs along the axis of a swale (between 410 and 405 ft a.m.s.l.) that formerly contained an oxbow lake that was reported to exist in the early 1800's (Illinois State Archives 2009).

The geologic materials at the site are mostly silty and clayey alluvial deposits over glacial outwash (Benton et al. 2009). The finer-grained materials are located in the swale area along Beaver Pond Ditch. These deposits generally limit water movement through the upper unit, and water tends to pond at land surface in localized depressions after floods or intense rainfall. However, surficial materials in the south portions of west field and the east portion of the east field are higher in elevation and contain coarser-grained sediments that are more conducive to infiltration. Therefore, wetland re-establishment efforts will focus where there are thicker, fine-grained surficial materials conducive to a perched water table and ponding, approximated by the areas mapped as Darwin silty clay. Wetland establishment will be required in higher portions of the fields within the areas mapped as Petrolia silty clay loam and Westland clay loam (Benton and Pociask 2011).

D. Site Hydrology and Hydrologic Alterations

The hydrologic conditions that supported wetlands in the past at the bank site have changed due to a variety of hydrologic alterations. Major hydrologic alterations include Beaver Pond Ditch, the Russell-Allison Levee and a pumping station just to the south of the site. Beaver

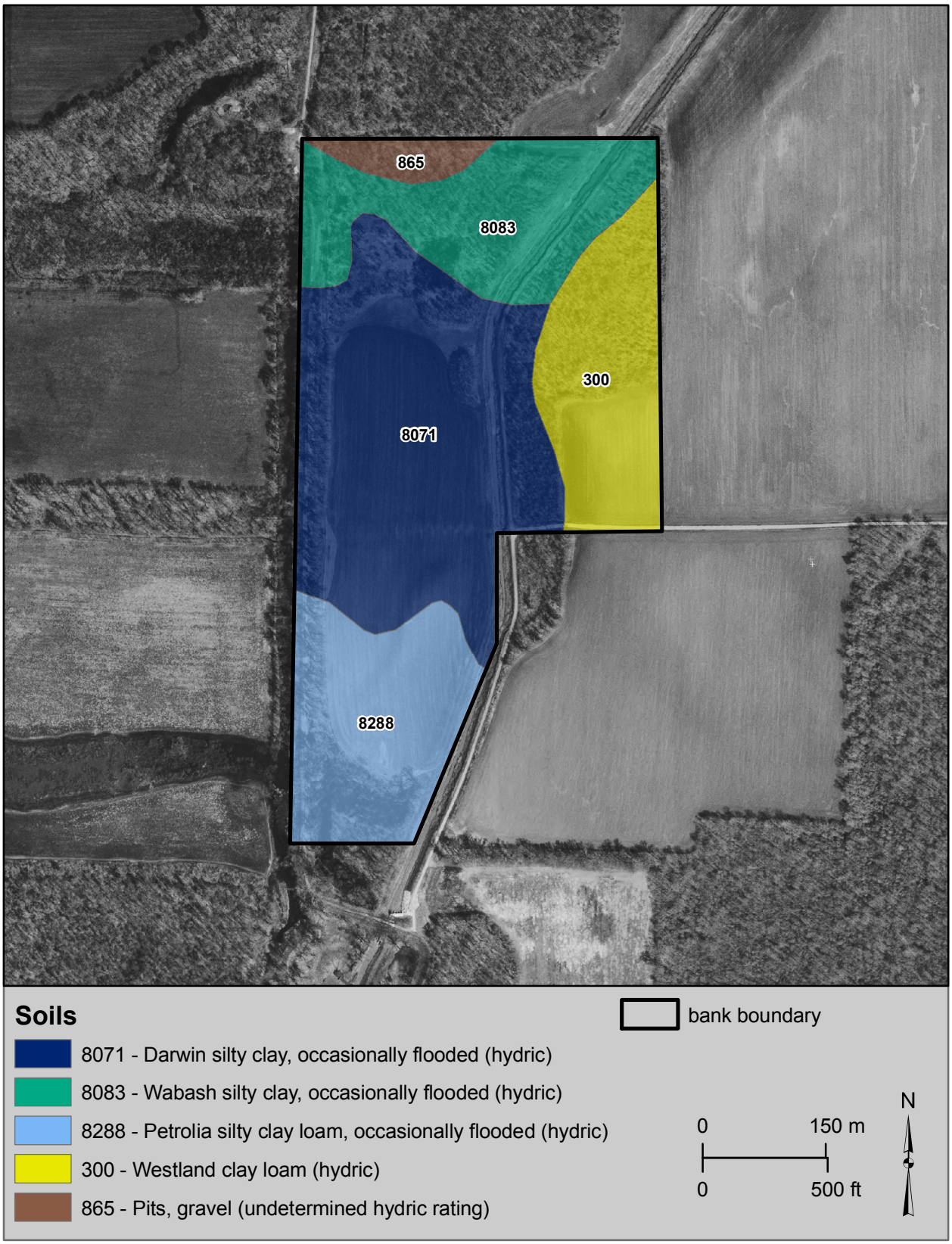

Figure 5. Soil map of the proposed Lawrence Wetland Bank site showing Soil Survey soil map units (U.S. Department of Agriculture 2009). Map based on Lawernce NE and Lawrence SE 2005 NAPP digital othophoto quarter quadrangles (Illinois State Geological Survey 2006).

Pond, which was excavated prior to 1912 (see Benton et al. 2009), bisects the site and provides drainage both at low water and during periods of flooding via the pumping station located where the ditch meets the Russell-Allison Levee (Figure 6). The Russell-Allison Levee encompasses much of the floodplain area between the Embarras and Wabash Rivers and in most years prevents direct flooding of the site from the Embarras River. Minor hydrologic alterations identified at the site include three culverts, one drain tile line, and smaller, discontinuous levees and spoil piles along Beaver Pond Ditch. The culverts and the tile line expedite drainage to Beaver Pond Ditch from the farm fields and some wetland areas adjacent to the ditch. Beaver Pond Ditch and the Russell-Allison levee cannot feasibly be manipulated for wetland re-establishment. However, hydrologic modification will be required in order to attain jurisdictional wetland hydrology and replicate the hydrologic conditions that formed the hydric soil. Therefore, hydrologic re-establishment will focus on removal of culverts and drainage tile and re-grading of levees and spoil piles along Beaver Pond Ditch.

E. Water Rights

The proposed bank site lies within Consolidated Drainage District which manages the pumping station just to the south of the site. It is expected that the drainage district will continue to operate the pump and maintain Beaver Pond Ditch to facilitate crop production into the long-term future. Although the IDOT will not have rights to control water levels in Beaver Pond Ditch, preliminary findings of a hydrologic investigation by the ISGS (see Appendix C) suggests that wetland re-establishment and establishment are feasible with the current conditions of pumping and ditch maintenance if on-site hydrologic alterations are reversed or modified (Benton and Pociask 2011).

F. Cultural Resources

An archeological survey was conducted at the site, and on March 3, 2010, the IDOT received the concurrence of the State Historic Preservation Officer in their determination that no cultural properties which are subject to protection under Section 106 of the National Historic Preservation Act of 1966, as amended, will be impacted by the establishment of the wetland mitigation bank site (see Appendix F).

III. Site Development Plan

A. Bank Size and Classes of Wetland Resources

The proposed bank site is approximately 73.1 acres and currently includes the various wetland and non-wetland areas outlined in Section II. A. and shown in Figure 3. After the mitigation bank is complete, the IDOT anticipates that approximately 60.2 acres of habitat will be preserved, enhanced, established, or re-established including 56 acres of forested wetlands and 4.2 acres of non-wetland areas consisting of upland forest. Proposed habitat types are shown in Figure 7 and proposed credit values listed in Table 1 to account for the conversion of cropland or existing degraded habitats into the proposed habitats. As such, although the total site area is approximately 73.1 acres, there will be an estimated 36.25 acres of credits generated and approximately 56 physical acres of wetlands upon completion of the mitigation bank development plan.

The IDOT plans to generate wetland mitigation credits through re-establishment, establishment,

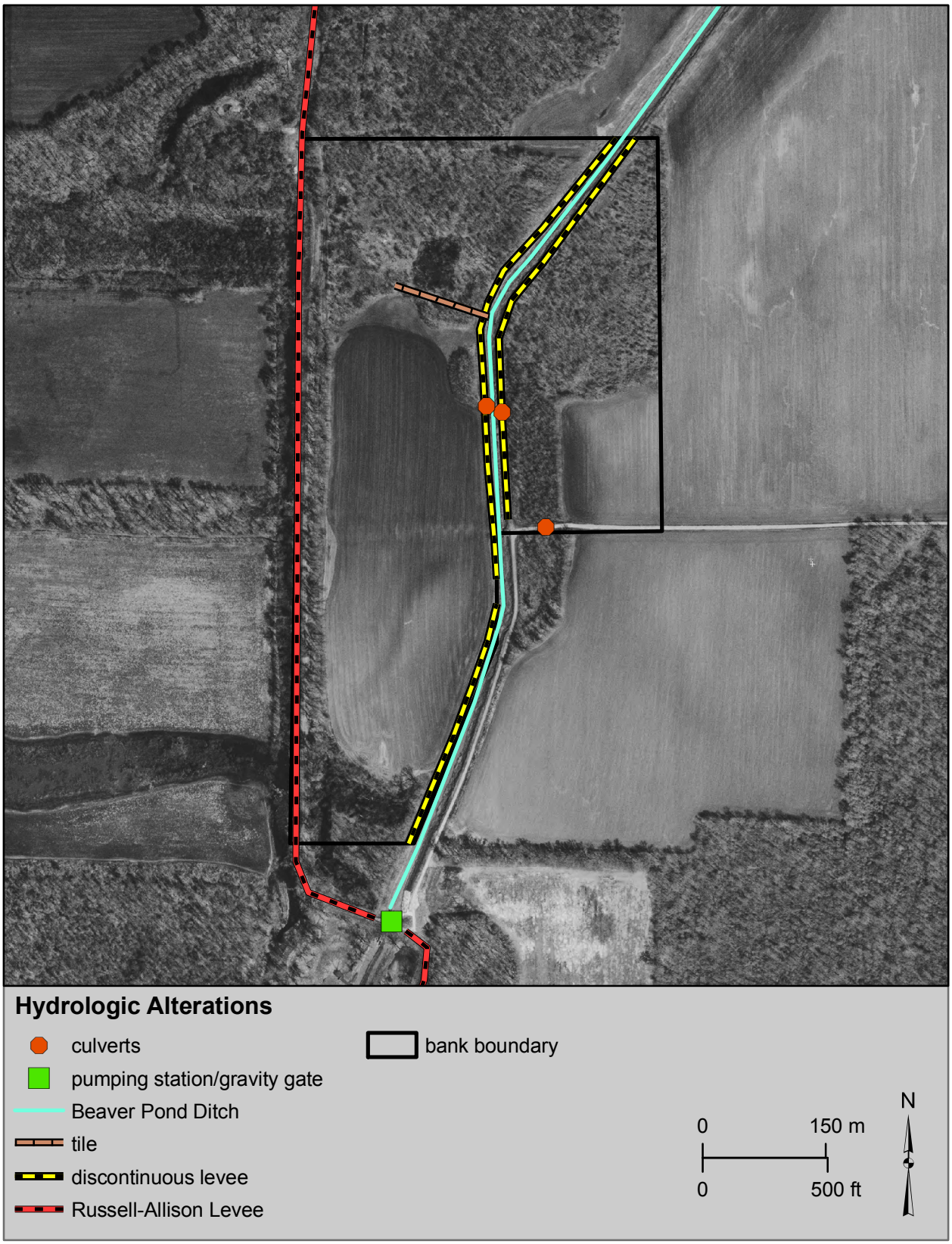

Figure 6. Existing hydrologic alterations at the proposed Lawrence Wetland Mitigation Bank. Map based on Lawernce NE and Lawrence SE 2005 NAPP digital othophoto quarter quadrangles (Illinois State Geological Survey 2006).

Figure 7. Site Development Plan - Proposed habitat areas for the Lawrence Wetland Mitigation Bank. Map based on Lawrence NE and SE 2005 NAPP digital othophoto quarter quadrangles (Illinois State Geological Survey 2006).

enhancement, and preservation. The IDOT will re-establish wetlands by reversing or modifying existing hydrologic alterations; establish wetlands by excavating to promote wetland hydrology; and enhance existing wetlands by removing or modifying hydrologic alterations to increase hydrologic and biogeochemical functions. Additionally, the IDOT will plant native hydrophytic trees in planned forested wetland re-establishment and establishment areas, allow natural regeneration of native hydrophytic plants, and control invasive species. Site modifications will include the following: removal of culverts that allow drainage to Beaver Pond Ditch, removal of a tile line in the existing wetland area in the northwest portion of the site, modification of the existing levees and spoil piles along Beaver Pond Ditch, excavation of portions of the site, and installation of two fixed-threshold spillways. The goal of implementing these modifications is to promote wetland hydrology over most of the site.

Wetland preservation and enhancement

Approximately 37.1 acres of the proposed bank (Sites 1, 2 and 3) were determined to be wetland (see Figure 3). Sites 1 and 2, located in the northeast and east portions of the project area, consist of 14.5 acres of floodplain forest with good natural quality that can be considered botanical assets (Wiesbrook et al. 2009). Proposed re-establishment, establishment and enhancement in adjacent areas will provide some degree of added function, such as added habitat connectivity and buffer thus a 1:0.1 credit ratio is requested. A credit ratio of 1:0.1 will result in 1.45 acres of wetland credit generated for this existing wetland area.

Table 1. Existing and proposed classes of wetlands.

Class	Existing habitat (Figure 3)	Proposed habitat[1] (Figure 7)	Proposed hydrologic zone[2]	Credit ratio	Area (acres)[1]	Credits (acres)
Wetland preservation	forested wetland (Sites 1 and 2)	forested wetland	V	1:0.1	14.5	1.45
Wetland enhancement	forested wetland (Site 3)	forested wetland	IV	1:0.25	12.4	3.1
Wetland re-establishment[3]	agricultural land (Site 5)	forested wetland	IV and V	1:1	12.4	12.4
Wetland establishment	agricultural land (Site 5)	forested wetland	IV and V	1:1	16.7	16.7
Non-wetland buffer preservation	upland forest (Site 4)	upland forest	VI	1:0.1	4.2	0.42
Other	levees/roads/ditch (Site 0, Site 3)	levees/roads/ditch	VI	0:0	12.9	0
TOTAL					73.1	34.07

[1]Due to unforeseen variations in hydrology, these proposed habitats and acreage estimates may be subject to revision. Revisions shall be approved by the IRT Chair.
[2]Representative zone as listed in Table 5 of the 1987 Wetland Delineation Manual (Environmental Laboratory 1987) however those listed as zone V shall meet 14-day hydrologic criteria according to the Midwest Supplement (US Army Corps of Engineers 2010).
[3]Re-establishment areas are those that have hydric soil, have been designated by the NRCS as 'PC', and will not be excavated during initial site development.

Wetland enhancement is proposed for the portions of Site 3 that are not part of the county right-

of-way (see Figures 3 and 7). The lower areas of the north and southernmost portions of the site and along the Russell-Allison Levee on the west boundary of the site, consists of approximately 12.4 acres of floodplain forest of moderate natural quality. Existing hydrologic alterations (i.e., drainage tile and culverts) will be reversed or modified within this site. Proposed wetland re-establishment and establishment activities within and adjacent to the enhancement area will provide added function, such as increased hydro-chemical residence time which will provide additional capacity for aquatic biogeochemical process to occur as well as add habitat connectivity thus a 1:0:25 credit ratio is requested. A credit ratio of 1:0.25 will result in 3.1 acres of wetland credit generated for the existing wetland areas in Site 3.

Wetland re-establishment and establishment

Wetland re-establishment and establishment is proposed for portions of Site 5 areas (see Figures 3 and 7). Site 5 areas encompass approximately 29.1 acres of the site. These areas are mapped as hydric soil, currently farmed, and designated by the NRCS as prior-converted wetlands and therefore represent areas where wetlands existed in the past. Approximately 12.4 acres of the current agricultural land, most of which is in the area west of Beaver Pond Ditch, will be re-established to wetland by reversing or modifying hydrologic alterations. However, the remaining areas of Site 5 (mainly mapped as Petrolia silt loam or Westland silt loam) have higher saturated hydraulic conductivity and are slightly higher in elevation. Wetland re-establishment will not be possible in these areas by only reversing existing hydrologic alterations and therefore wetland establishment by excavation will be required (Figure 9 and Appendix C). For areas where the IDOT proposes to re-establish and establish wetlands, the existing habitat (agricultural land) has little or no current wetland function and re-establishment and establishment activities will add functional wetlands at the bank site thus a 1:1 credit ratio is requested.

When work is complete, the bank site will contain re-established and newly established wetland areas consisting of mainly forested wetlands (29.1 acres). Wetland re-establishment and establishment areas will be seeded to native species of grasses (Table 2) and planted to native species of trees (Table 3) at rates specified in Table 4. The groundcover species composition of re-established or newly established wetlands will be augmented through natural colonization (Table 5).

Table 2. Native species of grasses for seeding in planned wetlands.

Common name	Scientific name	Wetland indicator status	Pounds/acre of pure live seed
Redtop	*Agrostis alba*	FACW	3
Beggarsticks	*Bidens spp.*	OBL	0.5
Stout wood reed	*Cinna arundinacea*	FACW	0.5
Virginia wild rye	*Elymus virginicus*	FACW-	2
Rice cutgrass	*Leersia oryzoides*	OBL	0.5
Timothy[1]	*Phleum pretense*	UPL	3
Annual rye grass[1]	*Secale cereal*	UPL	50

[1]nurse species

Table 3. Native species of trees and shrubs for planting in planned wetlands.

Common name	Scientific name	Wetland indicator status
Bitter-nut hickory	*Carya cordiformis*	FAC
Pecan	*Carya illinoensis*	FACW
Buttonbush	*Cephalanthus occidentalis*	OBL
Swamp white oak	*Quercus bicolor*	FACW+
Pin oak	*Quercus palustris*	FACW
Shumard oak	*Quercus shumardii*	FACW-

Table 4. Planting Specifications

	Forested Component		**Herbaceous Component**
	RPM trees	Bare-root seedlings	
Planting rate	60 2-3 gallon containers/acre	450 seedlings/acre	See Table 2
% for one species at initial planting	No more than 20% of initial planting (minimum 5 species)		See Table 2 (A minimum of 5 species will be planted

Non-wetland buffer preservation

Non-wetland buffer is planned for Site 4 which consists of approximately 4.2 acres (see Figures 3 and 7). For this effort, 0.42 acres of wetland credits will be generated. Non-wetland areas often provide important habitat and hydrologic functions complementary to those provided by wetlands. Many biological processes require both wetland and non-wetland areas. For example, the life history of most amphibians includes both aquatic and terrestrial stages. Of the 41 amphibian species that occur in Illinois, 37 use non-wetlands at least part of the time (Illinois Department of Natural Resources 1994).

Other

Approximately 12.9 acres of the bank site consists of roads, levees, and Beaver Pond Ditch. Roads will be maintained for access to the site and adjacent properties. The right-of-way along County Road 1500E near the base of levee was deforested in Fall 2009 and will be maintained to provide access for maintenance of the Russell-Allison Levee. Existing levees and spoil piles along the Beaver Pond Ditch will be graded to promote wetland hydrology in wetland re-establishment, establishment and enhancement areas. These levees will function to control site hydrology and may also be used as field access roads. No credits will be garnered from activities in areas encompassing the roads, levees, and Beaver Pond Ditch.

Table 5. Common (non-weedy) native herbaceous macrophytes likely to colonize planned wetlands (Wilm 2010, after Wiesbrook et al. 2009).

Forest	
Common name	Scientific name
Ontario aster	*Aster ontarionis*
panicled aster	*Aster simplex*
false nettle	*Boehmeria cylindrica*
Gray's sedge	*Carex grayi*
Sedge	*Carex muskingumensis*
day flower	*Commelina virginica*
Wood reed	*Cinna arundinacea*
Virginia wild rye	*Elymus virginicus*
white avens	*Geum canadense*
Jewelweed	*Impatiens capensis*
common satin grass	*Muhlenbergia frondosa*
sensitive fern	*Onoclea sensibilis*
deer-tongue grass	*Panicum clandestinum*
Canada clearweed	*Pilea pumila*
woodland bluegrass	*Poa sylvestris*
Virginia knotweed	*Polygonum virginianum*
smooth ruellia	*Ruellia strepens*
lizard's tail	*Saururus cernuus*
Wingstem	*Verbesina alternifolia*
Emergent/Marsh	
water plantain	*Alisma plantago-aquatica*
swamp milkweed	*Asclepias incarnata*
panicled aster	*Aster simplex*
Sedges	*Carex* spp.
flat sedges	*Cyperus* spp.
Spikerushes	*Eleocharis spp*
Jewelweed	*Impatiens capensis*
southern blue flag	*Iris shrevei*
sensitive fern	*Onoclea sensibilis*
water smartweed	*Polygonum amphibium*
dark green bulrush	*Scirpus atrovirens*

B. Work Timeline

As of July 2009, the IDOT initiated pre-construction monitoring for the proposed mitigation bank. For subsequent wetland bank development activities, the general approach will be to first reverse or modify hydrologic alterations to provide conditions suitable for hydrophytic species

and then plant native, non-weedy wetland tree and plant species as well as allow native plant community to naturally regenerate. The area planned for wetland re-establishment or establishment is currently in row-crop agriculture. Farming will continue in these areas until their scheduled mitigation bank implementation start dates. The IDOT plans to implement the site development plan according to the schedule as outlined Table 6 and Figure 8 of this document. During the development of the mitigation bank, hydrology and vegetation will be monitored by the ISGS and INHS, respectively. Results from monitoring will be reviewed on an annual basis by the IDOT. If modification of the initial site development plan is required, the IDOT will first propose such to the IRT Chair for approval and implementation.

Table 6. Proposed work items and time frames for the Lawrence wetland mitigation bank.

Work Items	Time frame
1-1a. Pre-construction hydrology monitoring	underway-year 1
1-1b. Drainage tile search	year 1
1-1c. Control weedy and invasive vegetation	underway-year 6
1-1d. Excavate wetland establishment areas if necessary	year 1
1-1d. Culvert removal	year 1
1-1d. Spillway installation	year 1
1-1d. Levee reconstruction	year 1
1-1e. Seeding and tree planting	year 1
1-2a. Post-construction hydrology monitoring	years 2-6
1-2b. Post-construction vegetation monitoring	years 2-6
1-6. Request final credit certification	year 6

C. As-Built Report

The IDOT shall submit to the IRT Chair an as-built report for each contract awarded for construction of the mitigation bank. Reports shall be submitted within 90 days following the date of completion of the contract. As-built reports shall include changes to the plans that were made after the contract was awarded and while it was open. Note that changes to the plans are to be approved by the IRT Chair prior to implementation.

D. Specifications

The following sections describe each work item listed in Table 6 and general guidelines that will be used to implement the mitigation plan. Draft plans and specifications for each contract shall be submitted by the IDOT to the IRT Chair for review and approval three months prior to advertisement for bid letting.

Pre-construction hydrology monitoring

Hydrologic monitoring at the bank site was initiated in July 2009 and is on-going. A partial monitoring network was installed by the ISGS using standard methods described in Appendix D and includes a combination of shallow monitoring wells, stage gauges, electronic water-level

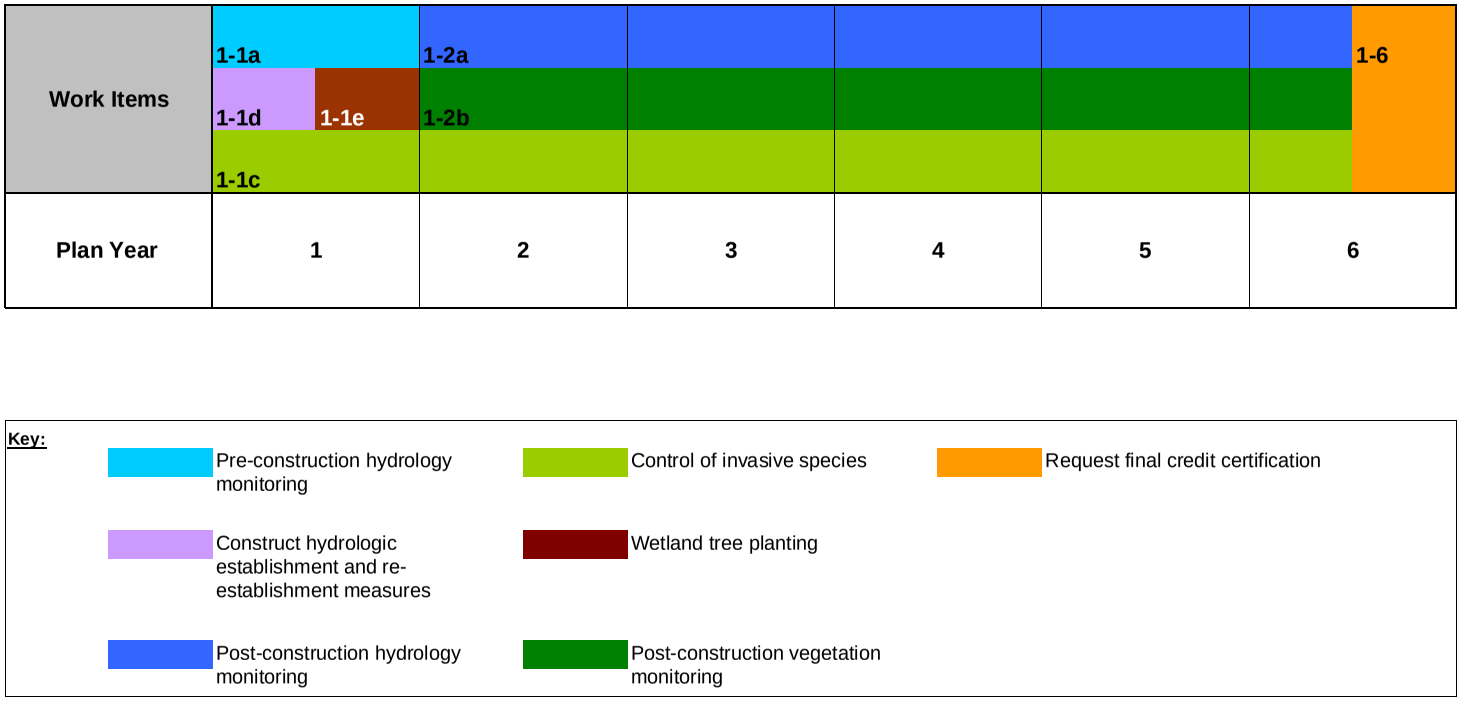

Figure 8. Site Development Plan - Proposed implementation schedule for the Lawrence wetland mitigation bank. The work items corresponding to the index numbers shown in this figure are listed in Table 5.

data loggers, and a tipping-bucket rain gauge (see Figure 10). The data collection schedule consists of biweekly measurements during the spring (early growing season) and monthly measurements during the remainder of the year. The monitoring data are being used to characterize hydroperiod and guide the site development plan for the mitigation bank. After bank development is complete, hydrologic monitoring data will be used to determine the areal extent of wetland hydrology and to evaluate attainment of performance standards.

Drainage tile/culvert search

No additional drain tile or culverts were found during a site visit conducted February 22-23, 2011 or during several subsequent visits during pre-construction site monitoring activities.

Control of weedy and invasive vegetation

Prior to development, the bank site will be farmed and weedy growth will be controlled through normal agricultural practices. Areas that are not farmed (e.g., levees and road embankments) may be periodically mowed.

During bank site development (i.e. seeding, tree and shrub planting), weedy and invasive vegetation will be controlled or eliminated as part of the site preparation for planting in accordance with IDOT Standard Specifications (Illinois Department of Transportation 2002; Appendix D).

In planned forested wetlands, vegetation between planted rows of trees and shrubs will be mowed for at least two growing seasons following the *period of establishment*—see Appendix D, Part G. Mowing will reduce competition from vegetation (planted and natural regeneration) and will assist in the growth and survivorship of planted trees and shrubs.

After the second growing season, weeds may be controlled by mowing or by spraying with herbicides. A pre-emergent herbicide, such as Oust or Simazine, or a post-emergent herbicide, such as Rodeo, may be used—see Appendix D, Part C. It is expected that some invasive species will diminish as the trees in reforested areas mature, canopies close, and the herbaceous layer becomes shaded.

Ten to fifteen years after planting, the forested wetlands may benefit from a timber stand improvement, such as a thinning or release cutting. Volunteer species of trees such as silver maple, cottonwood, and black willow may be selectively cut or treated with herbicide to favor higher-quality pecan, and pin oak and swamp white oak which, due to slower growth rates, may otherwise be shaded out. If the IDOT proposes any invasive or weedy vegetation control or timber stand improvement after construction is complete, the IDOT will submit its plans for such activity for approval from the Corps and the IRT.

Excavate wetland establishment areas

The south portion of the field west of Beaver Pond Ditch and the field east of Beaver Pond Ditch may be excavated to establish wetlands (Figure 9). Although these areas (approximately 11.6 acres combined) are mapped as hydric soil and are identified as prior-converted wetlands, higher elevation and saturated hydraulic conductivity in this part of the site may necessitate excavation to attain wetland hydrology criteria. Therefore, these areas may be considered for wetland establishment pending results of further hydrologic investigation. Any excavation to

establish wetland areas will follow standard specifications as outlined in Appendix D, Part D.

Culvert removal and spillway installation

Two culverts pass through the levee along Beaver Pond Ditch and drain the site (see Figure 6). Culvert 1 is located in the east levee and Culvert 2 is located in the west levee, each in the central portion of the site. Each of these culverts will be removed after work items involving excavation are complete, although culvert removal may be incorporated into these other work items if feasible and practical. The existing material covering each culvert will be excavated prior to culvert removal and reserved to patch the voids in the levee due to removal activities (see the following section describing levee reconstruction).

Two straight-drop type spillways will be constructed at the site to promote appropriate flood frequency and retention for wetland re-establishment and establishment areas. The spillways will be located near the locations the existing culverts (Figure 9). Specifications for culvert removal and spillway installation are described in Appendix D, Part E.

Levee reconstruction and spoil re-grading

Segments of the existing levees may reduce flood frequency locally, particularly in the south portion of the site west of Beaver Pond Ditch. The IDOT will re-grade levees and ditch spoil piles to a wide, low profile along both banks of Beaver Pond Ditch to allow flooding of the site while inhibiting surface drainage to the ditch. The goal of this activity is to increase the duration of inundation and saturation in planned wetland re-establishment and establishment areas.

The design elevation for the levees will range from 1 to 2 ft above the local site area and will have a continuous and consistent grade along their lengths. However, in locations where material must be added reach the design elevation, the levee will be constructed at least 0.5 ft higher than the local design elevation to allow for settling of material. Additional details of levee reconstruction are given in Appendix D, Part F.

Seeding, tree and shrub planting

In planned wetlands, the ground cover will be seeded according to the species and quantities specified in Table 2. All proposed changes to planting lists shall be approved by the IRT Chair prior to planting. All work, materials, and equipment shall conform to Sections 250 and 1081 of the IDOT Standard Specifications (see Appendix D). Trees and shrubs will be planted using either bare-root seedlings or 3-gallon containerized saplings. Species for planting will be selected from Table 3. Approximately equal numbers of each species will be planted. At least five different species of hard-mast producing trees (i.e. species of oak, hickory, pecan) will be planted. If bare-root seedlings are specified, 450 seedlings/acre will be planted on 9.5X9.5 ft centers; if containerized saplings are specified 60 saplings/acre will be planted on just over 27X27 ft centers. Both containerized saplings and bare-root seedlings shall be planted in the fall—from October 15 through December 15.

Vegetation between planted rows of trees and shrubs will be mowed for at least two growing seasons following the *period of establishment*—see Appendix D, Part G. Mowing will reduce competition from vegetation (planted and natural regeneration) and will assist in the growth and survivorship of planted trees and shrubs.

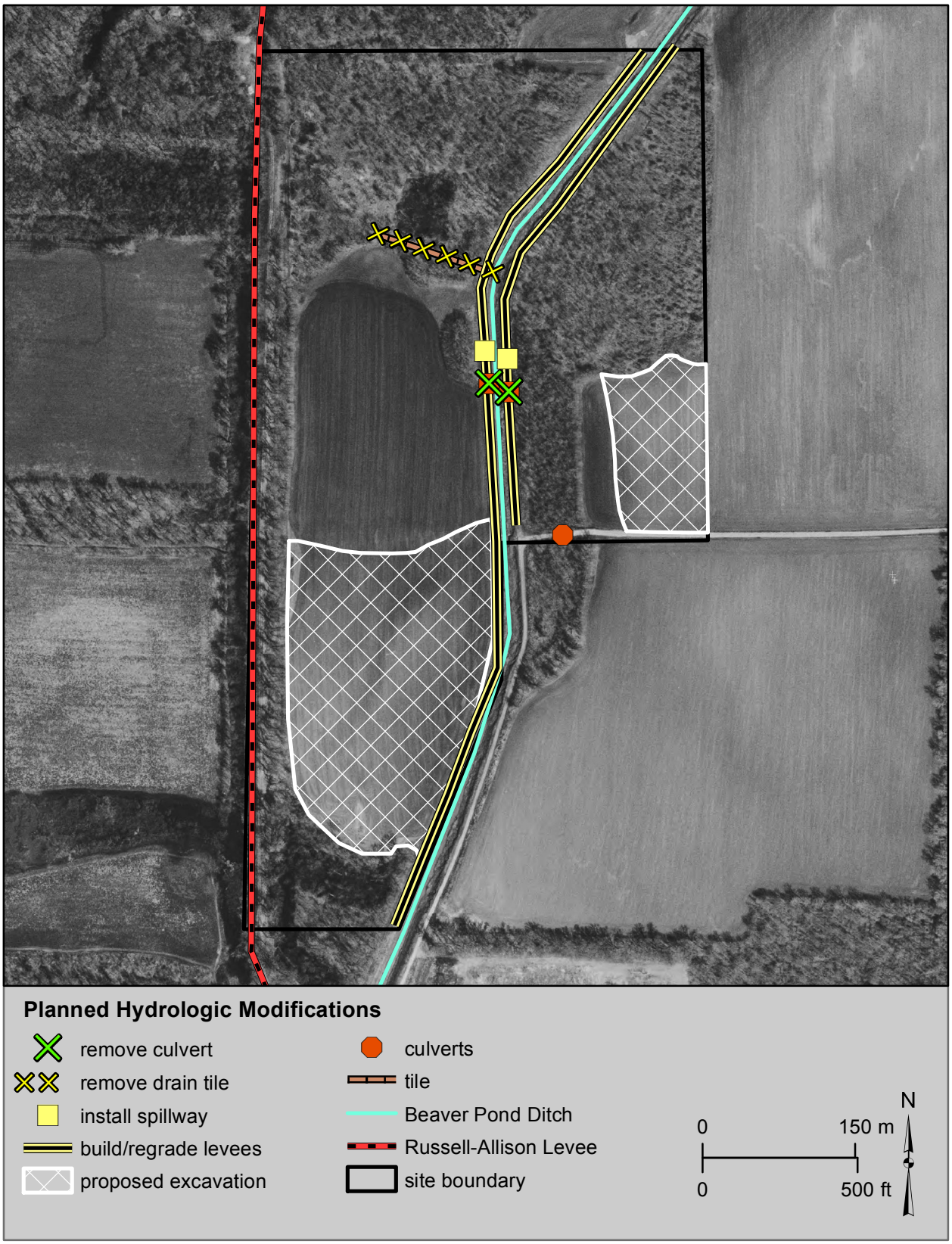

Figure 9. Site Development Plan - Planned hydrologic modifications at the proposed Lawrence Wetland Mitigation Bank. Map based on Lawernce NE and Lawrence SE 2005 NAPP digital othophoto quarter quadrangles (Illinois State Geological Survey 2006).

IV. Accounting, performance standards, and monitoring methods

A. Accounting Procedures

A rigorous functional assessment approach (i.e., Hydrogeomorphic Approach [HGM]) has not been developed for this region. Therefore, the IDOT will use acreage rather than a functional assessment approach to determine credits or debits as provided by sections 332.5(a) and 332.8(o) of the Final Mitigation Rule (pp.19678 and 19685, Federal Register 2008). All planned wetlands (i.e., re-establishments or enhancements) will qualify for certification only after attainment of the approved performance standards (see Section IV [B]). The IRT Chair will be responsible for certifying wetland credits.

As the site development plan is implemented and areas within the bank site achieve the approved performance standards, the IDOT will submit supporting information from the monitoring reports to the IRT Chair and request certification of these areas (5-acre minimum size) for wetland credit. The IDOT will also submit a copy of the bank ledger showing the proposed credit. Any request for credit certification shall not exceed the thresholds of the Credit Availability Schedule as given in Section IV of this document. If denied, the IRT Chair will provide an explanation of the basis for the denial. If applicable, the IRT will provide guidelines for the IDOT to make revisions to a denied request which would result in acceptance of some or all of the originally requested credits.

Credits used to mitigate an activity regulated under the Illinois Interagency Wetland Policy Act of 1989 can also be used to mitigate the same activity regulated under Section 404 of the Clean Water Act. Credits may not be used to mitigate more than one activity.

When debiting the bank, the IDOT will notify the Corps of Engineers during the Section 404 permit application process and the IDNR in accordance with the IDOT Wetlands Action Plan. Notification will include a copy of the bank ledger and a line item indicating the proposed debit. The bank ledger will be used to track all transactions at the bank site, showing credits, debits and available balances. Credits, debits and balances will be broken down by habitat and wetland type (*i.e.*, emergent or forested). The IDOT BDE will hold and maintain the bank ledger, recording all transactions.

B. Performance standards

Each planned wetland shall meet jurisdictional wetland criteria as outlined in the Midwest Regional Supplement to the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual (U.S. Army Corps of Engineers 2010, Environmental Laboratory 1987). The primary criteria are as follows:

a) Predominance of hydrophytic vegetation. More than 50% of the dominant plant species must be hydrophytic at each sampling location.
b) Presence of hydric soils. Hydric soil characteristics should be present, or conditions favorable for hydric soil formation should persist. Favorable conditions include inundation or saturation to within 12 inches of the surface.
c) Presence of wetland hydrology. The planned wetlands must be inundated at average depths less than 6.6 ft or have soils that are saturated to the surface for at least 14 consecutive days of the growing season in at least 5 of 10 years on average.

Table 7. Performance standards for wetland vegetation required by USACE-Louisville District.

	Forested Component		**Herbaceous Component**
	RPM trees	Bare-root seedlings	
% for one species at final count	No more than 25% of final stock		No more than 30% of initial planting
Survival requirement	90% of initial stock	50% of initial stock	Planted species must account for 70% of the surviving ground cover at the end of monitoring
Indicator Status	Complete community must carry greater than 70% FAC or wetter status		At least 70% of surviving ground cover must carry a FAC or wetter status

Also, each planned wetland resource area shall meet performance standards for planted species survival and floristic composition as outlined in Tables 7 and 8. Site performance will be assessed in year 2 as well as year 5 of post-construction monitoring in order to track site progress.

Table 8. Performance standards for wetland resource areas under the Illinois IWPA.

Parameter	**2-year performance standards**	**5-year performance standards**
Tree stocking	At least 217 live bare-root seedlings/acre or 54 saplings/acre should be established and living.	At least 217 live bare-root seedlings/acre or 54 saplings/acre should be established and living.
Native species composition	At least 50% of the plants present should be non-weedy, native, perennial and annual species.	At least 80% of the plants present should be non-weedy, native, perennial and annual species.
Dominant herbaceous species	It is expected that weedy species will remain dominant after 2-years; however, data from first 2-years of monitoring shall show a trajectory toward reduction in the percentage of non-native or weedy species.	None of the three most dominant plant species in any stratum may be non-native or weedy species, such as cattails (*Typha latifolia*), sandbar willow (*Salix interior*), reed canary grass (*Phlaris arundinacea*), giant ragweed (*Ambrosia trifida*), or giant reed (*Phragmites australis*).
Floristic Quality	FQI>10	FQI>20*

*FQI in forested areas is expected to decrease after canopy closure and recover thereafter as shade-tolerant species colonize the herbaceous and shrub layers.

C. Reporting Protocol and Monitoring Plan

Reporting Protocol

Planned wetlands will be monitored for attainment of each of the above stated performance standards annually for a minimum of five years (See Table 9). Vegetation monitoring will occur in the first and last month of the growing season. The start of yearly monitoring will depend on

the date of completion of mitigation bank development. If completed before June 1st the mitigation bank will be monitored that year. If the bank is completed after June 1st, monitoring will be initiated the following year.

Annual monitoring reports will be submitted to the IRT Chair by January 31st of the following year. Shortly after, the IRT Chair will notify the bank sponsor of needed remediation—see section IV. D. The bank sponsor and IRT may opt to expedite the reporting and remediation process with annual meetings at the end of each growing season in order to present the preliminary results of monitoring and to discuss plans for remediation to be implemented the following growing season.

Table 9. Monitoring schedule and requirements.

Duration	5 years for bare-root and seeded plantings; 3-5 years for RPM plantings
Inspection Schedule	Biannual – first and last month of the growing season
Photo stations	One station per 3 acres per wetland classification
Reporting	Due by January 31 after the first full growing season

Monitoring Plan

The goal for attainment of performance standards and certification of credit areas is five years from the date of completion of re-establishment activities. Monitoring may be extended where it appears remedial measures may lead to attainment of the performance standards or shortened where attainment is reached in less than five years. Monitoring may be discontinued where it appears attainment of performance standards may never be realized and where remedial measures may be ineffective. A brief description of the methods to be used for monitoring each of the three wetland parameters is given in the following paragraphs in this section. Additionally, photo monitoring will be conducted and photos submitted to the IRT as part of the annual reporting

Hydrology

Hydrology will be monitored by the ISGS. A combination of shallow monitoring wells, surface-water staff gauges, and surface- and ground-water data loggers will be employed to monitor depth and duration of inundation and saturation (Figure 10). Monitoring wells are constructed and installed according to Miner and Simon (1997) (see Appendix D). Water levels will be measured at frequencies and during time periods appropriate for determining whether wetland hydrology criteria as defined in the Midwest Regional Supplement to the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual has been satisfied (U.S. Army Corps of Engineers 2010).

Vegetation

Vegetation will be monitored by the INHS. Using visual estimation, the dominant species of vegetation in each stratum will be determined. Dominance is based on Importance Value, a numerical average of a species' relative frequency, density and aerial coverage (or basal area) (Cox 1985). In each stratum, dominant species include, starting with the most abundant, those species whose Importance Values, when summed in descending order, immediately exceed 50%, as well as any additional species whose Importance Values are 20% or greater (Federal

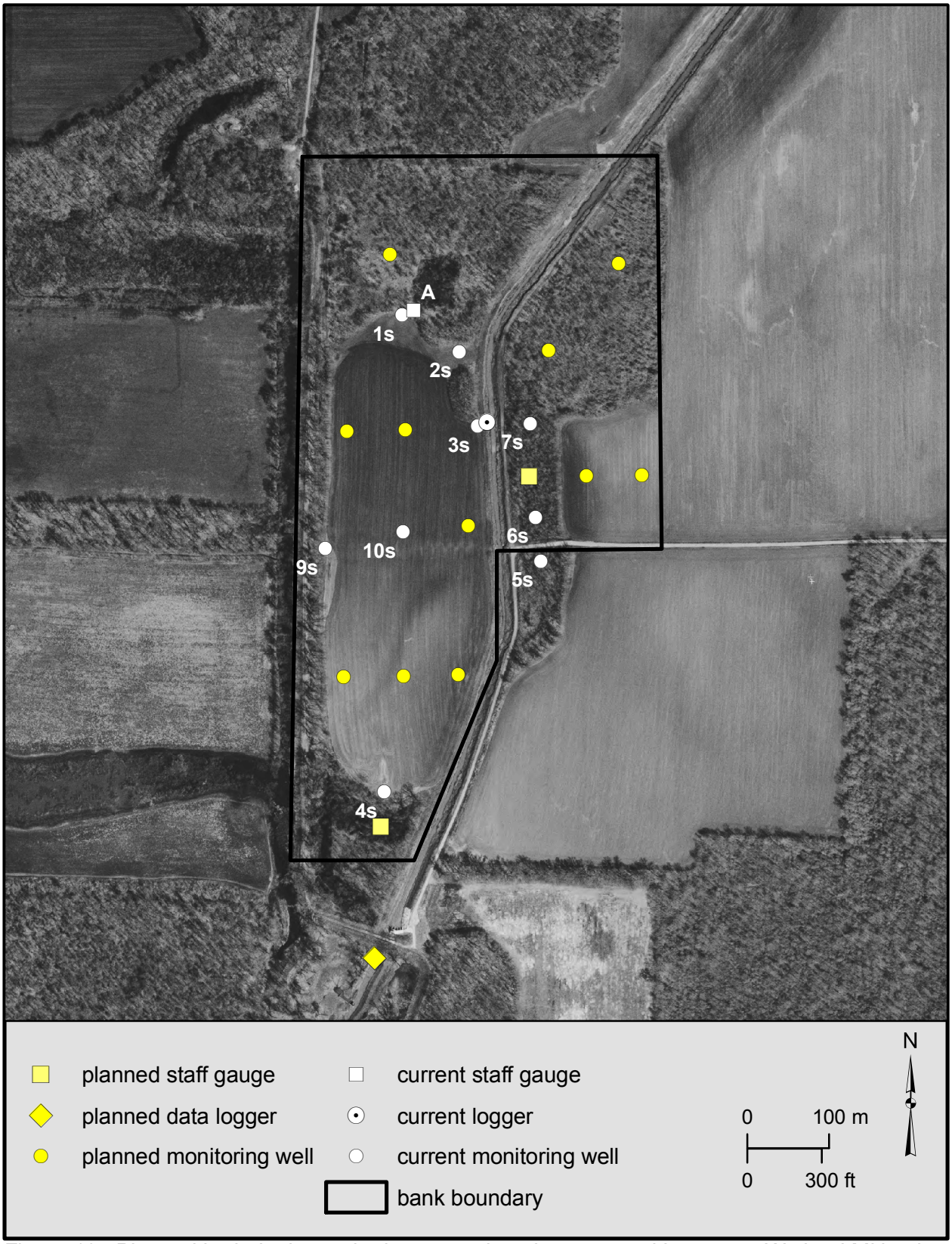

Figure 10. Planned hydrologic monitoring network at the proposed Lawrence Wetland Mitigation Bank. Map based on Lawrence, NE and SE digital orthophoto quarter quadrangles (Illinois State Geological Survey 2006).

Interagency Committee for Wetland Delineation, 1989). Dominant species are assigned wetland indicator status ratings (Reed 1988). Any plant rated facultative minus or wetter (FAC-, FAC, FAC+, FACW-, FACW, FACW+ or OBL) is considered hydrophytic. Hydrophytic vegetation is determined to be present if greater than 50% of the dominant species are hydrophytic (Environmental Laboratory 1987).

Survivorship of planted trees will be determined through quantitative sampling. On consecutive planted rows, the first 100 ft in each 1000 ft section of row is sampled (10.6 ft X 100 ft (0.024 acre) plot). This procedure results in a 10% sample (n = 40). Within each sampled section (plot) live trees are tallied by species. A minimum of 217 live bare-root seedlings or 54 three-gallon containerized tree saplings per acre must be present after five years. Importance Values of planted species are calculated as an average of relative frequency and relative density. The tree planting area is mapped using Trimble GPS (global positioning system) and overlaid on digital ortho-quadrangle imagery using ArcView 3.2.

Dominant herbaceous species within the wetland compensation site will be determined annually by visual estimation in an attempt to ensure that none of the three most dominant species are nonnative or weedy, and that at least 80% of the plant species present are native and non-weedy through the fifth year of monitoring. A species list will be prepared annually and a Floristic Quality Index computed for the site (Taft et al. 1997). In order to determine whether at least 80% of the plant species present are native and non-weedy, each plant community is carefully searched late in the growing season and a complete list of the species observed is constructed. Nativity and perennial and annual status for each species observed is determined by consulting an appropriate flora (Gleason and Cronquist 1991). Professional judgment is used to determine whether a plant, including a native species, is a weed. Some native species, such as sandbar willow (*Salix interior*), are considered to be weedy. Percent native non-weedy perennial and annual species is determined by dividing the number of native non-weedy perennial and annual species by the total number of species observed and multiplying by 100. For our purposes here, certain native, early successional species (C=1) that commonly occur in healthy wetlands and do not tend to overwhelm plant communities are not considered weedy: *Acer saccharinum*, *Bidens frondosa*, *Polygonum pensylvanicum*, *Ranunculus abortivus*, etc.

Soils

Soils will be monitored by the INHS according to the Midwest Regional Supplement to the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual (U.S. Army Corps of Engineers 2010). Because features that indicate hydric soils (*e.g.*, low chroma mottling, and gleying) develop relatively slowly, monitoring and reporting of these features may be missing from all but the final monitoring reports. In the final monitoring report, a soil description and hydric soil determination will be provided for each of the planned wetlands.

Photo Stations

Each annual monitoring report provided after the end of the growing season shall include digital images of the planned forested wetlands. Ten photo stations will be established with the planned forested wetland re-establishment and establishment areas. Captions for each image will provide the geographic coordinates and the direction in which the image was taken.

D. Maintenance and Adaptive Management Plans

The IDOT will be responsible for adaptive management at the Lawrence wetland mitigation bank. The IDOT recognizes that there are several potential challenges that pose risks to the success of the mitigation bank. The IDOT will monitor site conditions and provide reports on an annual basis to the Corps. Based on the findings of the annual reports, the IDOT, in consultation with the IRT, will apply appropriate adaptive management strategies such as outlined in this section.

Among the anticipated challenges that pose a risk to bank success are floods, drought, spillway or berm degradation, invasive species, and tree mortality.

Pre-project monitoring has shown that the majority of the site floods frequently, although flood durations are not long enough to satisfy jurisdictional wetland hydrology criteria over large portions of the site. Thus, the IDOT plans to remove culverts, re-grade levees along Beaver Pond Ditch, install fixed-elevation spillways, and excavate to prolong the period and area of inundation at the site. However, it is likely that planned wetland re-establishment areas will be wetter or drier than planned in a given year. Therefore, the IDOT will assess whether annual and seasonal climate patterns (e.g. precipitation and flooding) were within the normal long-term range.

If climate patterns are within the normal range and jurisdictional wetland hydrology area estimates are less than the targeted wetland re-establishment acreage, the IDOT will review the site development plan (see Figure 9) and consider adaptive management strategies to increase the period of saturation and/or inundation such as adjusting the threshold elevations of the spillways. If minor adjustments to the spillway elevations do not help in meeting hydrologic performance standards, potential remedial actions would be additional excavation or adjustment of berm elevations. If adaptive management of water levels does not aid in meeting the performance standard, then the principal remedial actions that would be proposed are shallow excavation to establish additional or deeper depressions on the floodplain and adjustment of berm elevations.

If planted tree survival does not meet the performance standard, then remedial measures such as replanting, or installing tree berms and replanting on them, or planting more mature stock may be considered. Weed mats and mowing to reduce competition may also be considered to improve survivorship where it appears the site supports establishment of forested wetlands.

It is also likely that planned forested wetland areas may be more suitable to emergent vegetation after hydrology is re-established. If planted forested wetlands remain inundated for prolonged periods after site development, there is a possibility that flooding will cause planted trees to die. If hydrologic conditions are wetter than anticipated and prevent development of a planned forested wetland area, the IDOT will propose either replanting with emergent vegetation or allowing for natural regeneration by flood tolerant species based on vegetation monitoring provided by the INHS.

The IDOT expects native species composition to progress so that at least 80% of the herbaceous plants present will be non-weedy, native, perennial and annual species, and that none of the three most dominant plant species in any stratum will be non-native or weedy species by the end of the 5-year monitoring period. To achieve these final performance standards the need for vegetation maintenance will be determined from annual monitoring

reports provided by the INHS. Starting at the end of year 2 after the completion of construction both planted and non-planted fields containing weedy, invasive, or non-native species will be sprayed with a systemic herbicide either in the early fall or in both spring and early fall. Examples of species that will be targeted for control are reed canary grass (*Phalaris arundinacea*), common reed (*Pragmities australis*), Japanese honeysuckle (*Lonicera japonica*) and mulitfora rose (*Rosa multiflora*). Control of these species may also be accomplished though prescribed burns.

There is the possibility that some plantings will be overcome by natural growth and survivorship of planted trees will be low. If the floristic quality of volunteer community meets the performance standard (Table 6) and the vegetation is dominated by hydrophytic plants, then the IDOT will request that the IRT grant re-establishment of that area through natural regeneration. If floristic quality does not meet the performance standard, the IDOT will implement additional vegetation management to improve floristic quality.

For any resource area failing to meet the performance standards outlined in this banking instrument, remedial actions may also involve modification of performance standards and attendant vegetative sampling, hydrologic monitoring schemes. In such a case, performance standards would be modified to evaluate aquatic resource functions (e.g. water-quality improvement) that are not directly evaluated as proposed in the original banking instrument. Any modification of monitoring or performance standards would be executed in consultation with the IRT.

Remedial actions and responsibilities

Should the Corps, in consultation with the IRT, determine that remedial action is necessary because the bank site or credit area is failing to achieve the performance standards specified in Section IV. B., the IDOT shall develop and implement remedial action plans in coordination with the IRT. Corps and IRT determinations will be based on results provided in monitoring reports—see IV. C.

In the event IDOT fails to implement necessary remedial actions at the bank site within 90 calendar days or other time period determined by the IRT, the IRT Chair will notify IDOT that debiting from the bank is suspended.

Default and suspension procedures

If the Corps determines that the IDOT is not complying with the terms of the Mitigation Bank Instrument, appropriate action will be taken. Such actions may include, but are not limited to, the following: implementation of adaptive management activities, extension of monitoring periods, reduction or suspension of credits releases, requirement to implement additional or alternative mitigation, termination of the Instrument or other actions as approved by the Corps.

E. Schedule of Credit Availability

Wetland mitigation credits generated from wetland and upland buffer re-establishment/establishment will be available for debiting as the mitigation bank is developed. Upon submittal of all appropriate documentation by IDOT and subsequent approval by the USACE District, in consultation with the IRT, it is agreed that credits will become available for use by IDOT in accordance with the following schedule:

1. Initially, 15 percent of total anticipated credits shall be available for debiting after the IRT's approval of the Banking Instrument, and protection of the bank land under a Declaration of Covenants and Restrictions to be recorded with the Lawrence County Recorder of Deeds Office. Construction would begin no later than the first full growing season following the first debit from the site.

2. An additional 15 percent of total anticipated credits shall be available for debiting immediately after submittal and approval of the as-built report for mitigation bank construction.

3. Up to an additional 30 percent of total anticipated credits shall be available for debiting following demonstration of meeting performance standards for two consecutive years. The number of credits released will be based on the proportion of proposed wetlands meeting the vegetation and hydrology success criteria.

4. The remaining 40 percent of total anticipated credits for each resource type shall be made available by the IRT Chair for withdrawal when five successive years of performance standards have been attained. If a portion of the Bank does not meet the hydrologic, vegetative, or soil success criteria, the equivalent credit for the area that does not meet the criteria will not be available for debiting until the criteria are achieved. The IDOT must submit documentation to the Corps demonstrating that the appropriate milestones for a release of credits have been achieved and requesting the release. The Corps will provide copies of this documentation to the IRT members for review. IRT members must provide any comments to the district engineer within 15 days of receiving this documentation. However, if the district engineer determines that a site visit is necessary, IRT members must provide any comments to the IRT chair within 30 days of receipt of this documentation. After full consideration of any comments received, the IRT chair will determine whether the milestones have been achieved and the credits can be released.

V. Financial Assurances and Long-term Management

The IDOT will program state funds for the establishment, monitoring, and maintenance of the bank site. State funds will also be programmed to perform remediation on planned wetlands that do not appear on track to attaining one or more of the established performance standards. The IDOT will not post performance bonds, hold escrow accounts or dedicate legislatively enacted funds to cover contingency measures.

The bank site was acquired in 2010 by District Seven of the IDOT for approximately $120,000. Site planning was performed by the IDOT with assistance from ISGS and INHS. Site engineering will be provided by engineers with the IDOT in District Seven, in Effingham, Illinois. Legal services will be provided by lawyers with the IDOT Office of Chief Counsel in Springfield, Illinois.

The bank site will be constructed in one phase. Within three years after the bank site instrument is signed, the IDOT District Seven will program a total of approximately $150,000 to construct the mitigation bank. This estimate includes cost of mobilization. Completion of site development will require up to two years.

Site monitoring will be provided by the IDOT BDE through their Intergovernmental Agreement for Illinois Transportation Biological and Wetland Survey Program Between the State of Illinois,

Department of Transportation and the Board of Trustees of the University of Illinois. The agreement was first executed September 12, 1980 and then updated in October 25, 2006. The agreement is effective until June 30, 2016. Each fiscal year for 28 fiscal years, the IDOT has programmed funds to implement this agreement. Under the agreement, either the INHS or ISGS or both conduct field surveys for threatened and endangered species, wetlands and compensatory mitigation projects and prepare reports that support departmental compliance with the Endangered Species Act, Clean Water Act, Illinois Endangered Species Act, Interagency Wetland Policy Act of 1989 and the National Environmental Policy Act. The central office of Planning and Programming programs funds each fiscal year for the Statewide Biological Survey and Assessment Program Between the State of Illinois, Department of Transportation and the Board of Trustees of the University of Illinois. The FY11 Program provided $3.56 million for this program.

One year following completion of mitigation bank development, monitoring for attainment of performance standards will begin. If monitoring reports by the INHS and ISGS indicate the need for remediation, the IDOT District will program funds for remedial measures. Remedial measures will be implemented between 9 and 18 months after identification of non-attainment. Up to $25,000 of district discretionary funds could be used to implement corrective measures that would shorten the time period between identification of non-attainment and implementation of remedial action.

The Lawrence wetland mitigation bank site has been designed for low-maintenance. As long as the bank site is owned by the IDOT, it will be maintained for its designated use. After the mitigation bank is established and the final credit allocation is released, the IDOT will transfer the site to the IDNR for long-term stewardship. Such transfer shall not require a commitment from IDOT to provide funds to IDNR to support the management activities. These provisions for the transfer and long-term management of compensatory wetlands and wetland bank sites are contained in the IDOT's Wetlands Action Plan—co-signed in 1998 by the Director of the IDNR and the Secretary of the IDOT. The IDNR is not able to program in perpetuity funds for the maintenance and management of targeted IDNR lands including wetland bank sites transferred from the IDOT. Each year the state legislature appropriates funds for the management IDNR lands and from that, funds are programmed for site management. The distribution of funds is based on need.

VI. Signatories

In accordance with The Final Rule for 33 CFR 332 and 40 CFR 230 Compensatory Mitigation for Losses of Aquatic Resources (Federal Register / V. 73 No. 70 pages 19594-19642, 04-10-2008) this document has been prepared to describe the provisions for establishment, use, and operation of the Lawrence mitigation bank site in Lawrence County, IL by the IDOT. The undersigned agencies hereby agree that this banking instrument shall provide the basis for proceeding with establishment and operation of the Lawrence mitigation bank site in accordance with its terms as approved or as subsequently amended with the concurrence of all signatory agencies.

Ann L. Schneider 3/23/12

Ann L. Schneider Date

Secretary
Illinois Department of Transportation

VI. Signatories

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3-29-2013

Patrick A. Malone Date

Manager Interagency Wetland Program
Illinois Department of Natural Resources

VI. Signatories

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3/27/2013

Matt Mangan Date

Marion Ecological Services Sub-Office
U.S Fish and Wildlife Service

VI. Signatories

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_____

Kevin Pierard Date

Chief, Watersheds and Wetlands Branch
U.S. Environmental Protection Agency, Region V

VI. Signatories

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Jim Townsend 27 MARCH 2013

Jim Townsend Date

Regulatory Branch Chief, Louisville District
U.S. Army

VI. Signatories

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Ward Lenz 26/Mar/2013

G. Ward Lenz Date

Regulatory Branch Chief, Rock Island District
U.S. Army

VI. Signatories

In accordance with The Final Rule for 33 CFR 332 and 40 CFR 230 Compensatory Mitigation for Losses of Aquatic Resources (Federal Register / V. 73 No. 70 pages 19594-19642, 04-10-2008) this document has been prepared to describe the provisions for establishment, use, and operation of the Lawrence mitigation bank site in Lawrence County, IL by the IDOT. The undersigned agencies hereby agree that this banking instrument shall provide the basis for proceeding with establishment and operation of the Lawrence mitigation bank site in accordance with its terms as approved or as subsequently amended with the concurrence of all signatory agencies.

for Danny D. McClenton 3/26/13

Colonel Christopher G. Hall Date

Commander, St. Louis District
U.S. Army

Chief Regulatory Branch

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VIII. Appendix

TRANSMITTAL

To: Bureau of Design and Environment
Attention: Matthew J. Sunderland
From: Illinois Natural History Survey
Regarding: Mitigation Site Assessment

Title and Location

Title: Lawrence County Wetland Mitigation Bank
Location: Burt Pals property southeast of Lawrenceville, IL
Sequence Number: 14912
County: Lawrence
IDOT District: District 7

Survey Conducted By: Scott M. Wiesbrook (Soils and Hydrology)
Brian Wilm (Vegetation and Hydrology)
Brad Zercher (GPS/GIS)
University of Illinois
Institute of Natural Resource Sustainability
Illinois Natural History Survey
1816 South Oak Street
Champaign, Illinois 61820
(217) 265-0368 (Wiesbrook)

Date Conducted: May 21 and June 2, 2009

Project Summary:

A wetland survey was conducted for the site in Lawrence County. This site was divided into five smaller sites based on vegetative character. A brief description of the sites is included along with a discussion of existing vegetation, soils, and hydrology. The potential of the sites for wetland creation or restoration is addressed. All potential wetlands within the project area were also examined by evaluating features of vegetation, soils, topography, and hydrology. The attached report describes the methods and references used in completing the determinations. Results are summarized in the report and are explained in more detail on the accompanying forms. A brief functional assessment of the wetland sites is also provided in the report. All of the sites are marked on the DOQ included with this report.

Signed:

Dr. Allen E. Plocher
INHS/IDOT Project Coordinator
and Principal Investigator

Date: June 25, 2009

Mitigation site assessment for Lawrence County wetland mitigation bank site, Lawrence County, Illinois

Introduction and Project Summary

A mitigation site assessment in Lawrence County was conducted on May 21 and June 2, 2009. The site, owned by Mr. Burt Pals, is located approximately four miles southeast of Lawrenceville, IL. The potential mitigation site was assessed using the method of Admiraal et al. (1997). Wetland delineations were performed on sites which were previously identified by the National Wetlands Inventory (NWI) and on sites which were otherwise thought to be existing wetlands.

The following sources were examined while conducting the survey to determine wetland locations and boundaries: the United States Geological Survey topographic and National Wetlands Inventory (NWI) maps (Lawrenceville 7.5-minute quadrangle), *Soil survey of Lawrence County, Illinois* (Fehrenbacher and Odell 1956), *National list of plant species that occur in wetlands: Illinois* (Reed 1988), *Corps of Engineers wetlands delineation manual* (Environmental Laboratory 1987), *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region* (US Army Corps of Engineers 2008), and aerial photographs.

Characteristics of vegetation, soils, topography, and hydrology were evaluated during four on-site wetland determinations (Mohlenbrock 1986; Reed 1988). Locations of observation points for the determinations were selected based on plant community borders and topographic changes. Three of these sites meet the three criteria of a wetland established by the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region* (US Army Corps of Engineers 2008). Results of the determinations are summarized on the following pages and are described in more detail on the accompanying forms. A brief functional assessment of each site is also provided as described below. Adjacent uplands were also examined; however, forms were not completed for them.

The location of each determination site was overlaid on a DOQ using ArcView 3.3 software (ESRI 2002). Printouts of this DOQ are included with this report. The spatial data has been digitally uploaded to the extranet site (http://frostycap.isgs.uiuc.edu/idot_extranet).

The Floristic Quality Assessment (Taft et al. 1997) was applied to the plant community at each 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 Illinois native plant species is assigned a conservatism coefficient (C) ranging from 0 to 10. Individual conservatism coefficients reflect the committee's confidence level for a taxon's correspondence to anthropogenic disturbances. Plant species assigned 0 tend to have low affinities for natural areas, whereas those assigned 10 have very high affinities. When a complete species list is assembled for a 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. Index values less than 5 indicate that the area has been disturbed or is in an early successional stage. Index values between 20 and 35 ($\bar{c} \geq 3.0$) indicate that the area has evidence of native character and can be considered a botanical asset. Index values between 35 and 50 ($\bar{c} \geq 3.5$) indicate that the area has significant native character (Swink and Wilhelm 1994).

Site Description

Acreage: 53.603 ha (132.455 ac)
Location: Approximately four miles southeast of Lawrenceville, IL
Legal location: N/2, NW/4, sec. 22, and SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Landscape position: Immediate floodplain/low terrace of a moderate size stream (Beaver Pond Ditch)
Pre-settlement environment: Mixture of wet savanna, deciduous forest, sedge meadow, and wet meadow
Surrounding land uses: The majority of the surrounding land is used for row-crop agriculture; however there are also some significant areas of floodplain forest, wet meadow, and sedge meadow in the area.

Stream Description and Characterization

TR 800 N crosses Beaver Pond Ditch within the project site. The channel is approximately 4-5 m (13-17 ft) wide, incised approximately 3 m (10 ft), and the substrate is predominantly silt and sand. The channel was bank full of water on May 21; by June 2 the water level had dropped to less than 1 m (3.3 ft). Agricultural land lines the channel in the vicinity of the project area, although some areas of floodplain forest remain within the project area. This channel has been straightened and appeared to be of low quality. The watershed area of the channel in the project area is approximately 33.7 km^2 (13 mi^2).

While the Embarras River nearby downstream of this area was mapped as a class D – Limited aquatic resource, Beaver Pond Ditch within the project area was not mapped (Biological Stream Characterization Work Group 1989). The project area lies within the United States Geological Survey Ohio River hydrologic unit 05120112, Embarras River. The areas of Beaver Pond Ditch and its associated levees are excluded from the soil and vegetation characterizations.

General Soil Characterization

<u>Darwin silty clay, occasionally flooded (Map unit 8071):</u>
Fine, smectitic, mesic Vertic Endoaquolls
11.660 ha (28.811 ac) mapped at site
Poorly drained
Subject to occasional flooding and/or ponding
Apparent high water table at surface January through December
Formed in clayey alluvium on flood plains
Potential for creation of pond reservoir areas: Not limited
100% Darwin and similar soils

<u>Petrolia silty clay loam, occasionally flooded (Map unit 8288):</u>
Fine-silty, mixed, superactive, nonacid, mesic Fluvaquentic Endoaquepts
8.352 ha (20.638 ac) mapped at site
Poorly drained
Subject to occasional flooding and/or ponding
Apparent high water table at surface January through December
Formed in silty alluvium on flood plains

Potential for creation of pond reservoir areas: Somewhat limited due to slight seepage concerns
100% Petrolia and similar soils

Psamments (Map unit 800):
Psamments
1.053 ha (2.601 ac) mapped at site
Not assigned a soil drainage class by the NRCS, but certainly moderately well drained or better
Subject to flooding and/or ponding: Unknown
Apparent high water table: Unknown
Formed in sandy material placed by human activities
Potential for creation of pond reservoir areas: Severely limited due to seepage concerns
100% Psamments and similar soils

Wabash silty clay, occasionally flooded (Map unit 8083):
Fine, smectitic, mesic Cumulic Vertic Endoaquolls
3.710 ha (9.167 ac) mapped at site
Poorly drained
Subject to occasional flooding; not subject to ponding
Apparent high water table at 0.15 m (6 in) January through December
Formed in alluvium on flood plains
Potential for creation of pond reservoir areas: Not limited
100% Wabash and similar soils

Westland clay loam (Map unit 300):
Fine-loamy, mixed, superactive, mesic Typic Argiaquolls
24.870 ha (61.456 ac) mapped at site
Poorly drained
Subject to frequent ponding; not subject to flooding
Apparent high water table at surface January through December
Formed in loess over calcareous sand and gravel outwash on stream terraces
Potential for creation of pond reservoir areas: Very limited due to severe seepage concerns
100% Westland and similar soils

Five Natural Resources Conservation Service (NRCS) soil map units comprised of five soil series account for all of the soils at this site. Four of these series (Darwin, Petrolia, Wabash, and Westland) are poorly drained Aquepts or Aquolls. These are typical floodplain or low terrace soils formed in alluvium. The Darwin and Wabash soils are typically on slightly lower portions of the floodplain than the Petrolia soils, and contain more clay in the control section than Petrolia. Westland soils formed in loess over outwash on low terraces, above the floodplain; these soils contain much more sand than the Darwin, Petrolia, or Wabash soils. All of these four soils formed in areas with primarily forested or herbaceous wetland vegetation, and all of these soils are hydric.

The fifth soil that occurs at this site was mapped by the NRCS as Pits, gravel (which is a non-soil map unit), but has been refined to the generic Psamments soil map unit. This material was placed by human activities when mining for gravel, but since that time there has been soil development enough to form a surface horizon and hence a soil. Psamments are not assigned a soil drainage class by the NRCS, but given the site geography and texture, this soil is certainly moderately well drained or better.

The potential for hydric soil creation is small due to the presence of existing hydric soil at 98% of the site. The only potential area for hydric soil creation is the small area (2.601 ha [1.053 ac]) of Psamments, which are forested and therefore unsuitable for excavation.

General Vegetation Characterization

The plant communities at this site can be described as three main types, agricultural land, mesic floodplain forest, and floodplain forest. The floodplain forest type can be further split into three sub-types, based on the dominant tree species. A brief description of the dominant vegetation of each plant community follows.

Agricultural land:
This plant community is dominated by herbaceous plants (*Alopecurus carolinianus*, *Gratiola neglecta*, *Setaria faberi*, and *Xanthium strumarium*). All these species except *Gratiola neglecta* are typical of highly disturbed areas. *Setaria faberi* is a non-native, non-wetland plant species, all the rest of these species are native hydrophytes with wetland indicator ratings of FAC, FACW, or OBL.

Mesic floodplain forest:
This plant community is dominated by woody plants (*Carya ovata*, *Celtis occidentalis*, and *Quercus palustris*), herbaceous plants, (*Toxicodendron radicans* and *Viola pratincola*), and saplings (*Celtis occidentalis*). These species are fairly typical of moderately disturbed mesic/wet floodplain forests. *Carya ovata* is a non-wetland species, all the rest of these species are hydrophytes with wetland indicator ratings of FAC, FACW, or OBL.

Floodplain forests:
Hackberry-oak-hickory dominant
This plant community is dominated by woody plants (*Carya ovata*, *Celtis occidentalis*, and *Quercus palustris*), herbaceous plants, (*Toxicodendron radicans* and *Viola pratincola*), and saplings (*Celtis occidentalis*). These species are fairly typical of moderately disturbed mesic/wet floodplain forests. *Carya ovata* is a non-wetland species, all the rest of these species are hydrophytes with wetland indicator ratings of FAC, FACW, or OBL.

Silver maple-poison ivy dominant
This plant community is dominated by woody plants (*Acer saccharinum*), herbaceous plants, (*Toxicodendron radicans*), and saplings (*Acer saccharinum*). These species are fairly typical of highly disturbed wet floodplain forests. Both of these species are hydrophytes with wetland indicator ratings of FAC, FACW, or OBL.

Silver maple-buttonbush dominant
This plant community is dominated by woody plants (*Acer saccharinum*) and shrubs (*Cephalanthus occidentalis*). These species are fairly typical of moderately disturbed wet floodplain forests. Both of these species are hydrophytes with wetland indicator ratings of FAC, FACW, or OBL.

General Hydrology Characterization

This is a brief description only; for an exhaustive treatment see the ISGS report for this site.
Inputs: Precipitation, sheet flow from surrounding uplands, and occasional overflow from Beaver Pond Ditch
Outputs: Evapotranspiration, groundwater recharge, and sheet flow into Beaver Pond Ditch
Ponded areas: Multiple areas scattered across all plant communities during both site visits
Hydrologic alterations apparent: Beaver Pond Ditch has been channelized and has water level maintained by large pumps located just off-site to the south, also many ditched areas and possible some subsurface drainage tile
General description of topography: Predominantly flat floodplain/low terrace area
Elevation: 125-128 m (410-420 ft) AMSL
Apparent water table depth: At surface across entire site during May 21 site visit; ranging from surface to >0.48 m (19 in) at time of June 2 site visit

Summary of Potential for Wetland Creation:

With the exception of the 1.053 ha (2.601 ac) mapped as Psamments, the soils at this entire site are suitable for wetland creation, restoration, and preservation. The vegetation across the entire XXX ha (YYY ac) site is dominated by hydrophytes, and is suitable for wetland creation, restoration, and preservation. There were some indicators of wetland hydrology located across the site (except for the 1.053 ha (2.601 ac) site 4), but there is a question whether the site will be able to meet the measured wetland hydrology criteria (Steve Benton, ISGS, pers. comm.). All areas that are currently agricultural land should be suitable for wetland creation and restoration, provided the wetland hydrology criterion can be met.

Wetland Site Summaries:

1. This floodplain forest is located in three areas, one on the eastern edge of the southern 80 acres, and two in the northeast portion of the northern 40 acres, on both sides of Beaver Pond Ditch. Approximately 12.776 ha (31.570 ac) of this site are included within the project limits. Dominant hydrophytic vegetation, hydric soils, and wetland hydrology are present; therefore, we determined that this site is a wetland. This site is identified in the NWI as a temporarily flooded, broad-leaved deciduous, forested, palustrine wetland (PFO1A). The FQI for this site is 27.8, and the $\bar{c}$ is 3.3. These values indicate good natural quality, and this site can be considered a botanical asset. This wetland provides surface water storage and good quality wildlife habitat. This site requires IEPA Case Specific Water Quality Certification due to the presence of *Betula nigra* (river birch), *Carya glabra* (pignut hickory), *Carya illinoensis* (pecan), *Carya laciniosa* (kingnut hickory), *Carya ovata* (shagbark hickory), *Quercus bicolor* (swamp white oak), *Quercus lyrata* (overcup oak), *Quercus macrocarpa* (bur oak), and *Quercus palustris* (pin oak).

2. This floodplain forest is located in two areas, both north and south of CR 800 N and immediately east of Beaver Pond Ditch. Approximately 1.748 ha (4.320 ac) of this site are included within the project limits. Dominant hydrophytic vegetation, hydric soils, and wetland hydrology are present; therefore, we determined that this site is a wetland. This site is identified in the NWI as a temporarily flooded, broad-leaved deciduous, forested, palustrine wetland (PFO1A). The FQI for this site is 19.2, and the $\bar{c}$ is 3.7. These values indicate good natural quality, and this site can be considered a botanical

asset. This wetland provides surface water storage and good quality wildlife habitat. This site requires IEPA Case Specific Water Quality Certification due to the presence of *Cephalanthus occidentalis* (buttonbush), *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), *Quercus bicolor* (swamp white oak), *Quercus macrocarpa* (bur oak), and *Quercus palustris* (pin oak).

3. This floodplain forest is located beginning immediately east of the levee on the western edge of the site. Approximately 6.675 ha (16.493 ac) of this site are included within the project limits. Dominant hydrophytic vegetation, hydric soils, and wetland hydrology are present; therefore, we determined that this site is a wetland. This site is identified in the NWI as temporarily flooded, broad-leaved deciduous, forested, palustrine wetland (PFO1A). The FQI for this site is 12.1, and the $\bar{c}$ is 3.1. These values indicate moderate natural quality. This wetland provides surface water storage and moderate quality wildlife habitat. This site requires IEPA Case Specific Water Quality Certification due to the presence of *Betula nigra* (river birch), *Cephalanthus occidentalis* (buttonbush), and *Quercus palustris* (pin oak).

Non-wetland Site Summaries:

4. This mesic floodplain forest is located beginning immediately southeast of the northwestern corner of the site. Approximately 1.053 ha (2.601 ac) of this site are included within the project limits. While dominant hydrophytic vegetation is present, hydric soils and wetland hydrology are absent; therefore, we determined that this site is not a wetland. This site is identified in the NWI as temporarily flooded, broad-leaved deciduous, forested, palustrine wetland (PFO1A). The FQI for this site is 14.4, and the $\bar{c}$ is 3.0. These values indicate moderate natural quality. This site provides moderate quality wildlife habitat.

5. This agricultural land is located beginning immediately southeast of the northwestern corner of the site. Approximately 27.399 ha (67.678 ac) of this site are included within the project limits. Although dominant hydrophytic vegetation, hydric soils, and wetland hydrology are present, this site is currently under agricultural cultivation and is under NRCS jurisdiction; therefore, we determined that this site is not a wetland. This site is identified in the NWI as upland (U). The FQI and the $\bar{c}$ were not calculated for this site, due to the current agricultural land use. This site provides low quality wildlife habitat.

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ROUTINE ONSITE WETLAND DETERMINATION
Site 1 (page 1 of 5)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Floodplain forest
Legal Description: W/4, NW/4, NW/4, and E/2, NE/4, NW/4 sec. 22, and SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Three areas, one on the eastern edge of the southern 80 acres, and two in the northeast portion of the northern 40 acres, on both sides of Beaver Pond Ditch.

Are climatic/hydrologic conditions typical for time of year? Yes: X No:
Do normal environmental conditions exist at this site? Yes: X No:
Has the vegetation, soil, or hydrology been significantly disturbed? Yes: No: X

VEGETATION

Dominant Plant Species	Indicator Status	Stratum
1. *Carya ovata*	FACU	tree
2. *Celtis occidentalis*	FAC-	tree
3. *Quercus palustris*	FACW	tree
4. *Celtis occidentalis*	FAC-	sapling
5. *Toxicodendron radicans*	FAC+	herb
6. *Viola pratincola*	FAC	herb

Percentage of dominant species that are OBL, FACW, or FAC: 83%

Hydrophytic vegetation: Yes: X No:
Rationale: More than 50% of the dominants are OBL, FACW, or FAC.

SOILS (2 main soil types present, both hydric)
Series and phase: Westland clay loam (Southeastern portion of site)
Drainage Class: Poorly drained Taxonomy: Typic Argiaquoll
Profile Description:

Depth (inches)	Matrix Color	Redox Features Color	Percent	Type	Texture	Remarks
0-8	10YR 4/1	10YR 3/4	3%	Conc.	CL	
8-28+	10YR 5.5/1	10YR 5/6	25%	Conc.	CL/L	

Hydric soils: Yes: X No:
Rationale: This soil meets NRCS hydric soil indicator F3 – Depleted matrix.

ROUTINE ONSITE WETLAND DETERMINATION
Site 1 (page 2 of 5)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Floodplain forest
Legal Description: W/4, NW/4, NW/4, and E/2, NE/4, NW/4 sec. 22, and SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Three areas, one on the eastern edge of the southern 80 acres, and two in the northeast portion of the northern 40 acres, on both sides of Beaver Pond Ditch.

SOILS (Continued)
Series and phase: Wabash silty clay (Northwestern portion of site)
Drainage Class: Poorly drained Taxonomy: Cumulic Vertic Endoaquoll
Profile Description:

Depth (inches)	Matrix Color	Redox Features Color	Percent	Type	Texture	Remarks
0-17	10YR 3/1	10YR 5/6	5%	Conc.	SIC	
17-25+	N 3/ & 4/	10YR 5/6	10%	Conc.	SIC/SICL	

Hydric soils: Yes: X No:
Rationale: This soil meets NRCS hydric soil indicator F6 – Redox dark surface.

HYDROLOGY
Landform: Floodplain Local Relief: Level to concave
Inundated: Yes: X (In part) No: Depth of standing water: <0.08 m (3 in)
Depth to saturated soil: At surface
Overview of hydrological flow through the system: Primary hydrologic inputs to this site are precipitation, surface runoff from surrounding uplands, and rare overflow from Beaver Pond Ditch. Evapotranspiration, groundwater recharge, and flow into the channel are the major hydrologic outputs.
Size of watershed: Approximately 33.7 km^2 (13 mi^2).
Primary indicators: Surface water (in spots), high water table, saturation, water marks, drift deposits, and water-stained leaves.
Secondary indicators: FAC-Neutral Test
Wetland hydrology: Yes: X No:
Rationale: Field evidence indicates that the site is flooded or saturated for a sufficient period during the growing season to meet the wetland hydrology criterion.

ROUTINE ONSITE WETLAND DETERMINATION

Site 1 (page 3 of 5)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Floodplain forest
Legal Description: W/4, NW/4, NW/4, and E/2, NE/4, NW/4 sec. 22, and SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Three areas, one on the eastern edge of the southern 80 acres, and two in the northeast portion of the northern 40 acres, on both sides of Beaver Pond Ditch.

WETLAND DETERMINATION AND RATIONALE

Is the site a wetland? Yes: X No:

Rationale: Dominant hydrophytic vegetation, hydric soils, and wetland hydrology are present; therefore, we determined that this site is a wetland. This site is identified in the NWI as a temporarily flooded, broad-leaved deciduous, forested, palustrine wetland (PFO1A). This site requires IEPA Case Specific Water Quality Certification due to the presence of *Betula nigra* (river birch), *Carya glabra* (pignut hickory), *Carya illinoensis* (pecan), *Carya laciniosa* (kingnut hickory), *Carya ovata* (shagbark hickory), *Quercus bicolor* (swamp white oak), *Quercus lyrata* (overcup oak), *Quercus macrocarpa* (bur oak), and *Quercus palustris* (pin oak).

SPECIES LIST

Scientific name	Common name	Stratum	Wetland indicator status	Coefficient of conservatism#
Acer negundo	box elder	tree, sapling, shrub	FACW-	1
Acer rubrum	red maple	tree	FAC	5
Acer saccharinum	silver maple	tree, sapling, shrub	FACW	1
Allium canadense	wild garlic	herb	FACU	2
Ambrosia artemisiifolia	common ragweed	herb	FACU	0
Ambrosia trifida	giant ragweed	herb	FAC+	0
Amorpha fruticosa	false indigo bush	shrub	FACW+	6
Anemone virginiana	tall anemone	herb	UPL	4
Arisaema dracontium	green dragon	herb	FACW	4
Asimina triloba	paw-paw	tree, sapling, shrub	FAC	4
Aster ontarionis	Ontario aster	herb	FAC	4
Aster simplex	panicled aster	herb	FACW	3
Betula nigra	river birch	tree	FACW	4
Campsis radicans	trumpet creeper	shrub, vine, herb	FAC	2
Carex grayi	bur sedge	herb	FACW+	6
Carex muskingumensis	sedge	herb	OBL	6
Carex spp.	sedges	herb	-----	--
Carya glabra	pignut hickory	tree, sapling	FACU	5
Carya illinoensis	pecan	tree, shrub	FACW	6
Carya laciniosa	kingnut hickory	tree	FACW	7
Carya ovata	shagbark hickory	tree, sapling, shrub	FACU	4
Celtis occidentalis	hackberry	tree, sap, shrub, herb	FAC-	3

Species list continued on next page

ROUTINE ONSITE WETLAND DETERMINATION
Site 1 (page 4 of 5)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Floodplain forest
Legal Description: W/4, NW/4, NW/4, and E/2, NE/4, NW/4 sec. 22, and SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Three areas, one on the eastern edge of the southern 80 acres, and two in the northeast portion of the northern 40 acres, on both sides of Beaver Pond Ditch.

SPECIES LIST (Cont.)

Scientific name	Common name	Stratum	Wetland indicator status	Coefficient of conservatism#
Cercis canadensis	eastern redbud	tree, sapling	FACU	3
Chenopodium album	lamb's quarters	herb	FAC-	*
Cinna arundinacea	stout wood reed	herb	FACW	5
Commelina virginica	day flower	herb	FACW	5
Cornus drummondii	rough-leaved dogwood	sapling, shrub	FAC	2
Diospyros virginiana	persimmon	tree, sapling, shrub	FAC	2
Elymus virginicus	Virginia wild rye	herb	FACW-	4
Erigeron annuus	annual fleabane	herb	FAC-	1
Fraxinus pennsylvanica	green ash	tree, sapling, shrub	FACW	2
Galium aparine	annual bedstraw	herb	FACU	0
Gleditsia triacanthos	honey locust	tree, sapling, shrub	FAC	2
Gymnocladus dioica	Kentucky coffeetree	tree	UPL	6
Impatiens capensis	jewelweed	herb	FACW	2
Iris shrevei	southern blue flag	herb	OBL	5
Juglans nigra	black walnut	tree	FACU	4
Laportea canadensis	wood nettle	herb	FACW	2
Lindera benzoin	spicebush	shrub	FACW-	5
Liquidambar styraciflua	sweet gum	tree, sapling, shrub	FACW	6
Lysimachia ciliata	fringed loosestrife	herb	FACW	4
Menispermum canadense	moonseed	herb	FAC	4
Morus alba	white mulberry	tree, sapling, shrub	FAC	*
Morus rubra	red mulberry	tree	FAC-	4
Muhlenbergia frondosa	common satin grass	herb	FACW	3
Onoclea sensibilis	sensitive fern	herb	FACW	5
Oxalis stricta	yellow wood sorrel	herb	FACU	0
Panicum clandestinum	deer-tongue grass	herb	FACW	4
Parthenocissus quinquefolia	Virginia creeper	vine, herb	FAC-	2
Pilea pumila	Canada clearweed	herb	FACW	3
Plantago rugelii	red-stalked plantain	herb	FAC	0
Platanus occidentalis	sycamore	tree	FACW	3
Poa sylvestris	woodland bluegrass	herb	FAC	5
Polygonum punctatum	dotted smartweed	herb	OBL	3
Polygonum scandens	climbing buckwheat	herb	FAC	2
Polygonum virginianum	Virginia knotweed	herb	FAC	3
Populus deltoides	eastern cottonwood	tree	FAC+	2
Quercus bicolor	swamp white oak	tree, sapling	FACW+	7
Quercus lyrata	overcup oak	tree, sapling	OBL	7
Quercus macrocarpa	bur oak	tree, sapling	FAC-	5
Quercus palustris	pin oak	tree, sapling	FACW	4

Species list continued on next page

ROUTINE ONSITE WETLAND DETERMINATION
Site 1 (page 5 of 5)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Floodplain forest
Legal Description: W/4, NW/4, NW/4, and E/2, NE/4, NW/4 sec. 22, and SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Three areas, one on the eastern edge of the southern 80 acres, and two in the northeast portion of the northern 40 acres, on both sides of Beaver Pond Ditch.

SPECIES LIST (Cont.)

Scientific name	Common name	Stratum	Wetland indicator status	Coefficient of conservatism#
Rosa multiflora	multiflora rose	shrub	FACU	*
Rubus pensylvanicus	blackberry	shrub	FAC-	2
Ruellia strepens	smooth ruellia	herb	FAC+	6
Rumex altissimus	pale dock	herb	FACW-	2
Rumex crispus	curly dock	herb	FAC+	*
Salix exigua	sandbar willow	shrub	OBL	1
Salix nigra	black willow	tree	OBL	3
Sassafras albidum	sassafras	tree, sapling, shrub	FACU	2
Senecio glabellus	butterweed	herb	OBL	0
Smilax hispida	bristly greenbrier	vine, herb	FAC	3
Symphoricarpos orbiculatus	coralberry	shrub	FACU	1
Taraxacum officinale	common dandelion	herb	FACU	*
Toxicodendron radicans	poison ivy	shrub, vine, herb	FAC+	1
Ulmus americana	American elm	tree, sapling, shrub	FACW-	5
Verbesina alternifolia	wingstem	herb	FACW	4
Viola pratincola	common blue violet	herb	FAC	1
Vitis riparia	riverbank grape	vine, herb	FACW-	2

Coefficient of Conservatism (Taft et al. 1997) mCv = $\sum C/N$ =236/72 = 3.3
* Non-native species FQI = $\sum C/\sqrt{N}$ = 236/√72 = 27.8

Survey Conducted By: Scott M. Wiesbrook (Soils and Hydrology)
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ROUTINE ONSITE WETLAND DETERMINATION
Site 2 (page 1 of 3)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Floodplain forest
Legal Description: NE/4, NW/4, NW/4, sec. 22, and SE/4, SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Two areas, both north and south of CR 800 N and immediately east of Beaver Pond Ditch.

Are climatic/hydrologic conditions typical for time of year? Yes: X No:
Do normal environmental conditions exist at this site? Yes: X No:
Has the vegetation, soil, or hydrology been significantly disturbed? Yes: No: X

VEGETATION

Dominant Plant Species	**Indicator Status**	**Stratum**
1. *Acer saccharinum*	FACW	tree
2. *Acer saccharinum*	FACW	sapling
3. *Toxicodendron radicans*	FAC+	herb

Percentage of dominant species that are OBL, FACW, or FAC: 100%

Hydrophytic vegetation: Yes: X No:
Rationale: More than 50% of the dominants are OBL, FACW, or FAC.

SOILS

Series and phase: Darwin silty clay
Drainage Class: Poorly drained Taxonomy: Fluvaquentic Vertic Endoaquoll
Profile Description:

Depth (inches)	Matrix Color	Redox Features Color	Percent	Type	Texture	Remarks
0-14	10YR 3/1	10YR 3/4	5%	Conc.	SIC	
14-20+	10YR 4/1	10YR 3/4	5%	Conc.	SIC	

Hydric soils: Yes: X No:
Rationale: This soil meets NRCS hydric soil indicator F6 – Redox dark surface.

ROUTINE ONSITE WETLAND DETERMINATION
Site 2 (page 2 of 3)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Floodplain forest
Legal Description: NE/4, NW/4, NW/4, sec. 22, and SE/4, SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Two areas, both north and south of CR 800 N and immediately east of Beaver Pond Ditch.

HYDROLOGY

Landform: Floodplain Local Relief: Level to concave
Inundated: Yes: X (In part) No: Depth of standing water: <0.30 m (12 in)
Depth to saturated soil: At surface
Overview of hydrological flow through the system: Primary hydrologic inputs to this site are precipitation, surface runoff from surrounding uplands, and rare overflow from Beaver Pond Ditch. Evapotranspiration, groundwater recharge, and flow into the channel are the major hydrologic outputs.
Size of watershed: Approximately 33.7 km^2 (13 mi^2).
Primary indicators: Surface water (in spots), high water table, saturation, water marks, drift deposits, and water-stained leaves.
Secondary indicators: FAC-Neutral Test
Wetland hydrology: Yes: X No:
Rationale: Field evidence indicates that the site is flooded or saturated for a sufficient period during the growing season to meet the wetland hydrology criterion.

WETLAND DETERMINATION AND RATIONALE

Is the site a wetland? Yes: X No:
Rationale: Dominant hydrophytic vegetation, hydric soils, and wetland hydrology are present; therefore, we determined that this site is a wetland. This site is identified in the NWI as a temporarily flooded, broad-leaved deciduous, forested, palustrine wetland (PFO1A). This site requires IEPA Case Specific Water Quality Certification due to the presence of *Cephalanthus occidentalis* (buttonbush), *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), *Quercus bicolor* (swamp white oak), *Quercus macrocarpa* (bur oak), and *Quercus palustris* (pin oak).

ROUTINE ONSITE WETLAND DETERMINATION

Site 2 (page 3 of 3)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Floodplain forest
Legal Description: NE/4, NW/4, NW/4, sec. 22, and SE/4, SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Two areas, both north and south of CR 800 N and immediately east of Beaver Pond Ditch.

SPECIES LIST

Scientific name	Common name	Stratum	Wetland indicator status	Coefficient of conservatism#
Acer saccharinum	silver maple	tree, sapling, shrub	FACW	1
Amorpha fruticosa	false indigo bush	shrub	FACW+	6
Aster ontarionis	Ontario aster	herb	FAC	4
Aster simplex	panicled aster	herb	FACW	3
Bidens frondosa	common beggar's ticks	herb	FACW	1
Campsis radicans	trumpet creeper	shrub, vine, herb	FAC	2
Carex grayi	bur sedge	herb	FACW+	6
Carex muskingumensis	sedge	herb	OBL	6
Carex spp.	sedges	herb	-----	--
Carya glabra	pignut hickory	tree	FACU	5
Carya ovata	shagbark hickory	tree	FACU	4
Celtis laevigata	sugarberry	tree, sapling, shrub	FACW	5
Celtis occidentalis	hackberry	tree, sapling, shrub	FAC-	3
Cephalanthus occidentalis	buttonbush	shrub	OBL	4
Cornus drummondii	rough-leaved dogwood	shrub	FAC	2
Fraxinus pennsylvanica	green ash	tree, sapling, shrub	FACW	2
Gleditsia triacanthos	honey locust	tree	FAC	2
Juglans nigra	black walnut	shrub	FACU	4
Liquidambar styraciflua	sweet gum	tree	FACW	6
Populus deltoides	eastern cottonwood	tree	FAC+	2
Quercus bicolor	swamp white oak	tree, sapling	FACW+	7
Quercus macrocarpa	bur oak	tree	FAC-	5
Quercus palustris	pin oak	tree, sapl, shrub, herb	FACW	4
Saururus cernuus	lizard's tail	herb	OBL	5
Smilax hispida	bristly greenbrier	vine, herb	FAC	3
Toxicodendron radicans	poison ivy	shrub, vine, herb	FAC+	1
Ulmus americana	American elm	tree, sapling, shrub	FACW-	5
Vitis riparia	riverbank grape	vine. herb	FACW-	2

Coefficient of Conservatism (Taft et al. 1997) mCv = ∑C/N =100/27 = 3.7
* Non-native species FQI = ∑C/√N = 100/√27 = 19.2

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ROUTINE ONSITE WETLAND DETERMINATION
Site 3 (page 1 of 3)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Floodplain forest
Legal Description: SW/4, NW/4, NW/4, sec. 22, and W/2, SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Beginning immediately east of the levee on the western edge of the site.

Are climatic/hydrologic conditions typical for time of year? Yes: X No:
Do normal environmental conditions exist at this site? Yes: X No:
Has the vegetation, soil, or hydrology been significantly disturbed? Yes: No: X

VEGETATION

Dominant Plant Species	Indicator Status	Stratum
1. *Acer saccharinum*	FACW	tree
2. *Cephalanthus occidentalis*	OBL	herb

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

SOILS (2 main soil types present, both hydric)
Series and phase: Darwin silty clay (Northern portion of site)
Drainage Class: Poorly drained Taxonomy: Fluvaquentic Vertic Endoaquoll
Profile Description:

Depth (inches)	Matrix Color	Redox Features Color	Percent	Type	Texture	Remarks
0-14	10YR 3/1	10YR 3/4	5%	Conc.	SIC	
14-20+	10YR 4/1	10YR 3/4	5%	Conc.	SIC	

Hydric soils: Yes: X No:
Rationale: This soil meets NRCS hydric soil indicator F6 – Redox dark surface.

Series and phase: Petrolia silty clay loam (Southern portion of site)
Drainage Class: Poorly drained Taxonomy: Fluvaquentic Endoaquept
Profile Description:

Depth (inches)	Matrix Color	Redox Features Color	Percent	Type	Texture	Remarks
0-9	10YR 4/1	10YR 4/3	20%	Conc.	SICL	
9-22+	10YR 6/1	10YR 5/6	40%	Conc.	SICL	

Hydric soils: Yes: X No:
Rationale: This soil meets NRCS hydric soil indicator F3 – Depleted matrix.

ROUTINE ONSITE WETLAND DETERMINATION
Site 3 (page 2 of 3)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Floodplain forest
Legal Description: SW/4, NW/4, NW/4, sec. 22, and W/2, SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Beginning immediately east of the levee on the western edge of the site.

HYDROLOGY

Landform: Floodplain Local Relief: Level to concave
Inundated: Yes: X (Most) No: Depth of standing water: <1.0 m (39 in)
Depth to saturated soil: At surface
Overview of hydrological flow through the system: Primary hydrologic inputs to this site are precipitation, surface runoff from surrounding uplands, and rare overflow from Beaver Pond Ditch. Evapotranspiration, groundwater recharge, and flow into the channel are the major hydrologic outputs.
Size of watershed: Approximately 33.7 km^2 (13 mi^2).
Primary indicators: Surface water (most), high water table, saturation, water marks, drift deposits, inundation visible on aerial imagery, and water-stained leaves.
Secondary indicators: FAC-Neutral Test
Wetland hydrology: Yes: X No:
Rationale: Field evidence indicates that the site is flooded or saturated for a sufficient period during the growing season to meet the wetland hydrology criterion.

WETLAND DETERMINATION AND RATIONALE

Is the site a wetland? Yes: X No:
Rationale: Dominant hydrophytic vegetation, hydric soils, and wetland hydrology are present; therefore, we determined that this site is a wetland. This site is identified in the NWI as a temporarily flooded, broad-leaved deciduous, forested, palustrine wetland (PFO1A). This site requires IEPA Case Specific Water Quality Certification due to the presence of *Betula nigra* (river birch), *Cephalanthus occidentalis* (buttonbush), and *Quercus palustris* (pin oak).

ROUTINE ONSITE WETLAND DETERMINATION

Site 3 (page 3 of 3)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Floodplain forest
Legal Description: SW/4, NW/4, NW/4, sec. 22, and W/2, SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Beginning immediately east of the levee on the western edge of the site.

SPECIES LIST

Scientific name	Common name	Stratum	Wetland indicator status	Coefficient of conservatism#
Acer saccharinum	silver maple	tree, sapling, shrub	FACW	1
Betula nigra	river birch	tree, sapling	FACW	4
Bidens frondosa	common beggar's ticks	herb	FACW	1
Carex grayi	bur sedge	herb	FACW+	6
Carex spp.	sedges	herb	-----	--
Celtis occidentalis	hackberry	shrub	FAC-	3
Cephalanthus occidentalis	buttonbush	shrub	OBL	4
Fraxinus pennsylvanica	green ash	tree, sapling, shrub	FACW	2
Liquidambar styraciflua	sweet gum	tree	FACW	6
Platanus occidentalis	sycamore	tree	FACW	3
Populus deltoides	eastern cottonwood	tree	FAC+	2
Quercus palustris	pin oak	tree	FACW	4
Salix nigra	black willow	tree, sapling, shrub	OBL	3
Toxicodendron radicans	poison ivy	shrub, vine, herb	FAC+	1
Ulmus americana	American elm	tree, sapling, shrub	FACW-	5
Vitis riparia	riverbank grape	vine, herb	FACW-	2

Coefficient of Conservatism (Taft et al. 1997) mCv = $\sum C/N = 47/15 = 3.1$
* Non-native species FQI = $\sum C/\sqrt{N} = 47/\sqrt{15} = 12.1$

Survey Conducted By:

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Brian Wilm (Vegetation and Hydrology)
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1816 South Oak Street
Champaign, Illinois 61820
(217) 265-0368 (Wiesbrook)

ROUTINE ONSITE WETLAND DETERMINATION
Site 4 (page 1 of 3)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Mesic floodplain forest
Legal Description: N/2, SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Beginning immediately southeast of the northwestern corner of the site.

Are climatic/hydrologic conditions typical for time of year? Yes: X No:
Do normal environmental conditions exist at this site? Yes: X No:
Has the vegetation, soil, or hydrology been significantly disturbed? Yes: No: X

VEGETATION

Dominant Plant Species	**Indicator Status**	**Stratum**
1. *Acer negundo*	FACW-	tree
2. *Celtis occidentalis*	FAC-	tree
3. *Acer negundo*	FACW-	sapling
4. *Celtis occidentalis*	FAC-	sapling
5. *Galium aparine*	FACU	herb
6. *Toxicodendron radicans*	FAC+	herb

Percentage of dominant species that are OBL, FACW, or FAC: 83%

Hydrophytic vegetation: Yes: X No:
Rationale: More than 50% of the dominants are OBL, FACW, or FAC.

SOILS
Series and phase: NRCS mapped as Pits, gravel; revised to generic Psamment
Drainage Class: Not assigned (certainly moderately well or better) Taxonomy: Psamment
Profile Description:

Depth (inches)	Matrix Color	Redox Features			Texture	Remarks
		Color	Percent	Type		
0-5	10YR 3/1	N/A	N/A	N/A	S	
5-18+	10YR 4/4 & 10YR 5/3	N/A	N/A	N/A	S	

Hydric soils: Yes: No: X
Rationale: This soil meets none of the NRCS hydric soil indicators.

ROUTINE ONSITE WETLAND DETERMINATION
Site 4 (page 2 of 3)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Mesic floodplain forest
Legal Description: N/2, SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Beginning immediately southeast of the northwestern corner of the site.

HYDROLOGY

Landform: Terrace Local Relief: Level to convex
Inundated: Yes: No: X Depth of standing water: N/A
Depth to saturated soil: >0.46 m (18 in)
Overview of hydrological flow through the system: Primary hydrologic inputs to this site are precipitation and surface runoff from surrounding uplands. Evapotranspiration, groundwater recharge, and flow into the channel are the major hydrologic outputs.
Size of watershed: Approximately 33.7 km^2 (13 mi^2).
Primary indicators: None
Secondary indicators: None
Wetland hydrology: Yes: No: X
Rationale: Field evidence indicates that the site is not flooded or saturated for a sufficient period during the growing season to meet the wetland hydrology criterion.

WETLAND DETERMINATION AND RATIONALE

Is the site a wetland? Yes: No: X
Rationale: While dominant hydrophytic vegetation is present, hydric soils and wetland hydrology are absent; therefore, we determined that this site is not a wetland. This site is identified in the NWI as a temporarily flooded, broad-leaved deciduous, forested, palustrine wetland (PFO1A).

ROUTINE ONSITE WETLAND DETERMINATION

Site 4 (page 3 of 3)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Mesic floodplain forest
Legal Description: N/2, SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Beginning immediately southeast of the northwestern corner of the site.

SPECIES LIST

Scientific name	Common name	Stratum	Wetland indicator status	Coefficient of conservatism#
Acer negundo	box elder	tree, sapling, shrub	FACW-	1
Acer rubrum	red maple	tree	FAC	5
Acer saccharinum	silver maple	tree, sapling, shrub	FACW	1
Asimina triloba	paw-paw	tree, sapling, shrub	FAC	4
Campsis radicans	trumpet creeper	shrub, vine, herb	FAC	2
Carya ovata	shagbark hickory	tree, sapling, shrub	FACU	4
Celtis laevigata	sugarberry	tree, sapling, shrub	FACW	5
Celtis occidentalis	hackberry	tree, sapling, shrub	FAC-	3
Cercis canadensis	eastern redbud	tree, sapling, shrub	FACU	3
Diospyros virginiana	persimmon	tree	FAC	2
Galium aparine	annual bedstraw	herb	FACU	0
Gymnocladus dioica	Kentucky coffeetree	tree, sapling	UPL	6
Juglans nigra	black walnut	tree, sapling, shrub	FACU	4
Lindera benzoin	spicebush	shrub	FACW-	5
Maclura pomifera	hedge apple	tree	FACU	*
Menispermum canadense	moonseed	herb	FAC	4
Morus alba	white mulberry	shrub	FAC	*
Muhlenbergia frondosa	common satin grass	herb	FACW	3
Parthenocissus quinquefolia	Virginia creeper	vine, herb	FAC-	2
Platanus occidentalis	sycamore	tree	FACW	3
Smilax hispida	bristly greenbrier	vine, herb	FAC	3
Symphoricarpos orbiculatus	coralberry	shrub	FACU	1
Toxicodendron radicans	poison ivy	shrub, vine, herb	FAC+	1
Ulmus americana	American elm	tree, sapling, shrub	FACW-	5
Vitis riparia	riverbank grape	vine, herb	FACW-	2

Coefficient of Conservatism (Taft et al. 1997) mCv = $\sum C/N$ =69/23 = 3.0
* Non-native species FQI = $\sum C/\sqrt{N}$ = 69/$\sqrt{23}$ = 14.4

Survey Conducted By: Scott M. Wiesbrook (Soils and Hydrology)
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ROUTINE ONSITE WETLAND DETERMINATION
Site 5 (page 1 of 3)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Agricultural land
Legal Description: N/2, NW/4, sec. 22, and SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Three areas comprising all of the agricultural land at the site; one area east of Beaver Pond Ditch, and two west of the ditch, both north and south of CR 800 N.

Are climatic/hydrologic conditions typical for time of year? Yes: X No:
Do normal environmental conditions exist at this site? Yes: X No:
Has the vegetation, soil, or hydrology been significantly disturbed? Yes: No: X

VEGETATION

Dominant Plant Species	Indicator Status	Stratum
1. *Alopecurus carolinianus*	FACW	herb
2. *Gratiola neglecta*	OBL	herb
3. *Setaria faberi*	FACU+	herb
4. *Xanthium strumarium*	FAC	herb

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

SOILS (3 soil types present, all hydric)
Series and phase: Darwin silty clay (Northern portion of west side of site)
Drainage Class: Poorly drained Taxonomy: Fluvaquentic Vertic Endoaquoll
Profile Description:

Depth (inches)	Matrix Color	Redox Features Color	Percent	Type	Texture	Remarks
0-14	10YR 3/1	10YR 3/4	5%	Conc.	SIC	
14-20+	10YR 4/1	10YR 3/4	5%	Conc.	SIC	

Hydric soils: Yes: X No:
Rationale: This soil meets NRCS hydric soil indicator F6 – Redox dark surface.

Series and phase: Petrolia silty clay loam (Southern portion of west side of site)
Drainage Class: Poorly drained Taxonomy: Fluvaquentic Endoaquept
Profile Description:

Depth (inches)	Matrix Color	Redox Features Color	Percent	Type	Texture	Remarks
0-9	10YR 4/1	10YR 4/3	20%	Conc.	SICL	
9-22+	10YR 6/1	10YR 5/6	40%	Conc.	SICL	

Hydric soils: Yes: X No:
Rationale: This soil meets NRCS hydric soil indicator F3 – Depleted matrix.

ROUTINE ONSITE WETLAND DETERMINATION
Site 5 (page 2 of 3)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Agricultural land
Legal Description: N/2, NW/4, sec. 22, and SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Three areas comprising all of the agricultural land at the site; one area east of Beaver Pond Ditch, and two west of the ditch, both north and south of CR 800 N.

SOILS (Continued)
Series and phase: Westland clay loam (Eastern portion of site)
Drainage Class: Poorly drained Taxonomy: Typic Argiaquoll
Profile Description:

Depth (inches)	Matrix Color	Redox Features Color	Percent	Type	Texture	Remarks
0-8	10YR 4/1	10YR 3/4	3%	Conc.	CL	
8-28+	10YR 5.5/1	10YR 5/6	25%	Conc.	CL/L	

Hydric soils: Yes: X No:
Rationale: This soil meets NRCS hydric soil indicator F3 – Depleted matrix.

HYDROLOGY
Landform: Floodplain/low terrace Local Relief: Level to concave
Inundated: Yes: X (In part) No: Depth of standing water: <0.23 m (9 in)
Depth to saturated soil: At surface
Overview of hydrological flow through the system: Primary hydrologic inputs to this site are precipitation, surface runoff from surrounding uplands, and rare overflow from Beaver Pond Ditch. Evapotranspiration, groundwater recharge, and flow into the channel are the major hydrologic outputs.
Size of watershed: Approximately 33.7 km^2 (13 mi^2).
Primary indicators: Surface water (in spots), high water table, saturation, and oxidized rhizospheres on living roots.
Secondary indicators: FAC-Neutral Test
Wetland hydrology: Yes: X No:
Rationale: Field evidence indicates that the site is flooded or saturated for a sufficient period during the growing season to meet the wetland hydrology criterion.

WETLAND DETERMINATION AND RATIONALE
Is the site a wetland? Yes: No: X
Rationale: Although dominant hydrophytic vegetation, hydric soils, and wetland hydrology are present, this site is currently under agricultural cultivation and is under NRCS jurisdiction; therefore, we determined that this site is not a wetland. This site is identified in the NWI as upland (U).

ROUTINE ONSITE WETLAND DETERMINATION

Site 5 (page 3 of 3)

Field Investigators: Wiesbrook, Wilm, and Zercher **Date:** May 21 & June 2, 2009
Sequence No.: 14912 **Project Name:** Lawrence County Wetland Mitigation Bank
State: Illinois **County:** Lawrence **Applicant:** IDOT District 7
Site name: Agricultural land
Legal Description: N/2, NW/4, sec. 22, and SW/4, SW/4, sec. 15 T. 3 N., R. 11 W.
Location: Three areas comprising all of the agricultural land at the site; one area east of Beaver Pond Ditch, and two west of the ditch, both north and south of CR 800 N.

SPECIES LIST

Scientific name	Common name	Stratum	Wetland indicator status	Coefficient of conservatism#

A complete species list was not compiled for this site since it is currently under intensive agricultural management.

Survey Conducted By: Scott M. Wiesbrook (Soils and Hydrology)
Brian Wilm (Vegetation and Hydrology)
University of Illinois - Institute of Natural Resource Sustainability - Illinois Natural History Survey
1816 South Oak Street
Champaign, Illinois 61820
(217) 265-0368 (Wiesbrook)

Lawrence Wetland Mitigation Bank
Mitigation Site Assessment
Lawrence County

Lawrence Wetland Mitigation Bank
Mitigation Site Assessment
INHS-Mapped Soil Map
Lawrence County

Project Site and Soil Map Unit Boundaries
300-Westland clay loam
800-Psamments
8071-Darwin silty clay
8083-Wabash silty clay
8288-Petrolia silty clay loam

0 400 Feet
0 100 Meters

scale 1:4800
1 inch=400 ft

N W E S

06/09

Appendix B: NRCS Wetland Determination

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
2812 West Haven Road
Lawrenceville, IL 62439
Phone: 618.943.2621 Ext 3 Fax: 618.943.5613

RECEIVED
AUG 24 2009
I.D.O.T. - DISTRICT 7

August 18, 2009

Dear USDA Participant:

Per your request we have completed the Wetland Determination.

The non-cropland (woodland) that is adjacent to the Prior Converted (PC) fields is potentially wetlands please do not install perforated tile within 100 feet of the non-cropland (woodland) area. If you would like to tile closer to the woodland please completed a new 1026 request indicating this.

This determination has been conducted for the purpose of implementing the wetland conservation provisions of the Food Security Act of 1985. This determination may not be valid for identifying the Army Corps of Engineers' (COE) Clean Water Act jurisdiction for this site. If you intend to conduct any activity that constitutes a discharge of dredged or fill material into wetlands or other waters, you should request a jurisdictional determination from the local office of the COE prior to starting the work.

Attached you will find an NRCS-CPA-026E and a Map for your records.

If you have any questions please contact the office.

Respectfully,

Jeremy Bennett
District Conservationist
Lawrenceville Field Office (Lawrence and Wabash Counties)

Phone: (618) 943-2621 ext.3
Fax: (618) 943-5613

cc: case file

Appendix B: NRCS Wetland Determination

United States Department of Agriculture

Natural Resources Conservation Service

NRCS-CPA-026E
9/2000

HIGHLY ERODIBLE LAND AND WETLAND CONSERVATION DETERMINATION

Name Address:	Bart Pals 270 CO RD 950 E Jewett, IL 62436	Request Date:	7/14/09	County:	Lawrence
Agency or Person Requesting Determination:	Bart Pals	Tract No:	647	FSA Farm No.:	61

Section I - Highly Erodible Land

Is a soil survey now available for making a highly erodible land determination?	Yes
Are there highly erodible soil map units on this farm?	Yes

Fields in this section have undergone a determination of whether they are highly erodible land (HEL) or not; fields for which an HEL Determination has not been completed are not listed. In order to be eligible for USDA benefits, a person must be using an approved conservation system on all HEL.

Field(s)	HEL(Y/N)	Sodbust(Y/N)	Acres	Determination Date
1	N	N	12.1	8/18/09
2	N	N	13.0	8/18/09
3	N	N	5.7	8/18/09
4	N	N	38.7	8/18/09
	-	-		

The Highly Erodible Land determination was completed in thefield .

Section II - Wetlands

Are there hydric soils on this farm?	Yes

Fields in this section have had wetland determinations completed. See the Definition of Wetland Label Codes for additional information regarding allowable activities under the wetland conservation provisions of the Food Security Act and/or when wetland determinations are necessary to determine USDA program eligibility.

Field(s)	Wetland Label*	Occurrence Year (CW)**	Acres	Determination Date	Certification Date
1	PC		12.1	8/18/09	8/18/09
2	PC		13.0	8/18/09	8/18/09
3	PC		5.7	8/18/09	8/18/09
4	PC		38.7	8/18/09	8/18/09
	-				

The wetland determination was completed in the -Field It was -mailed to the person on 8/18/09.

Remarks: If you tile the Prior Converted Cropland (PC) fields please do not install perforated tile within 100 feet of the Woodland area because the woodland is a potential wetland.

This wetland determination was completed only for the specific area(s) or field(s) listed above. Other wetlands may occur on this tract. Please request a determination for other areas before clearing, draining or performing other activities that may impact or cause a conversion of wetlands.

I certify that the above determinations are correct and were conducted in accordance with policies and procedures contained in the National Food Security Act Manual.

Signature Designated Conservationist	Date
Jerry B. Bennett	8/18/09

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To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice or TDD). USDA is an equal opportunity provider and employer.

COPY

Appendix B: NRCS Wetland Determination

***DEFINITIONS OF WETLAND LABEL CODES**

AW	Artificial Wetland. An area that is artificial or irrigation induced wetland. These wetlands are not subject to the wetland conservation provision.
AW/FW	An area that contains both AW and FW.
AW/W	An area that contains both AW and W.
CC	Commenced Conversion exemption.
CPD	Corps Permit Decision. Corps of Engineers permit decisions regarding section 404 of the Clean Water Act will be relied upon to satisfy the wetland conservation provisions of the Food Security Act of 1985, as amended.
CMW	An area that receives a Categorical Minimal Effect determination.
CW	Converted Wetlands. An area converted between December 23, 1985 and November 28, 1990. IN any year that an agricultural commodity is planted on these converted wetlands, you will ineligible for USDA benefits.
**CW+year	An area converted after November 28, 1990. You will be ineligible for USDA program benefits until this wetland is restored.
CWNA	Converted Wetland Non-Agricultural use. A wetland area converted to other than agricultural commodity production.
CWTE	Converted Wetland Technical Error. An area converted or commenced based on an incorrect NRCS determination or misinformation from a NRCS or FSA employee.
FW	Farmed Wetland. An area that is farmed wetland; was manipulated and planted before December 23, 1985, but still meets wetland criteria. These may be farmed and maintained in the same manner as long as they are not abandoned.
FWP	Farmed Wetlands Pasture. An area that is pasture or hayland, manipulated before December 23, 1985 but still meets wetland criteria. These may be farmed and maintained in the same manner as long as they are not abandoned.
MIW	Mitigation Wetlands. Wetlands on which a person is actively mitigating a frequently cropped area or a wetland converted between December 23, 1985 and November 28, 1990. A converted wetland, farmed wetland, or farmed wetland pasture on which functions and values were lost are compensated for through wetland restoration, enhancement or creation.
MW	Minimal effect Wetland. An area determined to be minimal effect. These wetlands are to be farmed according to the minimal-effect agreement signed at the time the minimal-effect determination was made,
MWM	An area determined to be minimal effect with mitigation.
NI	Not Inventoried – No wetland determination has been completed.
NW	Non-Wetland. An area that does not contain a wetland.
NW/NAD	An area determined to be a non-wetland resulting from a decision from the National Appeals Division.
OW	Other Waters of the U.S. Area that fall under the jurisdiction of the Clean Water Act.
PC	Prior Converted cropland, which was drained filled, or manipulated before December 23, 1985; was cropped prior to December 23, 1985; was not abandoned; and does not meet FW criteria. These are not subject to the wetland conservation provision unless the area reverts to wetland as a result of abandonment.
PC/NW	An area that contains both PC and NW.
TP	Third Party Exemption.
W	Wetlands. An area meeting wetland criteria, including wetland farmed under natural conditions. If you plan to clear, drain, fill, level or manipulate these areas, contact NRCS and the Army Corp of Engineers prior to any such activity.
WX	A wetland area that has been manipulated after December 23, 1985, but was not, for the purpose of making production possible and production was not made possible. These include wetlands manipulated by drainage maintenance agreements.

COPY

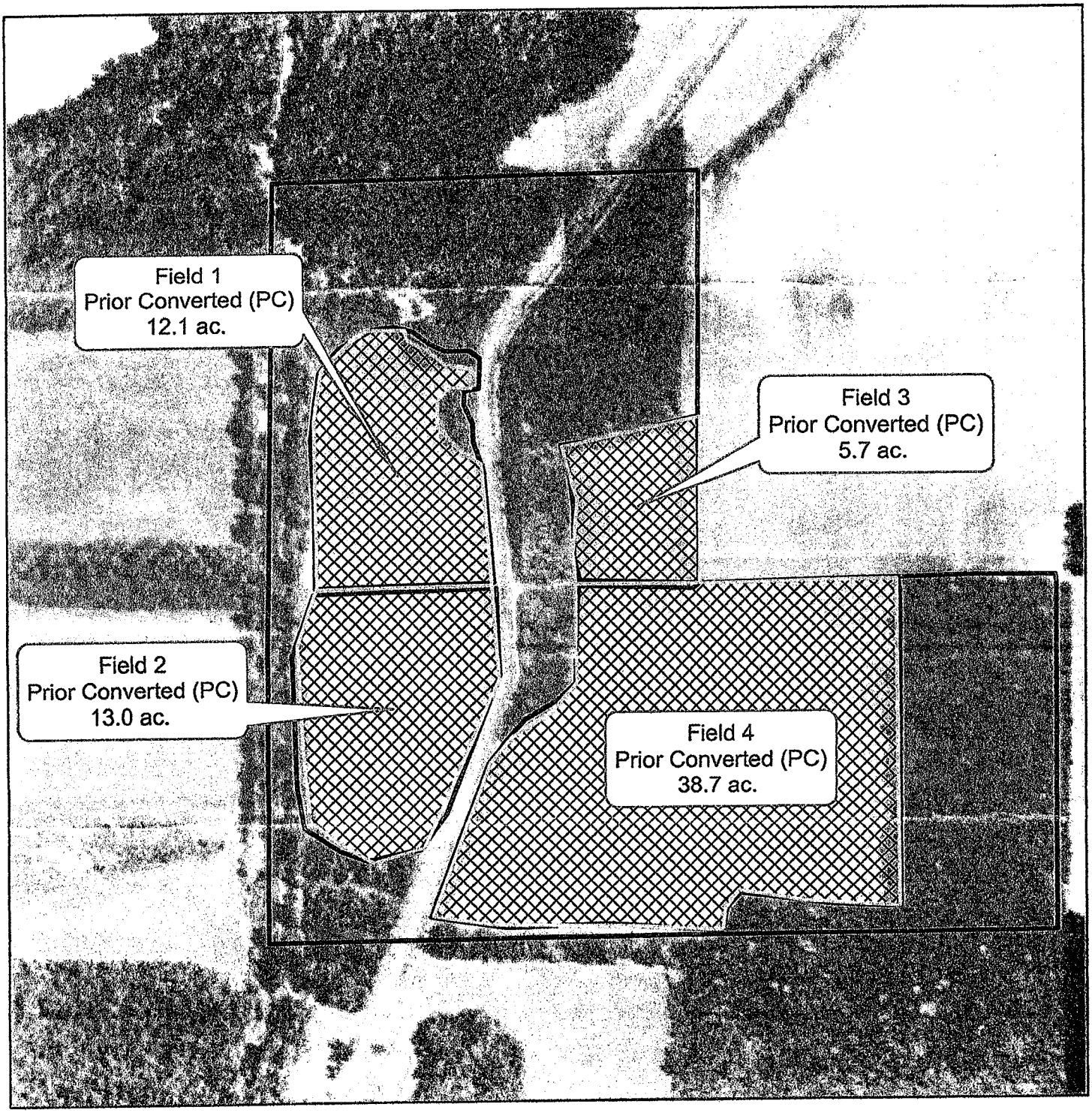
Determination MAP

Customer(s): BART C PALS

District: LAWRENCE COUNTY SOIL & WATER CONSERVATION DISTRICT

Field Office: LAWRENCEVILLE SERVICE CENTER

Map prepared by Jeremy Bennett



Legend

Prior Converted (PC)

T 647

300 0 300 600 900 1,200 Feet

N

Agency: NRCS

Date: 8/18/2009

LAWRENCE COUNTY PROPOSED WETLAND MITIGATION BANK: HYDROGEOLOGIC CHARACTERIZATION REPORT

County Road 800N and 1500E
Lawrence County, Illinois
(Sequence # 14912)

Steven E. Benton
Geoffrey E. Pociask
Wetlands Geology Section

Illinois State Geological Survey
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Submitted Under Contract No. IDOT 2011-05575
Illinois Department of Transportation
Bureau of Design and Environment, Wetlands Unit
2300 South Dirksen Parkway
Springfield, IL 62764

December 1, 2011

Illinois State Geological Survey
Open File Series 2011–4

EXECUTIVE SUMMARY

In July 2009, the Illinois Department of Transportation tasked the Wetlands Geology Section of the Illinois State Geological Survey with conducting a hydrogeologic characterization of the potential wetland mitigation bank site in Lawrence County, Illinois. Data collected were analyzed to determine the geology and hydrology of the site and to determine if wetland hydrology could be restored or created. Field work at this site began in November 2009 with the installation of a network of monitoring wells, staff gauges, and data loggers.

This site has a total area of 29.6 ha (73.1 ac); 13.3 ha (32.8 ac) have been delineated as wetland and 16.3 ha (40.3 ac) have been delineated as non-wetland. Of the non-wetland portion of the site, 12.1 ha (29.9 ac), consisting of agricultural fields, are available for wetland restoration/creation. The site is mostly mapped as hydric soils, including the 12.1 ha (29.9 ac) that is currently available for wetland restoration/creation. There are three reversible hydrologic alterations on the site, two culverts and a drain tile. The primary water source supporting wetland hydrology is flooding from Beaver Pond Ditch. Flooding occurs regularly before the start of pumping in Beaver Pond Ditch, which begins in March or April and ends in October. Reversing the hydrologic alterations and excavating portions of the agricultural fields in order to trap flood waters and lengthen the period of inundation will likely result in inundation and/or saturation during the non-pumping portion of the growing season (late February through March) for periods sufficient to satisfy criteria for jurisdictional wetland hydrology.

TABLE OF CONTENTS

INTRODUCTION 1

SUMMARY AND CONCLUSIONS 1

WETLAND RESTORATION/CREATION RECOMMENDATIONS 5
- West of Beaver Pond Ditch 5
- East of Beaver Pond Ditch 5

METHODS 8

SITE CHARACTERIZATION 11
- Geographic Setting 11
- Geology 11
- Soils 13
- Wetlands 15
- Hydrology 16
  - *Precipitation and Evapotranspiration* 16
  - *Surface Water* 16
  - *Groundwater* 20
  - *Hydrologic Alterations* 21
  - *Effect of Pumping* 28
  - *Wetland Hydrology* 28

CONCLUSIONS 31

ACKNOWLEDGMENTS 32

REFERENCES 33

APPENDIX A: Depth to Groundwater 36

APPENDIX B: Water-level Elevations 38

APPENDIX C: Well Construction Information 40

APPENDIX D: NWI Wetland Determination 41

APPENDIX E: NRCS Wetland Determination 42

APPENDIX F: Photographs of flooding at the proposed wetland bank 46

FIGURES

Figure 1: Location of proposed Lawrence County Wetland Mitigation Bank site 2
Figure 2: Existing habitats delineated by the Illinois Natural History Survey 3
Figure 3: Existing hydrologic alterations 4
Figure 4: Soil map 6
Figure 5: Planned hydrologic modifications 7
Figure 6: Monitoring network and elevation contours 9
Figure 7: Geologic cross-section 12
Figure 8: Quaternary deposits of Lawrence County 14
Figure 9: Monthly precipitation during the monitoring period 17
Figure 10: Monthly potential evapotranspiration 18
Figure 11: Embarras River stage, Beaver Pond stage, and on-site surface-water depth 19
Figure 12: Groundwater elevations in monitoring wells west of Beaver Pond Ditch 22
Figure 13: Depth to groundwater in monitoring wells west of Beaver Pond Ditch 23
Figure 14: Groundwater elevations in monitoring wells east of Beaver Pond Ditch 24
Figure 15: Depth to groundwater in monitoring wells east of Beaver Pond Ditch 25
Figure 16: Groundwater contour and flow map 26
Figure 17: Estimated area of jurisdictional wetland hydrology in 2010 29
Figure 18: Estimated area of jurisdictional wetland hydrology in 2011 30

TABLES

Table 1: Hydrologic properties of on-site soil types (Soil Survey Staff 2009) 15
Table 2: Days per month Embarras River at Lawrenceville, Illinois was at or above action stage 21
Table 3: Climate statistics 31

INTRODUCTION

This report was prepared by the Illinois State Geological Survey (ISGS) to provide the Illinois Department of Transportation (IDOT) with conclusions regarding the hydrogeologic conditions at a potential wetland mitigation bank near Lawrenceville, Illinois in Allison Township (SW ¼, SW ¼, Section 15, and the W ½, NW ¼, NW ¼, Section 22, T3N, R11W), Lawrence County, Illinois (Figure 1). The area of the site is about 29.6 ha (73.1 ac). Portions of the site are currently used for agriculture and the remainder is forested.

The purpose of this report is to provide IDOT with data regarding the hydrogeologic conditions of the site and to make recommendations regarding restoration and/or creation of wetlands. Therefore, for convenience, the report presents conclusions and design recommendations first, followed by a discussion of the methods and supporting data. The supporting data include groundwater and surface-water data, and precipitation data collected from November 2009 through May 2011, and geologic data collected during the installation of monitoring wells.

Data collection at the site is ongoing and will continue until terminated by IDOT. The data currently being collected will be used to compare the pre- and post-construction hydrology of the site and to determine the impact of restoration/creation activities on the area and the duration of wetland hydrology.

SUMMARY AND CONCLUSIONS

The following factors indicate that the potential for wetland restoration and creation at this site is **MODERATE**:

- A detailed on-site wetland determination, conducted by the INHS (Weisbrook, et al. 2009), delineated a total of 13.3 ha (32.8 ac) of wetlands at the site (Figure 2, sites 1, 2, and 3). The remainder, totaling 16.3 ha (40.3 ac), was delineated as non-wetland, and consisted of agricultural fields (site 5), levees and berms along Beaver Pond Ditch (site 0), and a portion of the forest west of Beaver Pond Ditch (site 4). The agricultural fields, totaling 12.1 ha (29.9 ac), are available for wetland restoration and/or creation.

- The primary water source supporting wetland hydrology at this site is inundation due to backflooding of Beaver Pond Ditch as the result of flooding on the Embarras River. Flood frequency analysis reveals that flooding on the Embarras River most often occurs in the months of February through May.

- Pumping of Beaver Pond Ditch by the Consolidated Drainage District starts about mid-March and ends in October or November. Despite this pumping, wetlands exist on the site because wetland hydrology criteria can be satisfied by floods that occur after the growing season begins, but before the site is ordinarily pumped for farming. Therefore, wetlands likely can be created or restored despite the continued presence of the ditch and pump.

- The hydrology of the site has been altered regionally, locally, and on-site (Figure 3). The regional hydrologic alteration is the Russell-Allison Levee, and the local alterations are Beaver Pond Ditch, a pumping station in the ditch, and two gravity drains with flapper gates in the ditch that pass through the levee. On-site alterations include

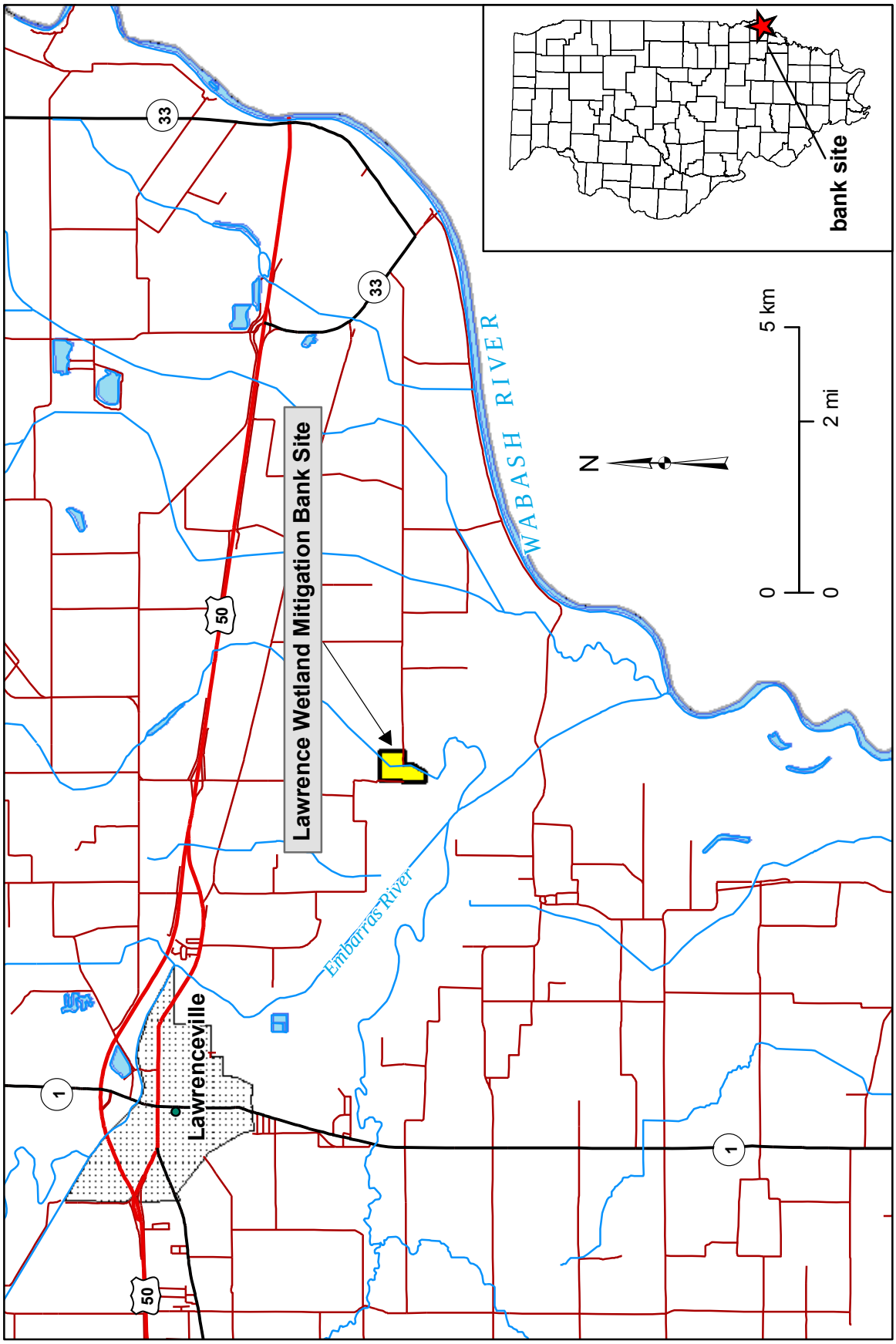

Figure 1. Location of the proposed Lawrence Wetland Mitigation Bank site (highlighted in yellow). The site is located southeast of the city of Lawrenceville and is within the Embarras River watershed in southeastern Lawrence County, IL.

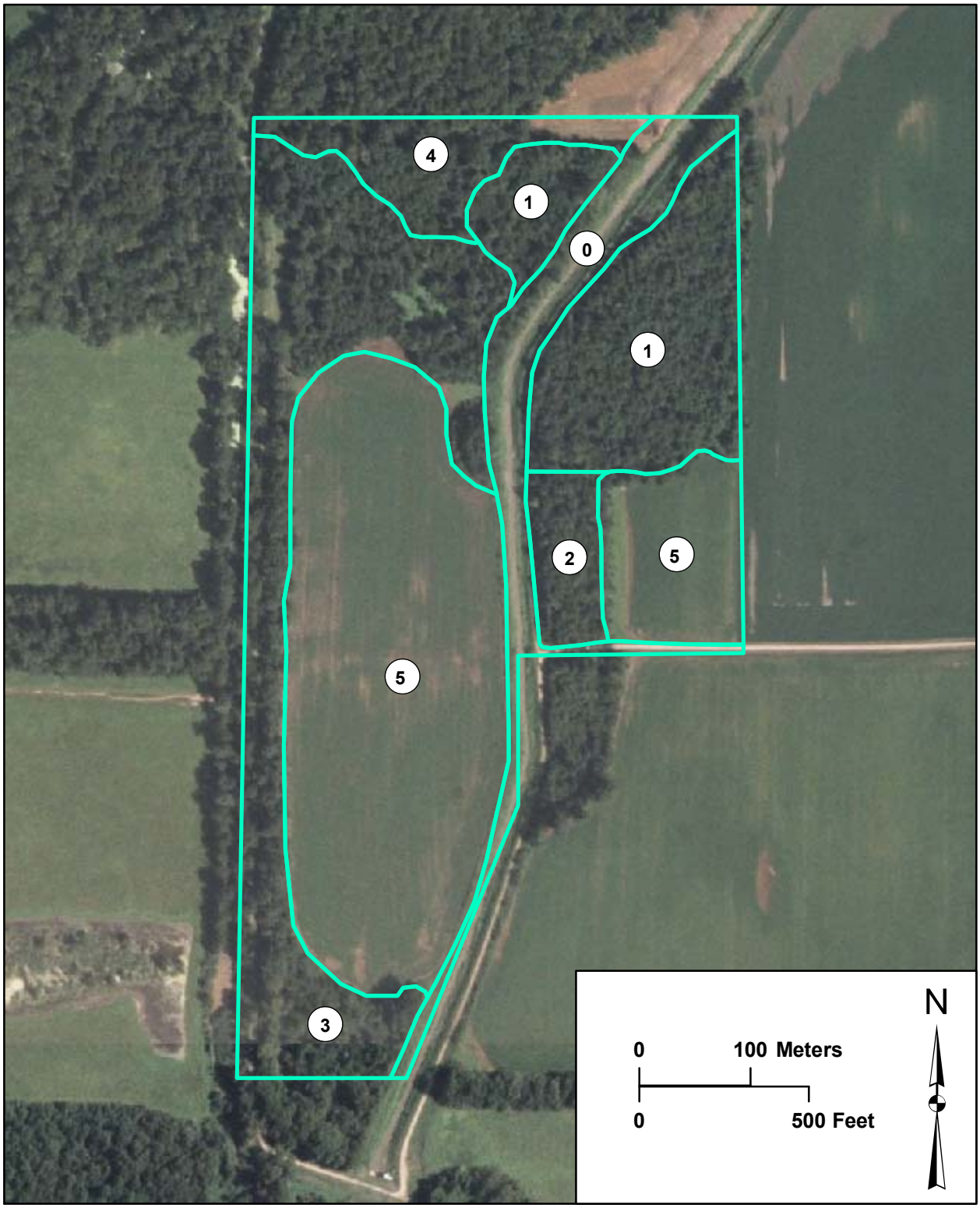

Figure 2. Exisitng habitats delineated by the Illinois Natural History Survey (Weisbrook et al. 2009). Map based on 2009 National Agricultural Imagery Program aerial photography (U.S. Department of Agriculture 2010).

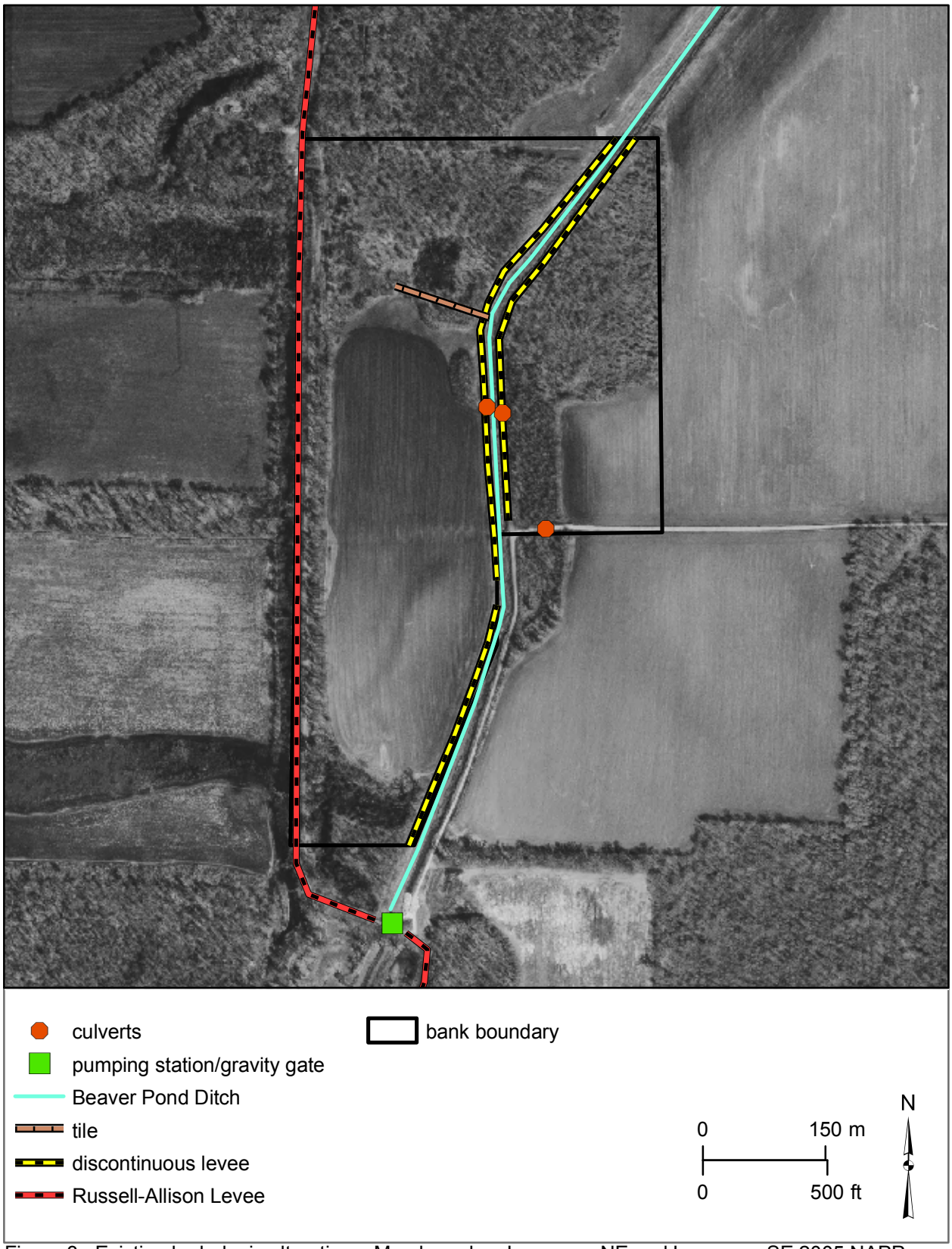

Figure 3. Existing hydrologic alterations. Map based on Lawernce NE and Lawrence SE 2005 NAPP digital othophoto quarter quadrangles (Illinois State Geological Survey 2006).

culverts in both banks of Beaver Pond Ditch, a drain tile in the forest north of the west field, and a discontinuous berm along Beaver Pond Ditch.

- It is not feasible to reverse the regional or local hydrologic alterations in order to restore wetland hydrology. Flooding of the site by the Embarras and Wabash Rivers was the primary water source supporting past wetland hydrology, but the regional levee and the local drainage system currently serves to protect and drain most of the surrounding floodplain for agriculture. However, the on-site hydrologic alterations can be reversed without affecting off-site properties.

- The agricultural fields did not exhibit wetland hydrology in 2010, a year that received nearly normal precipitation, and therefore are not likely to be wetland at present. This represents 12.1 ha (29.9 ac) of potential mitigation area.

- Almost the entire site is mapped as hydric soil, including the agricultural fields (Figure 4), indicating that most of the site formerly supported wetlands prior to drainage for conversion to agriculture.

- Most of the site is underlain by slowly permeable geologic materials that are conducive to ponding and a seasonal high water table. On-site soil borings show that the sediments are dominantly silty clay, and permeameter tests indicate that the areas mapped as Darwin, Wabash and Petrolia will likely retain surface water for periods of weeks to months. Areas mapped as Westland are more permeable and are less conducive to lengthy inundation and saturation.

WETLAND RESTORATION/CREATION RECOMMENDATIONS

The following alterations (Figure 5) are recommended for restoring or creating wetland on the site.

West of Beaver Pond Ditch

- Remove the culvert that discharges into Beaver Pond Ditch (Figure 5) and replace it with a spillway in order to allow input of floodwaters and retention of surface water. The recommended elevation of the spillway is 124.7 m (409.1 ft), based on recorded water levels in the ditch.

- Remove the drain tile located north of the agricultural field, thereby preventing drainage of the forested area and the northern portion of the agricultural field.

- Excavate about 4.2 ha (10.5 ac) of the agricultural field (Figure 5) to an elevation of 124.5 m (408.8 ft), removing as much as 0.7 m (2.3 ft) of sediment. With a spillway elevation of 124.7 m (409.1 ft), this will result in inundation depths ranging from 0.2 m (0.6 ft) to 0.6 m (1.9 ft) Construct a levee along the bank of Beaver Pond Ditch to an top elevation no lower than 125.0 m (410.1 ft).

East of Beaver Pond Ditch

- Remove the culvert that discharges into Beaver Pond Ditch (Figure 5) and replace it

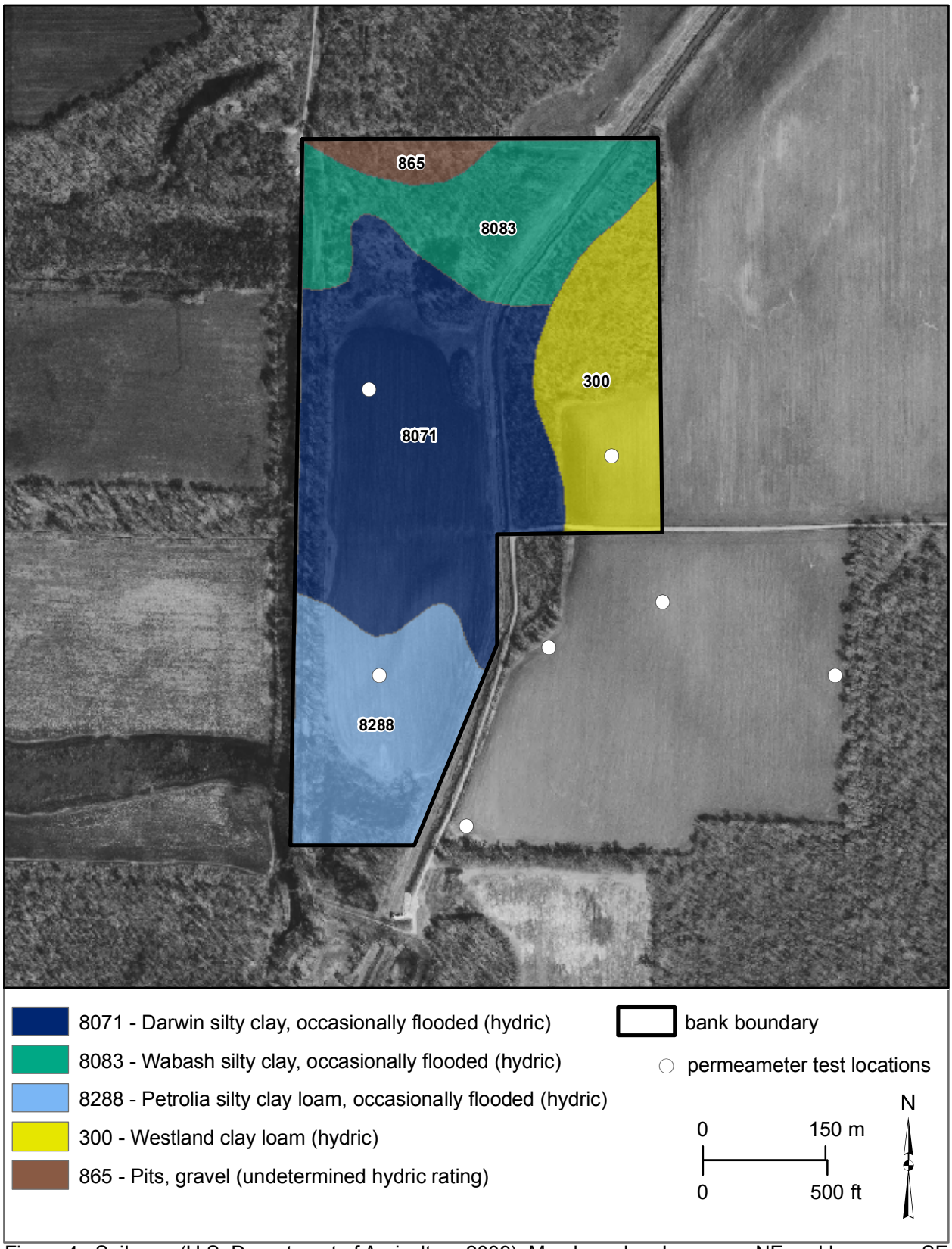

Figure 4. Soil map (U.S. Department of Agriculture 2009). Map based on Lawernce NE and Lawrence SE 2005 NAPP digital othophoto quarter quadrangles (Illinois State Geological Survey 2006).

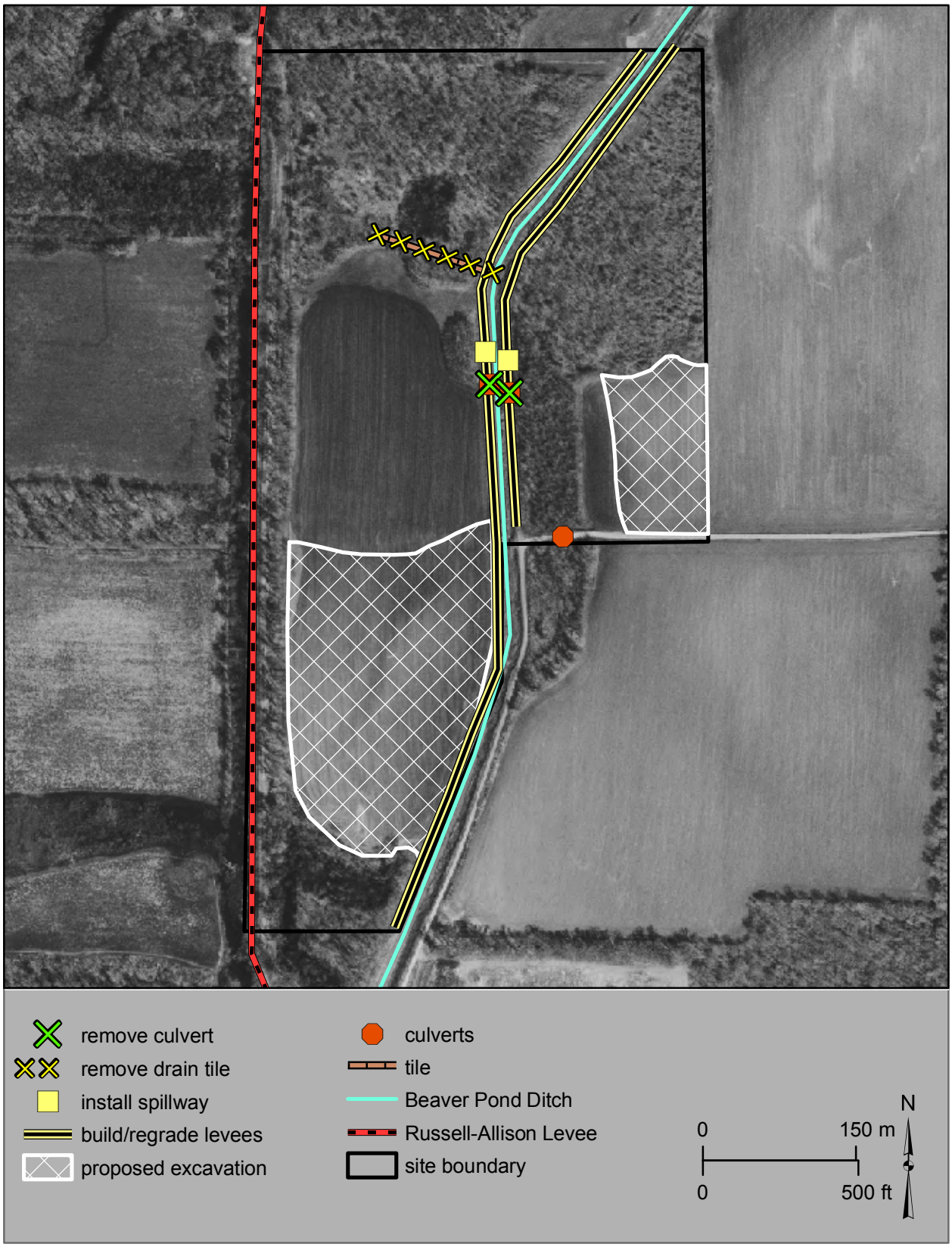

Figure 5. Planned hydrologic modifications. Map based on Lawernce NE and Lawrence SE 2005 NAPP digital othophoto quarter quadrangles (Illinois State Geological Survey 2006).

with a spillway in order to allow the input of floodwaters and retention of surface water. The recommended elevation of the spillway is 124.6 m (408.8 ft), which was chosen in order to maximize the area of inundation, but minimize potential impacts on the road along the southern boundary, which is at an elevation of about 124.8 m (409.5 ft).

- Excavate about 1.4 ha (3.5 ac) of the agricultural field (Figure 5) to an elevation of 124.5 m (408.5 ft), removing as much as 0.4 m (1.3 ft) of sediment. With a spillway elevation of 124.6 m (408.8 ft), this will result in inundation depths ranging from about 0.5 m (1.6 ft) near the spillway to about 0.1 m (0.3 ft) at the eastern boundary of the site. The area proposed for excavation is mapped as Westland clay loam (Figure 4). Permeameter tests in this soil reveal that the saturated hydraulic conductivity is highly variable, and the time for water on ground surface to infiltrate to a depth of 30.0 cm (12.0 in) ranges from 3 days to 1 year.

The invert elevation of the culvert under the east-west road east of Beaver Pond Ditch (Figure 5) is about 124.0 m (406.8 ft), which is lower than the proposed spillway elevation. Land surface elevation in the forested area south of the road (124.3 m [407.9 ft] at well 5S) is also lower than the proposed spillway elevation. Therefore, raising the elevation at which surface-water flows off the site into Beaver Pond Ditch will likely increase area of inundation south of the road, possibly impacting the adjacent farm field. Therefore, assuming the landowner gives permission, it is recommended that, either the elevation of the culvert and the road be raised, or that the culvert be removed, and a new culvert installed that will discharge directly into Beaver Pond Ditch, assuming the landowner agrees to the plan.

METHODS

The hydrology of the site was monitored using a combination of shallow monitoring wells and staff gauges (Figure 6) to evaluate the hydrogeologic conditions and to estimate the area of wetland hydrology. Water levels were measured on a biweekly to weekly basis from March to June and monthly during the remainder of the monitoring period. Groundwater levels were converted to depth-to-water below ground surface (Appendix A) and water-level elevation (Appendix B), but surface-water levels were expressed as elevation only (Appendix B).

Groundwater data were collected from 16 monitoring wells (Figure 6). Details of well construction are in Appendix C. The shallow (S) wells were designed to monitor groundwater within 0.75 m (2.5 ft) of ground surface, and were used to determine the timing and duration of saturation. Depth to groundwater was measured manually in all of the wells, but wells 4S, 7S, and 10S were also equipped with pressure transducers in order provide a more continuous record of groundwater levels. At well 10S, the data were initially recorded in 1-hour intervals, but this was later increased to 3-hour intervals; at wells 4S and 7S the data were all recorded in 3-hour intervals. The barometrically compensated height of the water column in each well was converted to depth-to-water below ground surface and to water-level elevation.

Surface-water data were collected from three staff gauges (Gauges A, B, and C). Gauges A and B were manually read gauges that were installed in areas of the site that are prone to prolonged inundation. Gauge C was a pressure-transducer installed first (November 2009) in Beaver Pond Ditch near the culvert in the west bank of the ditch, and, after it was destroyed by vandals in Fall 2010, replaced with a second pressure-transducer in February 2011, installed in a channel that drains water from the agricultural field west of Beaver Pond Ditch to the culvert

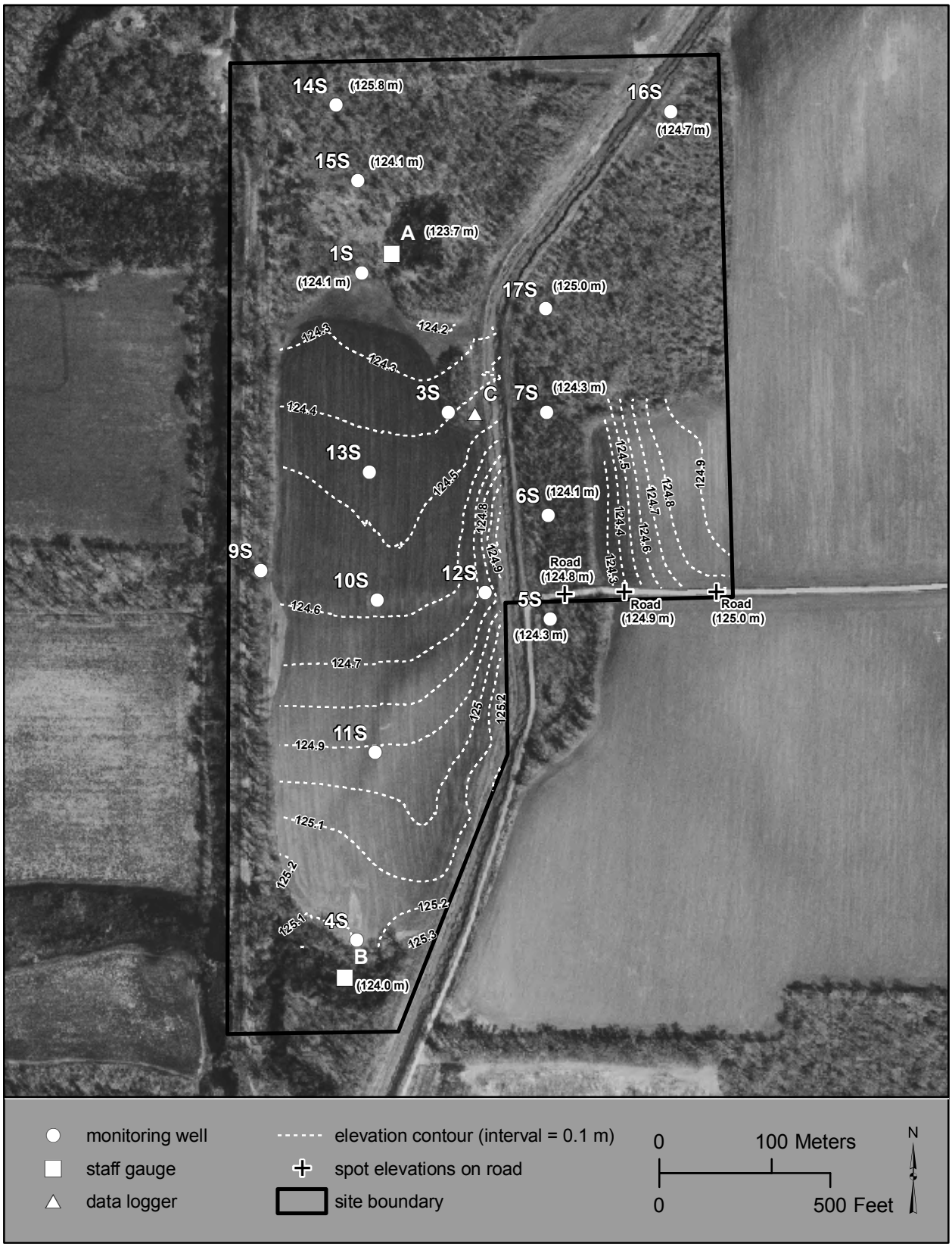

Figure 6. Monitoring network and elevation contours in the planned restoration areas at the proposed Lawrence Wetland Mitigation Bank (Illinois State Geological Survey 2006).

in the west bank of the ditch. Both transducers were programmed to record surface-water depth in 3-hour intervals.

Additionally, flood frequency analysis for the Embarras River was conducted using stage data recorded by the U.S. Geological Survey (USGS) at Lawrenceville, Illinois (gauge 03346500, U.S. Geological Survey 2011). The gauge is located on the U.S. 50 bridge, about 6.4 km (4.0 miles) upstream of the site by river. Stage data from 2002 to 2011 were used to characterize the influence that water levels on the Embarras River have on Beaver Pond Ditch and the site. For this investigation, we evaluated flood frequency above “action stage (27 ft)” and “flood stage (30 ft)” as defined by the National Weather Service, Advanced Hydrologic Prediction Service (Advanced Hydrologic Prediction Service 2011). These flood thresholds were chosen because observed backups in Beaver Pond Ditch generally commence with the exceedance of action stage, and the flapper gates on the gravity drains close when flood stage is exceeded.

Precipitation and potential evapotranspiration (PET) data were obtained the Midwestern Regional Climate Center (Midwestern Regional Climate Center 2011) at the Illinois State Water Survey (ISWS), and climatic data were obtained from the National Water and Climate Center (National Water and Climate Center 2011) at the Natural Resources Conservation Service (NRCS).

Daily precipitation data recorded at Lawrenceville, Illinois (station#114957) and daily potential evapotranspiration (PET) data recorded at Olney, Illinois (station#116446) were obtained from the Midwest Regional Climate Center (2011), and were used to evaluate the influence of annual and seasonal climate trends on groundwater, surface water, and wetland hydrology. The daily data were summed into monthly totals. In one instance (March 2011), it was found that monthly precipitation recorded at Lawrenceville was significantly less than the amount recorded at Vincennes, Indiana due to missing data. Therefore, the monthly total recorded at Vincennes, Indiana (MRCC station# 129113) was used instead. This station is about the same distance from the site as the Lawrenceville station. The total monthly precipitation values were compared to 30-year precipitation averages and thresholds obtained from the National Water and Climate Center (2011) in order to determine if the months were above or below normal, or within the normal range. Monthly PET values were compared to the 20-year (1991-2010) average monthly PET in order to determine which months were above or below normal, or within the normal range. In addition, ratios of monthly precipitation and PET were calculated in order to determine if a month had a precipitation surplus or deficit.

The start date, end date, and length of the growing season were determined using methods outlined in the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory 1987), and in the 2010 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region (U.S. Army Corps of Engineers 2010).

According to the 1987 Manual, the growing season is the period between the last occurrence of -2.2°C (28°F) temperatures in the spring and the first occurrence in the fall. The growing season dates were obtained from WETS tables for adjacent Richland County, Illinois (Olney, station#116446, National Water and Climate Center 2011) because no data were available for Lawrence County. The median length (5 out of 10 years) of the growing season for the region is 204 days, and the median starting date is April 6 and the median ending date is October 26.

According the Midwest Regional Supplement, the growing season start dates are determined

by above-ground growth and development of non-evergreen vascular plants or the entire period of continuous 30-cm (12-in.) soil temperature at or above 5.0°C (41°F). For this investigation, we measured soil temperatures at the site to determine growing season starting dates. Using this method, it was estimated that March 8 was the starting date of the 2010 growing season, and that February 28 was the starting date of the 2011 growing season.

The elevations of the staff gauges, water-level loggers, and monitoring wells were measured using a Sokkia B-1 automatic level and a fiberglass extending rod relative to benchmarks established on the site by the ISGS. The elevations of the benchmarks were established relative to the North American Vertical Datum of 1988 using a survey-grade Leica GPS 1200+.

SITE CHARACTERIZATION

Geographic Setting

The study site is located in the catchment of Beaver Pond Ditch, within the Embarras River watershed (HUC 05120112). The mouth of the ditch is 4.3 km (2.7 mi.) by river above the confluence of the Embarras River with the Wabash River, and 6.4 km (4.0 mi.) by river downstream of the USGS gauge near Lawrenceville, Illinois (Healy 1979). The site lies in the broad floodplain between the Embarras and Wabash rivers and is within the Springfield Plain in the Till Plains Section of the Central Lowlands Physiographic Province (Leighton et al. 1948).

Total relief at the site (Figure 6) is about 2.2 m (7.1 ft), not including the Russell-Allison Levee or Beaver Pond Ditch (Figure 4). West of the ditch, the lowest areas are closed depressions in the forested areas north and south of the agricultural field (near Gauges A and B). East of the ditch, the lowest area is the forest north of the road and south of well 7S. These areas are the most flood-prone on the site, and were the only areas to satisfy criteria for jurisdictional wetland hydrology in 2010.

Except for the Russell-Allison levee, the highest area on the site is the forested area north of well 15S. Well 15S is at the toe of a slope that rises to a mostly flat area between Beaver Pond Ditch and the levee. In this area, land-surface elevation at well 14S is 125.8 m (412.8 ft), 1.7 m (5.7 ft) higher than at well 15S.

The topographic map of the site (Figure 6) shows that total relief in the agricultural fields is about 0.6 m (2.0 ft) for the field east of Beaver Pond Ditch, and about 1.2 m (3.9 ft) for the field west of Beaver Pond Ditch. The field east of Beaver Pond Ditch ranges in elevation from about 124.9 m (409.8 ft) along the eastern site boundary to about 124.3 m (407.8 ft) near the east edge of the forest. There is also a shallow drainage ditch along the north side of the road that grades from 124.6 m (408.8 ft) to 124.3 m (407.8 ft) from east to west. The field west of Beaver Pond Ditch ranges in elevation from about 125.3 m (411.1 ft) at the south end to about 124.1 m (407.2 ft) at the north end, with some small depressions within the field.

Geology

The uppermost bedrock unit is the Pennsylvanian Bond Formation, which is composed mostly of limestone and sandstone (Willman et al. 1967). The site is on the east-facing slope of the buried Wabash River Valley (Herzog et al. 1994, Weibel 2005a) (Figure 7).

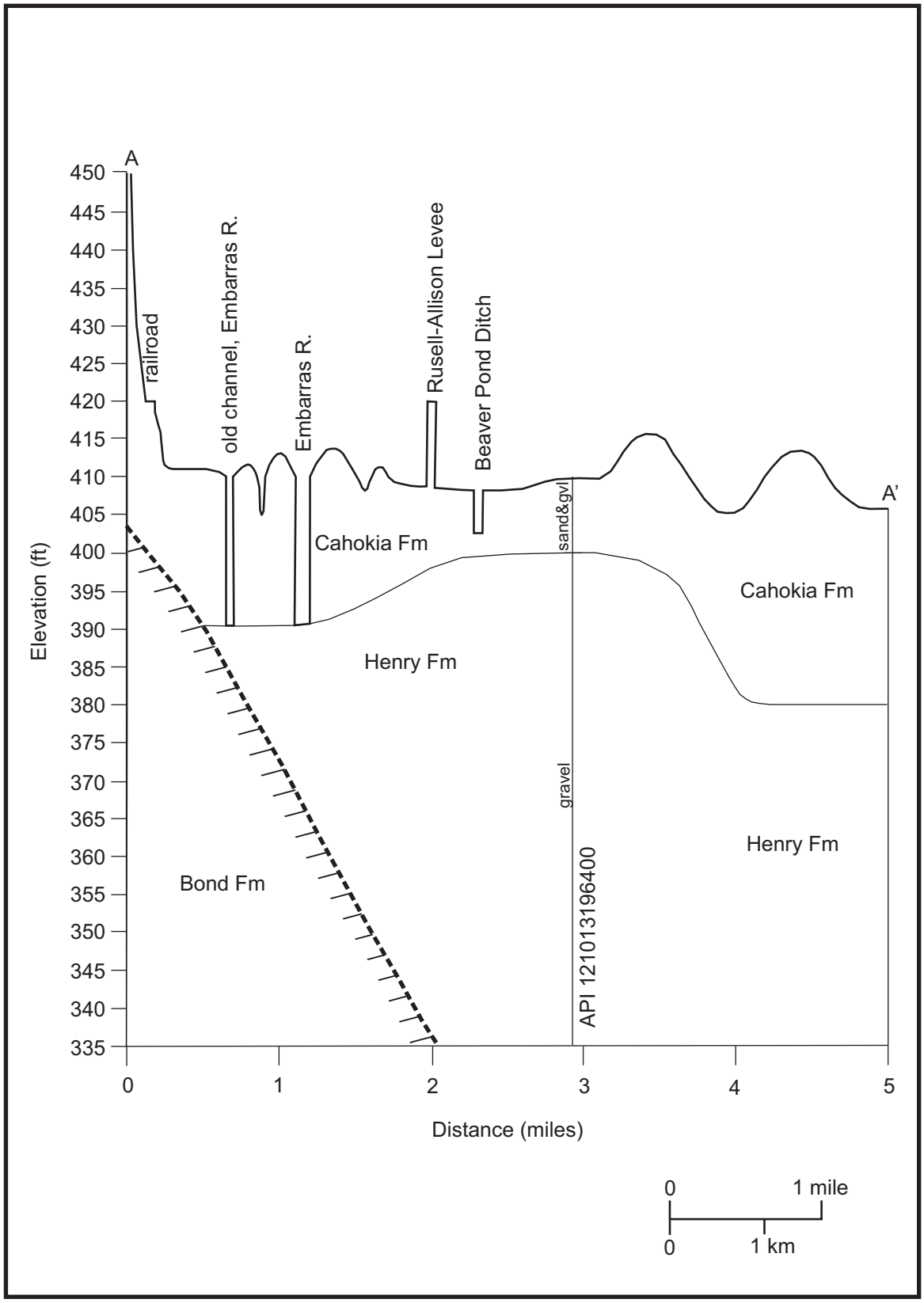

Figure 7. Geologic cross-section (vertical exaggeration 20 ft, line of section shown on Figure 8).

Unconsolidated sediment thickness at the site ranges from 7.6 m (25.0 ft) to 22.8 m (75.0 ft) (Piskin and Bergstrom 1975, Weibel 2005b). Surficial materials at the site are mapped as less than 6.0 m (19.7 ft) of Cahokia Formation overlying more than 6.0 m (19.7 ft) of the Henry Formation (Berg and Kempton 1988). The log of a water-supply well (Figure 7: API 12101396400), located in section 22, about 1 mile east of the site, shows 3.0 m (10.0 ft) of sand and gravel over 19.8 m (65.0 ft) of gravel. Logs of water-supply wells in sections 13, 14, and 15 (Illinois State Geological Survey 2011) are similar, showing sand and gravel to depths of as much as 24.4 m (80.0 ft).

The surficial deposit mapped at the site is Cahokia Formation alluvium (Lineback 1979, Figure 8), which generally consists of poorly sorted sand, silt and clay deposited on floodplains and in stream channels (Lineback 1979). The Mackinaw Member of the Henry Formation, which is a valley train deposit composed of sandy gravel or pebbly sand, is mapped just to the northwest of the site. It may underlie the site at depth, and may have been the source of the sediments mined from the former gravel pit in the northern portion of the site.

Soil borings completed at the site revealed that the Cahokia Formation is at least 2.0 m (6.5 ft) thick and was composed primarily of silty clay. There were some variations, such as at well 14S, where brown, loose, fine to medium sand was found to a depth of 75.0 cm (30.0 in), and at well 15S where the silty clay contained significant amount of gravel. Both of these wells are in or adjacent to the former gravel pit (Figure 3), and may represent disturbed conditions. Gravel was also found scattered on ground surface near the south end of the west field, but this may have been gravel from the road that formerly crossed the field from east to west.

The walls of Beaver Pond Ditch are composed of silty clay. However, the bottom of the ditch may intersect sand of the Henry Formation underlying the site, as was found in soil borings #1 and #3 (Benton et al. 2009).

Soils

All soils mapped at the site, except the area of the former gravel pits, are classified as hydric by the NRCS (Soil Survey Staff 2011) and are all poorly drained (Figure 4 and Table 1). The Darwin and Wabash soils are in hydrologic soil group D, meaning they have a very slow infiltration rate and high runoff potential when undrained, and are subject to occasional flooding and ponding (Soil Survey Staff 2011). The Petrolia soil belongs to hydrologic soil group C/D (Soil Survey Staff 2011), meaning it has a slow infiltration rate where drained (group C) and a very slow infiltration rate (group D) where undrained. The Petrolia is subject to occasional flooding and ponding (Soil Survey Staff 2009). Ponding has been observed during the monitoring period where this soil is mapped on the site, but flooding was observed only in May 2011. The Westland soil is in hydrologic soil group B/D (Soil Survey Staff 2011). This soil has a moderate infiltration rate where drained (group B) and a very slow infiltration rate where undrained (group D). The soil is not subject to flooding but it is subject to frequent ponding (Soil Survey Staff 2009). Ponding has not been observed during the monitoring period, however, flooding was observed in March and May 2011.

Several permeameter tests were conducted at the site to verify the permeability values reported by the Soil Survey. The results are given in Table 1, and the locations of the tests are shown on Figure 4. The test conducted in the Darwin soil in 2009 reveal that it has very slow permeability, within the range reported by the Soil Survey. The results of on-site permeameter

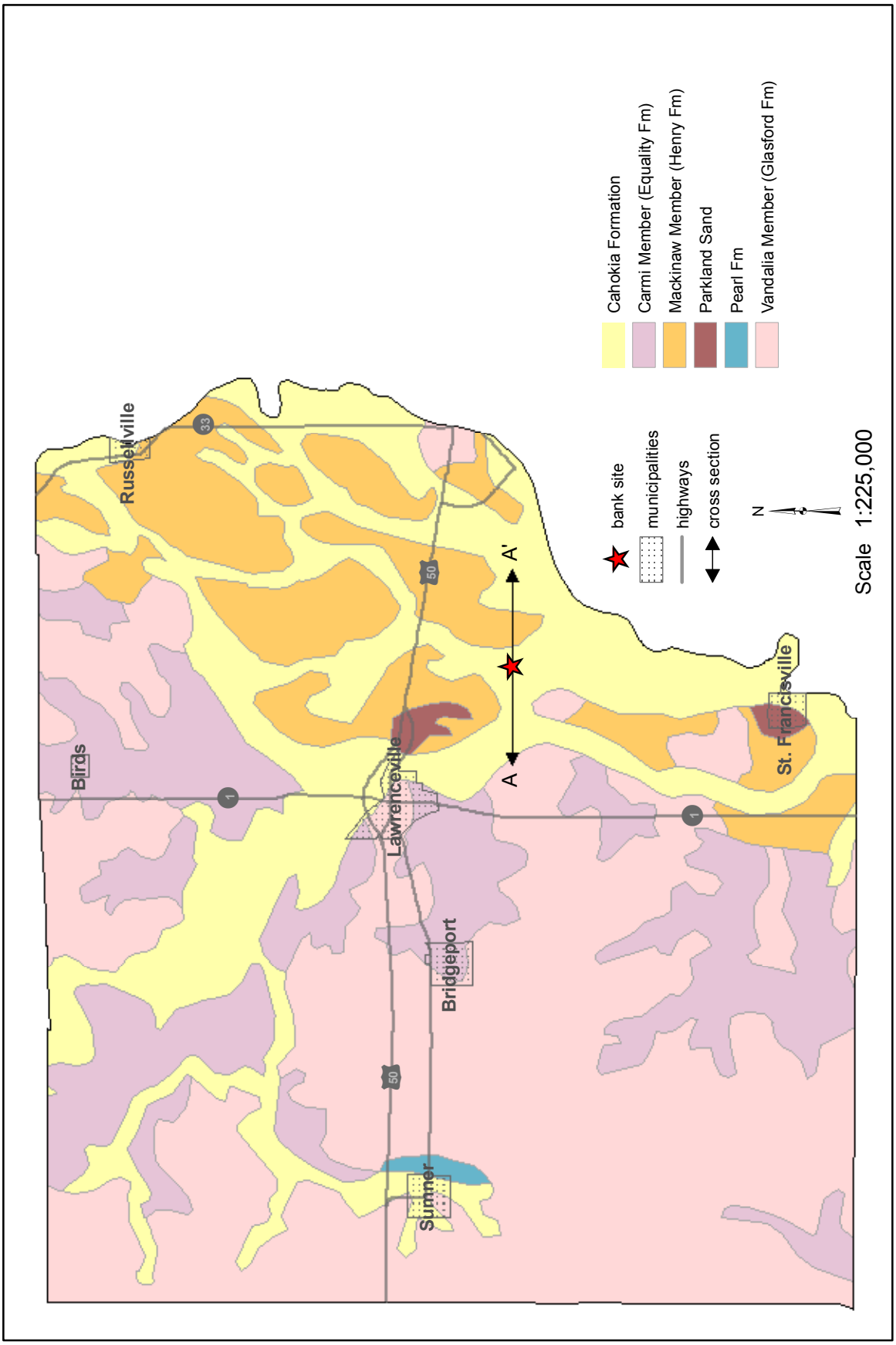

Figure 8. Quaternary Deposits of Lawrence County (adapted from Lineback 1979), original map scale is 1:500,000. Line of cross section corresponds with Figure 7.

tests conducted in the Petrolia soil show that it is somewhat less permeable than reported by the Soil Survey (Table 1).

The results of permeameter tests conducted in the Westland soil reveal that the saturated hydraulic conductivity of this soil is highly variable, in that, it would take as little as 3 days for water on ground surface to infiltrate 30.0 cm (12.0 in) into the soil (Table 1). Therefore, it is less likely that wetland hydrology can be restored in portions of the site where Westland soil is mapped (Figure 3) and excavation may be required to create wetlands in these areas, depending on elevation.

Soil Type	Hydric	Permeability of most limiting layer(cm/hr)	Permeability from on-site tests (cm/hr)	Flooding/Ponding	Water Table
Westland clay loam (300)	yes	1.52-5.08	0.0036-0.36	None/Frequent	Depth: 0.0 cm Period: Mar-Jun
Darwin silty clay (8071)	yes	0.00-0.15	0.00036	Occasional/Occasional	Depth: 0.0 cm Period: Mar-Jun
Petrolia silty clay loam (8288)	yes	0.51-1.52	0.036	Occasional/Occasional	Depth: 0.0 cm Period: Mar-Jun
Wabash silty clay 8083	yes	0.00-1.52	na	Occasional/None	Depth: 15.0 cm Period: Mar-Jun

Table 1: Hydrologic properties of on-site soil types (Soil Survey Staff 2009).

Wetlands

The NWI mapped about 17.5 ha (43.1 ac) of forested wetlands (PFO1A) at the site (Appendix D, U.S. Fish and Wildlife Service 2009), and the certified wetland determination by the NRCS indicates that the wetland status of the approximately 28.9 acres of cropland is prior converted, indicated as ‘PC’ in Appendix E.

A more detailed on-site wetland determination, conducted by the INHS, resulted in a total of 13.3 ha (32.8 ac) of wetlands delineated at the site (Wiesbrook et al. 2009, Figure 2). The remainder of the site 16.3 ha (40.3 ac) is non-wetland. The non-wetland areas identified by the INHS (Figure 2) include roads, levees, and Beaver Pond Ditch (Site 0), mesic floodplain forest (Site 4) and agricultural fields (Site 5). The levees and ditch within Site 0 cannot be restored to wetland because the Russell-Allison Levee and Beaver Pond Ditch will be maintained for flood control. The mesic floodplain forest in Site 4 does not have hydric soil and therefore was never wetland. The agricultural fields in Site 5 have hydric soil and dominant hydrophytic vegetation; however, they are currently drained and used for crop production. Therefore, the agricultural fields (Figure 2, site 5), totaling 12.1 ha (29.9 ac), are the target area for potential wetland restoration and/or creation.

Hydrology

Precipitation and Evapotranspiration

Average annual precipitation (1971-2000) at the Lawrenceville weather station is 114.6 cm (45.2 in.) (Midwestern Regional Climate Center 2011). The 30-year monthly averages show that most of the annual precipitation falls during the period March through June, with seasonal peaks occurring in May and November (Figure 9). Drier periods typically occur during late summer into fall (August through October) and winter (December through February).

Precipitation amounts recorded at the Lawrenceville weather station were 92% of normal for 2010 and, in 2011, 125% of normal through May 31. During the early growing season (February through May), precipitation was 94% normal in 2010 and 135% of normal in 2011, with an exceedingly wet April. Monthly precipitation during the monitoring period (Figure 9) was well-above average in 6 of the months, near average in 6 of the months, and well-below average in 7 of the months. The wettest month during the monitoring period was April 2011 with 296% of the 30-year average, and the driest month was October 2010 with 24% of the 30-year average.

Total PET during the monitoring period was 156.46 cm (61.60 in), which was 103% of the 20-year (1991-2010) average. On average, PET tends to be lowest in the winter (December through February), and highest in the summer (June through August) (Figure 10). Monthly PET during the monitoring period was generally close to the 20-year average. Ratios of monthly precipitation and PET (Figure 10) show that moisture surpluses (ratio $\geq$ 1.0) occurred in most months during the monitoring period, and have occurred every month starting in November 2010, which may have affected the number of duration of flood events in 2011.

Surface Water

Inundation on the site generally occurs when Beaver Pond Ditch is at least bank-full, which has happened at least twelve times during the monitoring period (Appendix F). At bank-full (Figure 11), water backs up the culverts in the banks of the ditch and inundates adjacent areas (see Appendix F, March 22, 2010). In this type of event, inundation west of Beaver Pond Ditch is generally confined to the forested area north of the agricultural field, and the northern portion of the field, and east of Beaver Pond Ditch it is generally confined to the forested areas adjacent to the east-west access road. At higher levels (Figure 11), inundation is more wide-spread. The area inundated depends of the height of the flood peak, but has encompassed the entire site (see Appendix F, March 15, 2011 and May 3, 2011).

The water level in Beaver Pond Ditch is influenced by the Embarras River. Analysis of peaks on the hydrographs of Embarras River stage and Beaver Pond Ditch stage in 2010 (Figure 11) reveals that they mostly occur at the same time. On-site observations revealed that the water level in the ditch was rising when the Embarras River at Lawrenceville reached action stage (8.2 m [27.0 ft]). This was observed at the site on February 23, 2011, when it was noticed that the flow of water in Beaver Pond Ditch was reversed, that is, the water was flowing upstream. In addition, the water level in the ditch rose noticeably during the course of the day (Figure 11), revealing that the gravity drains in the Russell-Allison levee were still open. At Lawrenceville, river stage that day was above action stage (Figure 11), and stage increased from 8.5 m (28.0 ft) to 8.8 m (28.8 ft) during the course of the day (U.S. Geological Survey 2011).

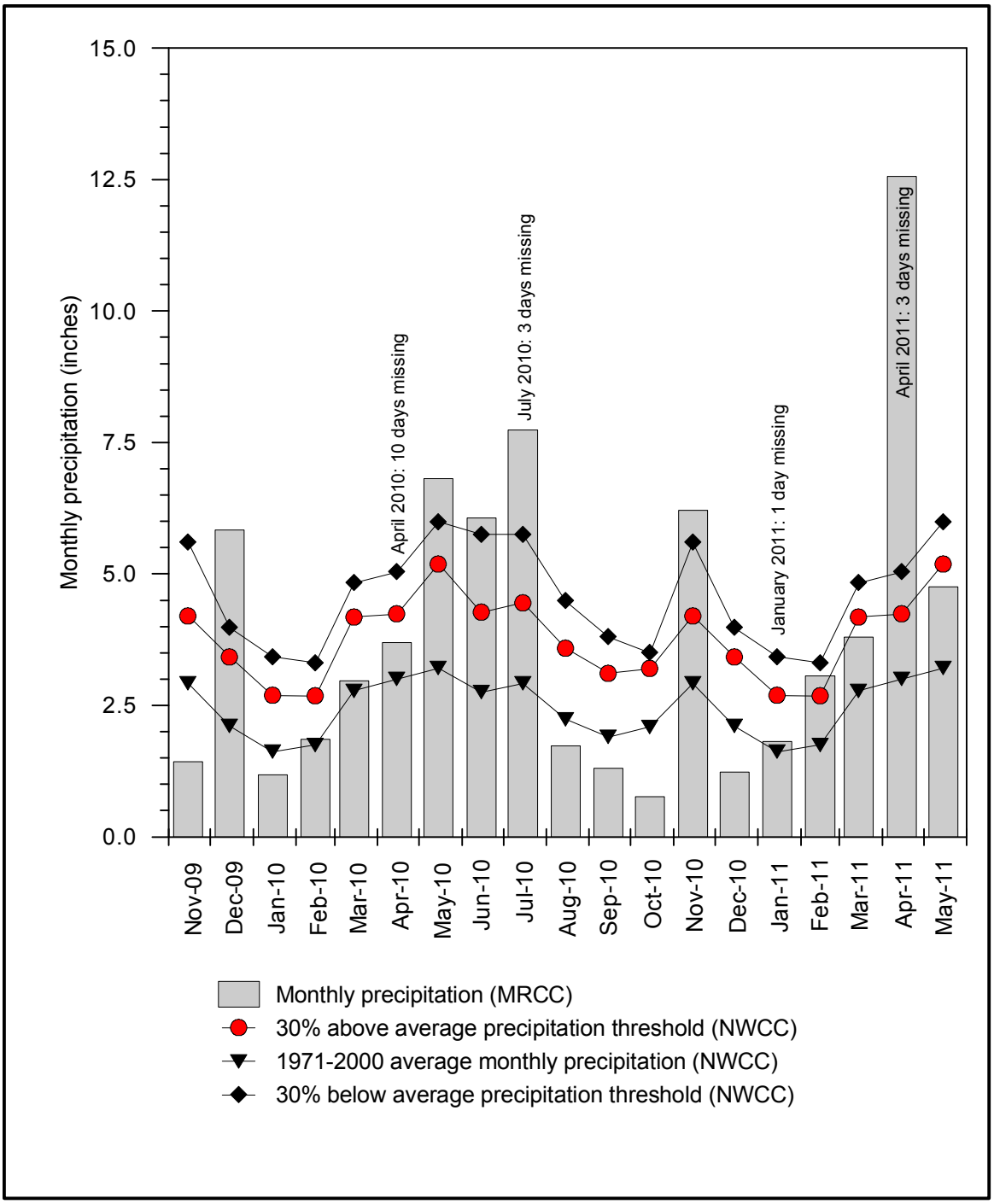

Figure 9. Monthly precipitation during the monitoring period.

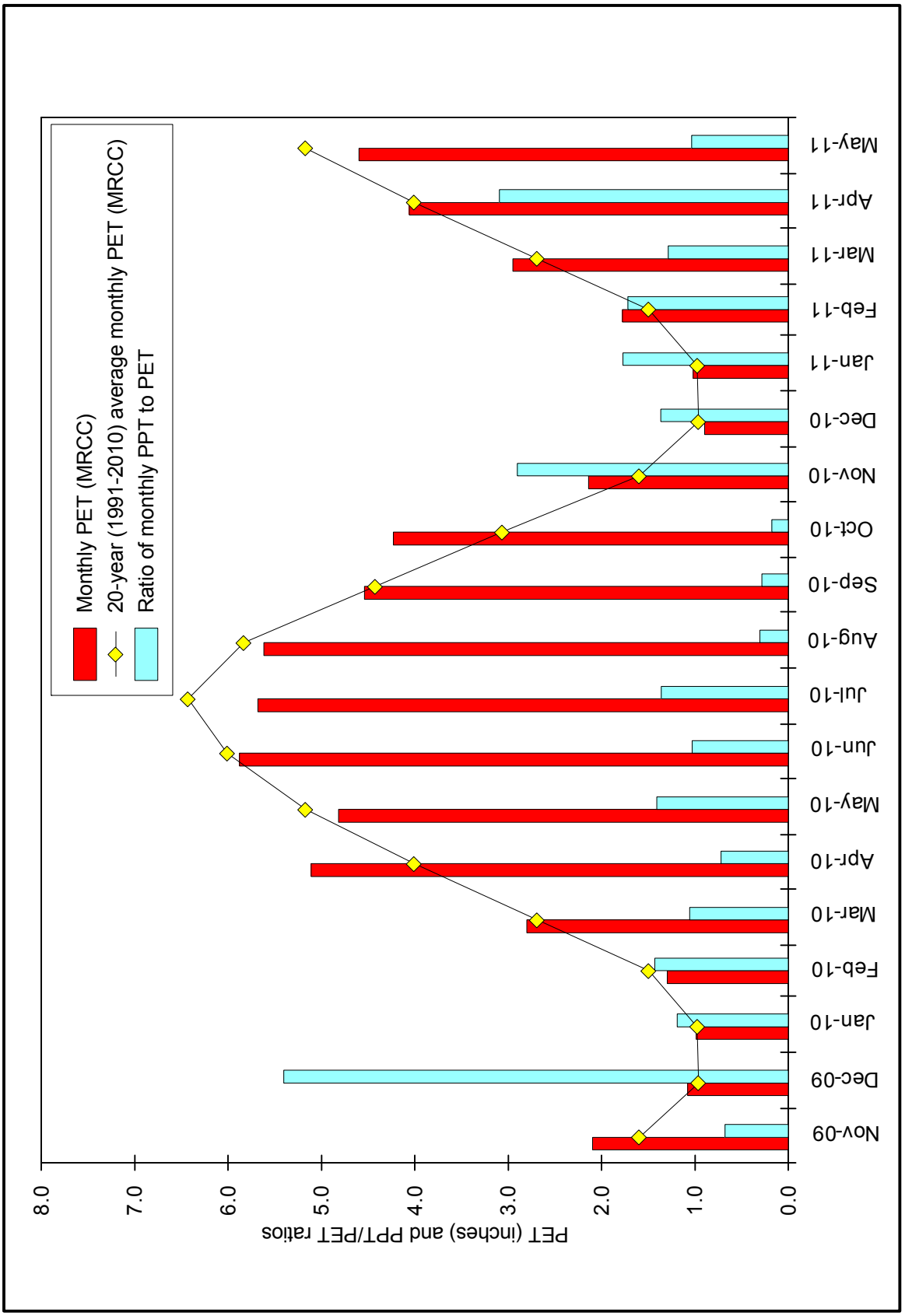

Figure 10. Potential evapotranspiration measured at Olney, Illinois and ratios of precipitation and potential evapotranspiration

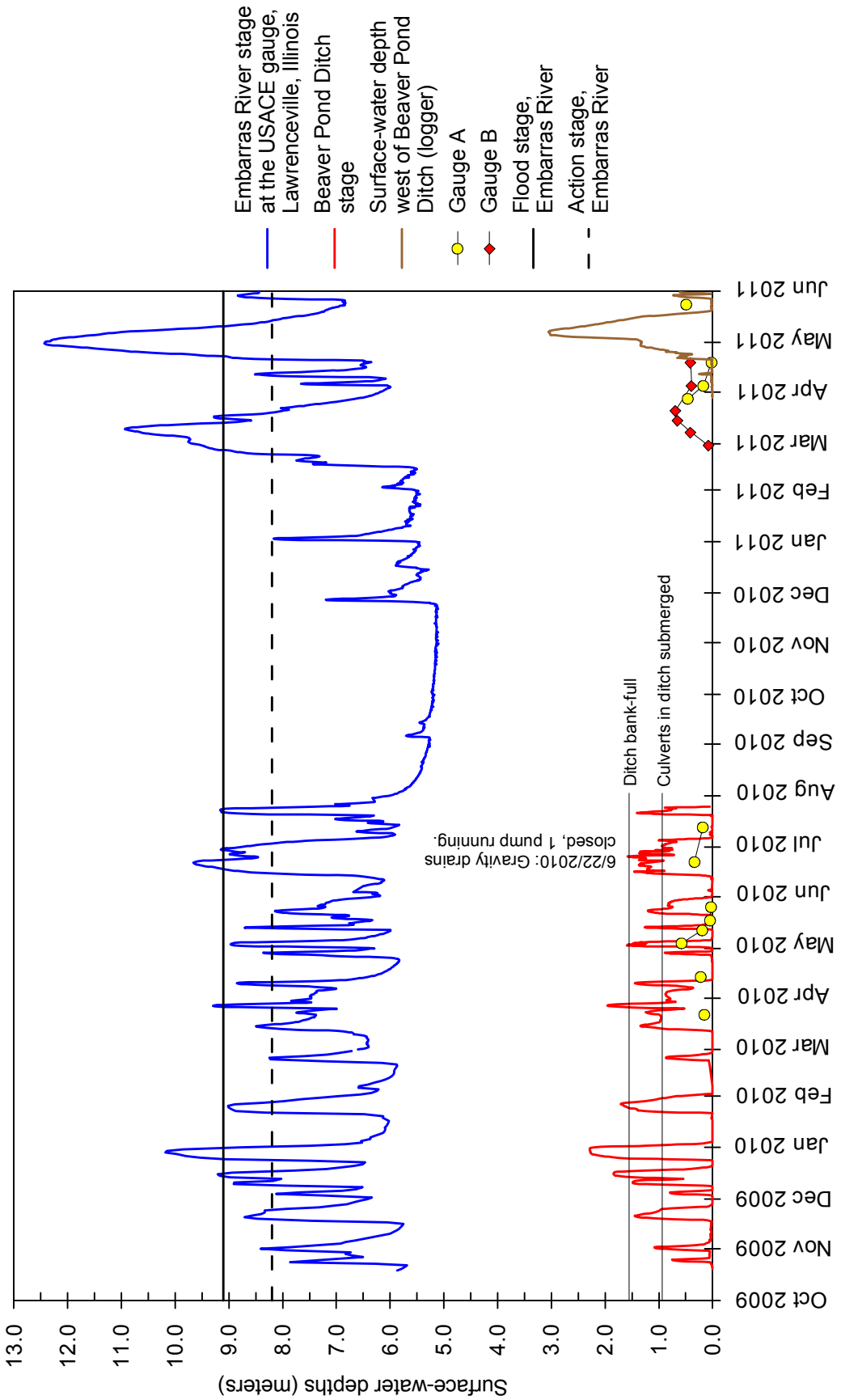

Figure 11. Embarras River stage, Beaver Pond Ditch stage, and on-site surface-water depth

When the Embarras River reaches flood stage at Lawrenceville, then the water level outside the Russell-Allison levee exceeds the elevation of the gravity drains, and the water pressure forces them closed. This traps any further runoff inside the levee, and, if the pumps are not running, results in the inundation of the site. In March 2011, about two-thirds of the site was inundated during a flood event on the Embarras River. The river reached action stage on February 22, and flood stage (9.1 m [30.0 ft]) on February 25. During a site visit on March 8, it was observed that the portion of the site west of Beaver Pond Ditch was inundated as far south as well 11S (Figure 6), and that inundation extended up to 0.8 km (0.5 mile) east of the site. The Embarras River remained above action stage until March 18. On March 15, 2011, most of the site was still inundated (Appendix F), and on March 21, it was observed that the gravity drains were still submerged, but that water was flowing out. By March 28, the site was mostly drained. The only inundation was in the forest north of the agricultural field west of Beaver Pond Ditch, and in the forest adjacent to the east-west road east of Beaver Pond Ditch.

The greatest extent of inundation on the site occurs as the result of the Russell-Allison Levee being overtopped and/or breached. On the morning of May 3, 2011, it was discovered that the levee had been breached overnight in several locations near the confluence of the Embarras and Wabash Rivers (Lawrence County Emergency Management Agency 2011). During a visit to the site on May 24, erosion gullies on the inside of, and sand bags on the top of, the portion of the Russell-Allison levee along the western boundary of the site, reveal that it had been overtopped during the recent flood event. On April 29, the Embarras River had reached a stage of 12.3 m (40.2 ft), which was more than 3.0 m (10.0 ft) above flood stage. The hydrograph of the logger in the field west of Beaver Pond Ditch (Figure 11) shows that surface water on the site had peaked at a depth of about 1.3 m (4.3 ft) on April 29. However, starting at about 6PM on May 2, water depth began to increase again, likely as the result of the levee breaches. As a result, the entire site was inundated (Appendix F), and surface-water depth peaked at about 3.0 m (10.0 ft) on May 6.

Flood frequency analysis shows that Embarras River levels are high enough to likely cause back flooding of Beaver Pond Ditch in most years, and occurred most often in the winter and spring. Table 2 shows the number of days per month that the Embarras River was at or above action stage in the period 2002 through 2011. The table shows that action stage events mostly occurred in the winter (December to February) and spring (March to May), which is usual for Illinois (Changnon et al. 1983). The months with the highest probability of having an action stage event are March, April, and May, followed by February. The months with the lowest probability of having an action stage event are August, September, and October.

Overland flow and storm runoff are relatively minor water sources at the site, although they may provide more of a contribution to the portion of the site east of Beaver Pond Ditch due to higher land elevations adjacent to the eastern boundary.

Groundwater

The Henry Formation and the Pennsylvanian Bond Formation are major aquifers in Lawrence County, and are utilized for municipal, agricultural, and domestic water supply (Hanson 1950, Illinois State Geological Survey 2011, Selkregg et al. 1957). At the site, the Henry Formation likely does not contribute to wetland hydrology because it is overlain by Cahokia Formation alluvium (Figure 7 and 8). Instead, saturation in the soil zone at the site occurs as perched

groundwater. Figures 12, 13, 14, and 15 show, respectively, groundwater elevation and depth to groundwater in monitoring wells west of Beaver Pond Ditch, and groundwater elevation and depth to groundwater in monitoring wells east of Beaver Pond Ditch. On both sides of the ditch, groundwater tends to be closest to ground surface in the spring, and furthest from ground surface in the fall. This is because inundation of the site is most likely to occur in the spring (Table 2).

Calender year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002		7	11	11	27							
2003					10		10		3			
2004			8	4	4	10				1	8	14
2005	25	16										
2006			11	12	1						3	13
2007	26	4	10	7								
2008	5	17	19	15	10	15	4					7
2009	5	11	23	28	8							
2010			5	4	1	18	4					
2011		6	19	12	18							
Total	61	61	106	93	79	43	18	0	3	1	11	34

Table 2: Days per month Embarras River at Lawrenceville, Illinois was at or above action stage.

Local groundwater flow often is towards Beaver Pond Ditch as shown on Figure 16. The ditch tends to flow year-round, and seepage has been observed in the bottom and walls of the ditch when the water level is low, suggesting that it receives groundwater discharge.

The site is likely affected by groundwater recharge when the Embarras River is at or above action stage. It has been observed at the site that flood water outside the Russell-Allison levee rises about halfway up the levee when the Embarras River is near flood stage. This likely causes an upward groundwater gradient inside the levee, which is a factor contributing to on-site saturation.

Hydrologic Alterations

Various hydrologic alterations facilitate drainage of the site for agriculture. The regional hydrologic alteration is the Russell-Allison Levee, which protects an area of about 12,150 ha (30,000 ac) from Embarras and Wabash River flooding. The levee is about 6.1 m (20.0 ft) tall at the site. Local alterations are Beaver Pond Ditch, two gravity drains with flapper gates in the levee, and a pumping station (Figure 3). Beaver Pond Ditch is about 16 km (10 mi.) long and drains an area of about 3,240 ha (8,000 ac) within the leveed area (Healy 1979, Pickels and

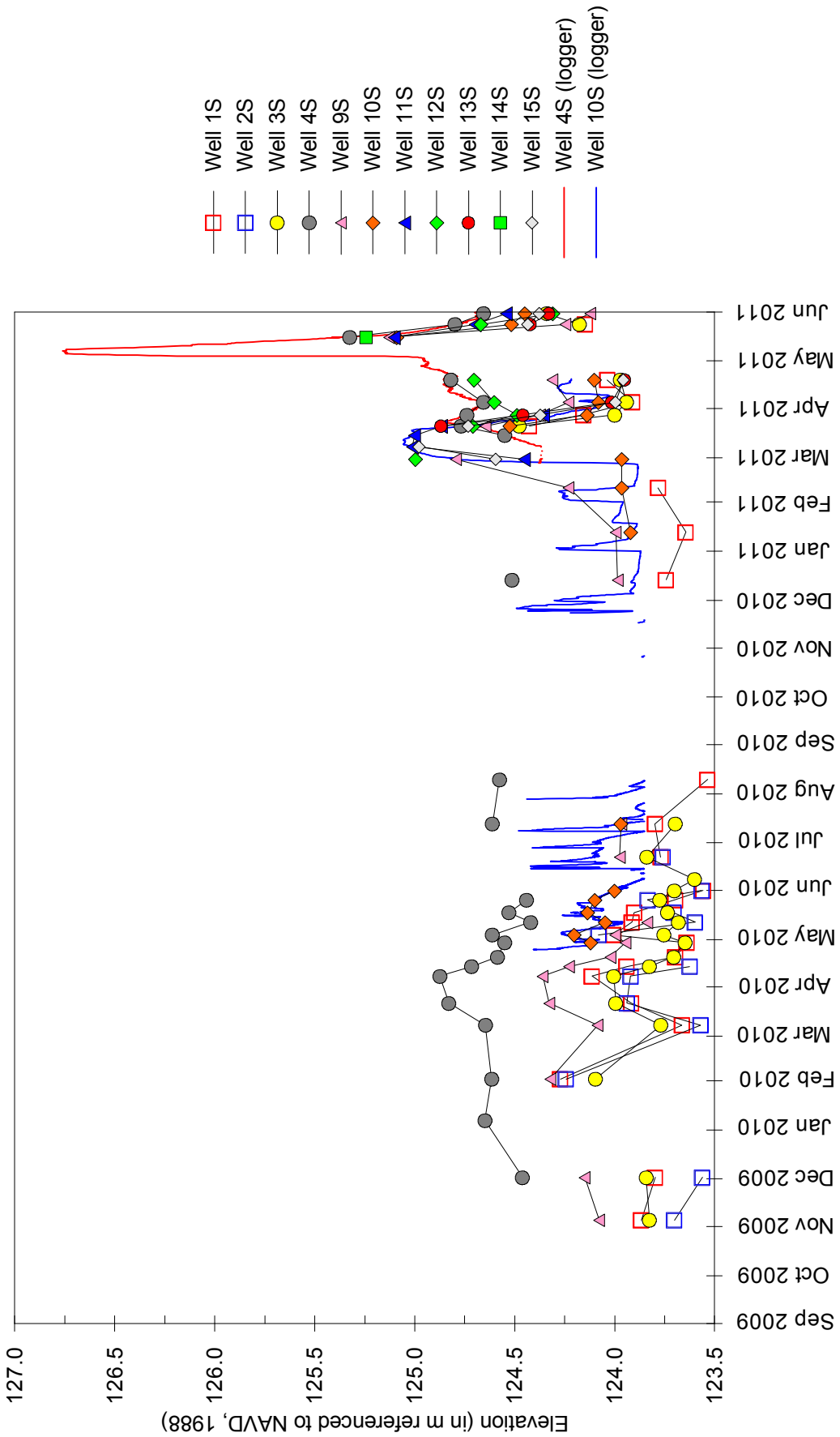

Figure 12: Groundwater elevations in monitoring wells west of Beaver Pond Ditch.

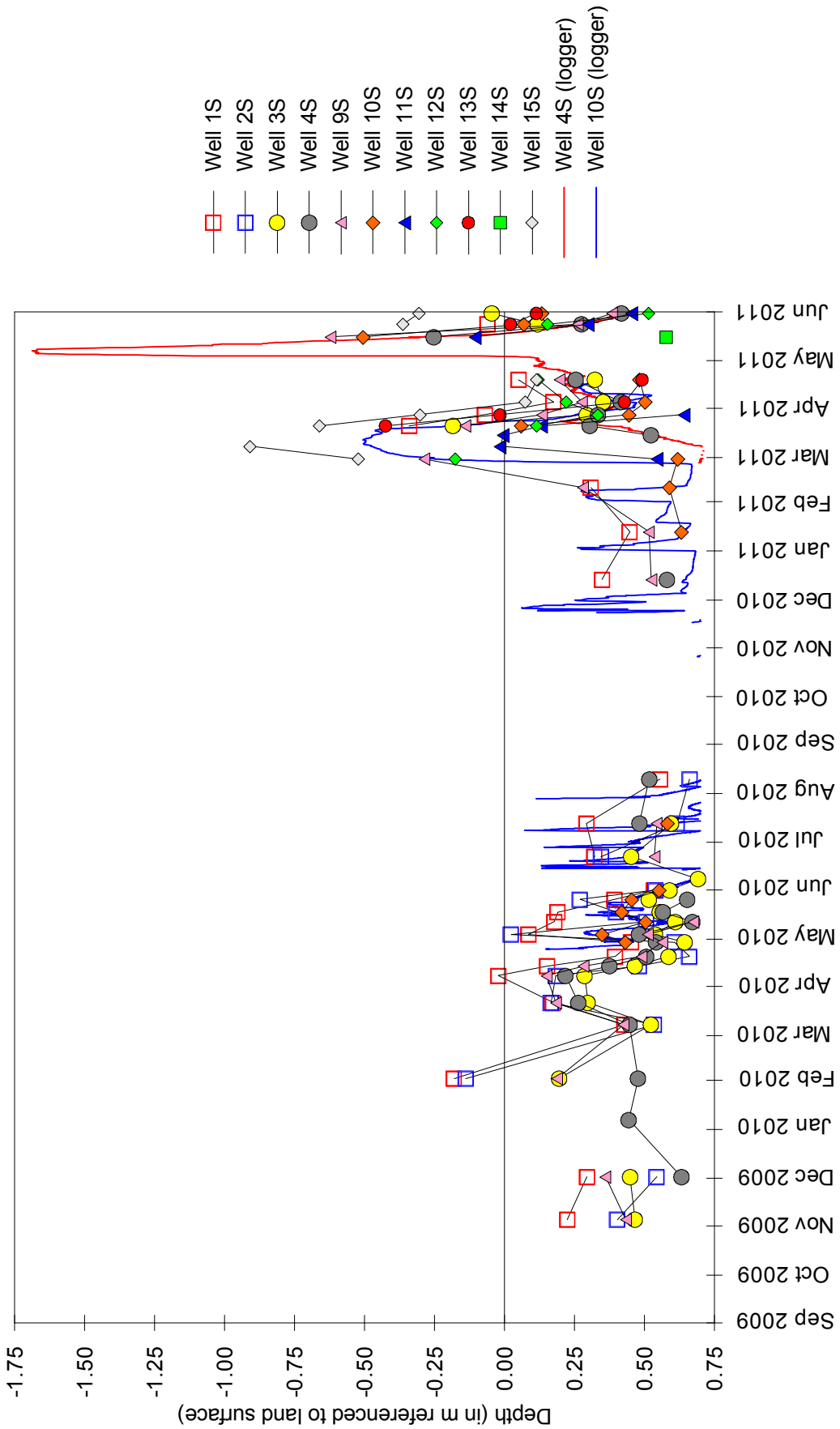

Figure 13: Depth to groundwater in monitoring wells west of Beaver Pond Ditch

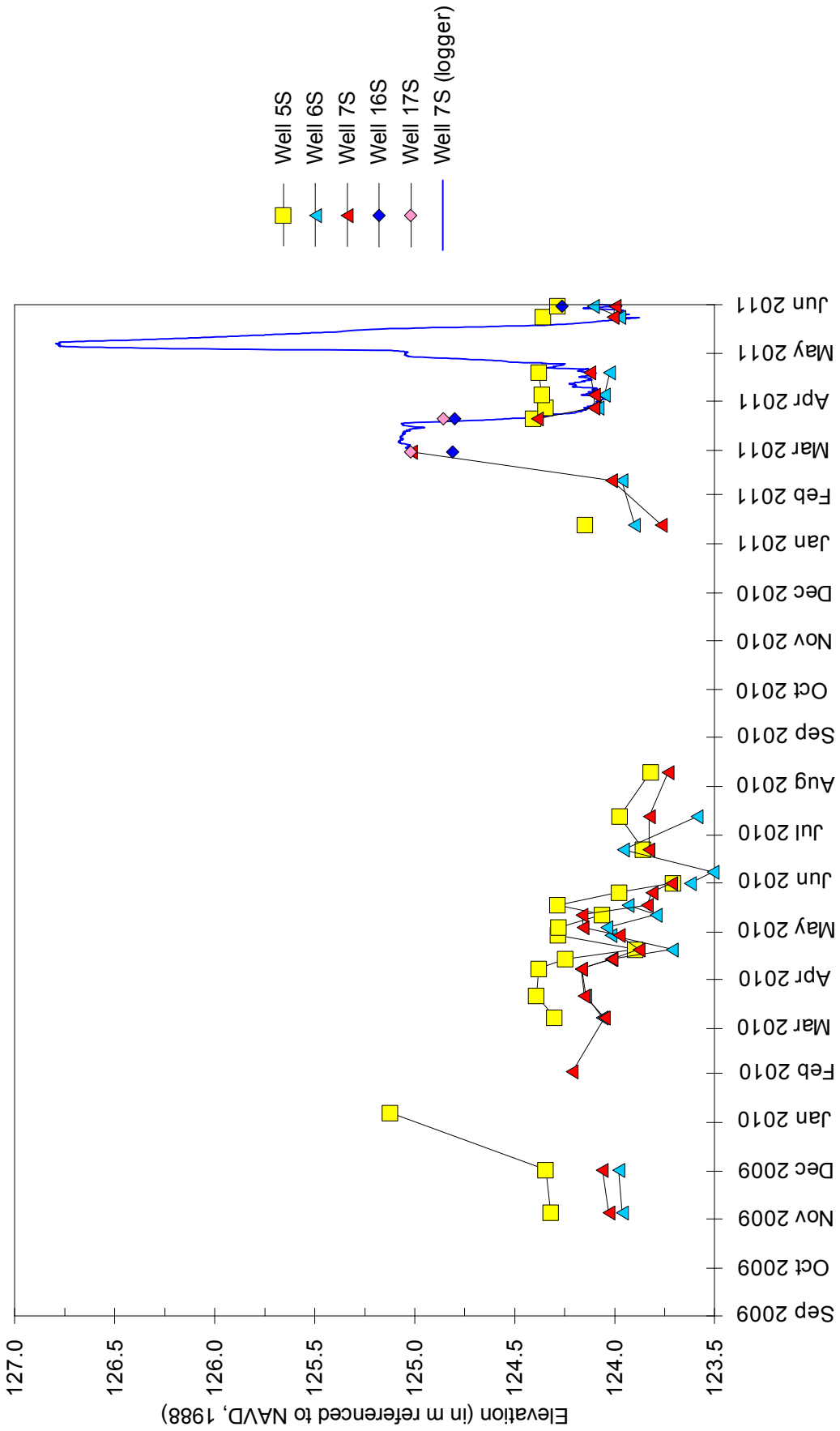

Figure 14: Groundwater elevation in monitoring wells east of Beaver Pond Ditch.

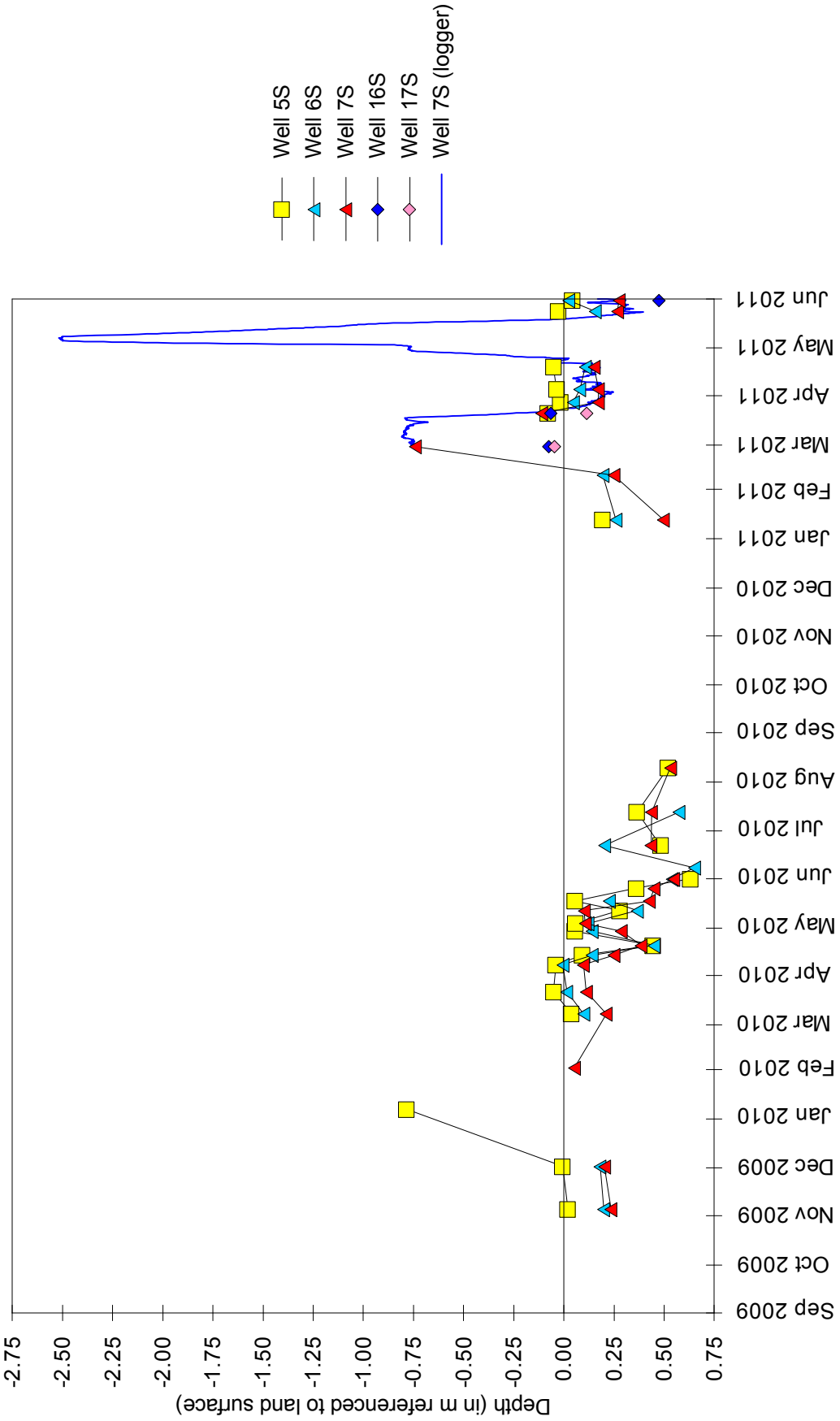

Figure 15: Depth to groundwater in monitoring wells east of Beaver Pond Ditch

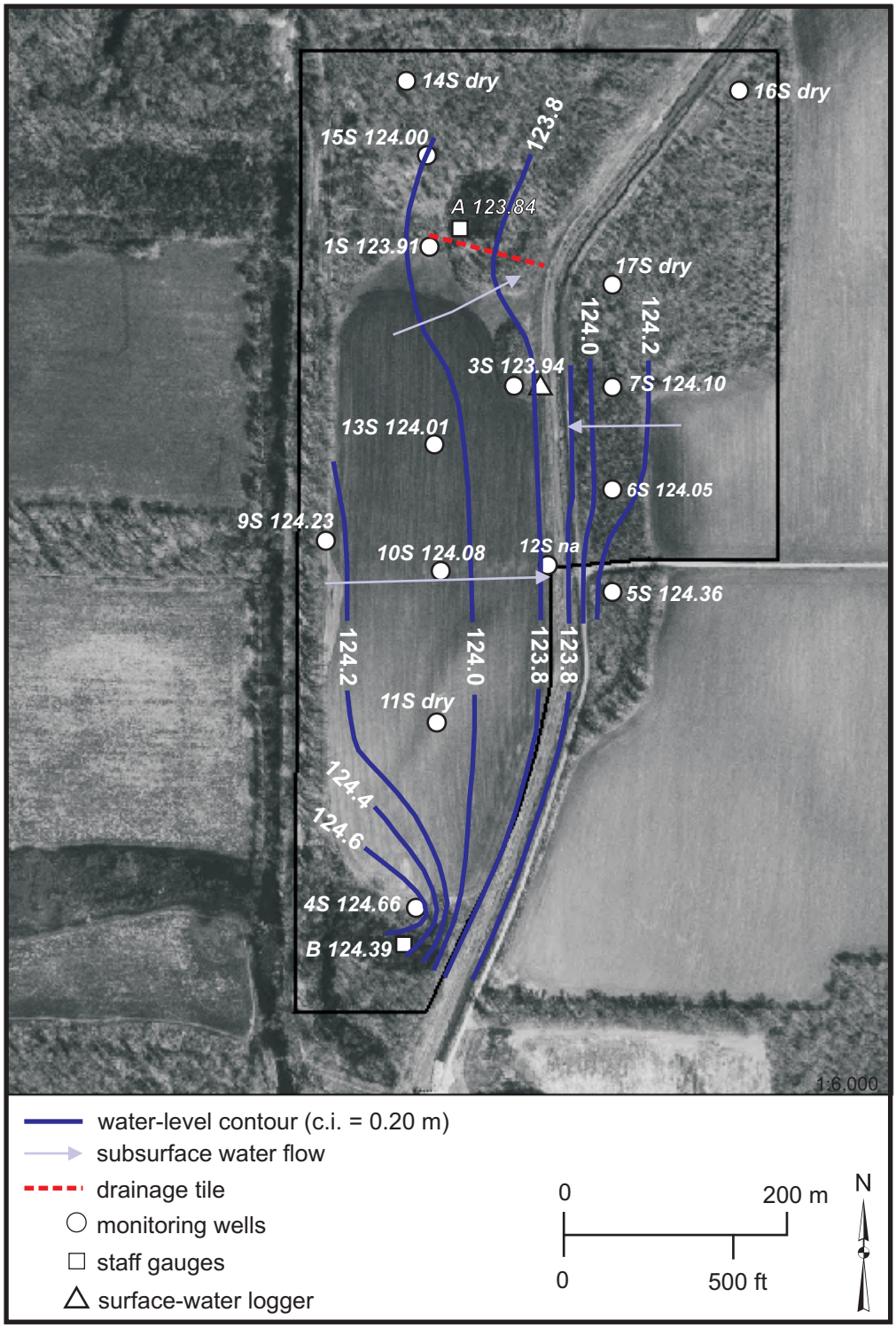

Figure 16. Water-level contour and flow map (April 5, 2011).

Leonard 1929). The ditch divides the site and is about 5.5 m (18.0 ft) wide and about 2.4 m (8.0 ft) deep where it passes through the site. Exact dates for levee construction, pumping station installation, and ditch excavation could not be determined from a records search, but the levee was first proposed in 1912 (Harman 1912), and a map in the same publication depicts the ditch in its current location.

The on-site hydrologic alterations include culverts in both banks of Beaver Pond Ditch, a drain tile in the forest north of the west field, and a discontinuous levee along Beaver Pond Ditch (Figure 3). The culverts are 61-cm (24-in) diameter corrugated steel. The invert elevation of the west culvert is 123.51 m (405.24 ft), which is 0.89 m (2.92 ft) below the top of the bank, and the invert elevation of the east culvert is 123.32 m (404.61 ft), which is 0.80 m (2.62 ft) below the top of the bank. The drain tile is 5.1-cm (2.0-in) diameter PVC at the outlet. It is about 1.5 m (5.0 ft) below the top of the bank where it discharges into the ditch. The length of the tile is not known.

The west bank of Beaver Pond Ditch was likely formed by spoil when the ditch was excavated. Its height above the adjacent farm field ranges from 0.19 m (0.62 ft) near the south end of the field to 0.45 m (1.47 ft) near the north end of the field. The top of the bank is mostly at or above an elevation of 125.0 m (410.1 ft). Only in the vicinity of the culvert and a former bridge abutment (near well 12S) is it below that elevation. At the culvert, the top of the bank is at an elevation of 124.4 m (408.1 ft), while at the abutment it is at an elevation of 124.6 m (408.8 ft). In addition, there is a drainage channel at the abutment that directs water around it and into Beaver Pond Ditch, that appears to be lower than 124.6 m (408.8 ft).

The east bank of Beaver Pond Ditch is a dirt road north of the T-intersection and a gravel road south of the intersection (Figure 3). There are noticeable spoil piles, overgrown with trees and brush, along the east side of the road that are likely spoil from Beaver Pond Ditch. The dirt road is mostly at or above an elevation of about 124.5 m (408.5 ft), except in the vicinity of the culvert, where it is at an elevation of 124.1 m (407.2 ft). The spoil piles are somewhat higher than the road, except at the location of the culvert where they are missing.

A potentially significant hydrologic alteration adjacent to the site is a 0.3 m (1.0 ft) diameter, corrugated steel culvert under the east-west road east of Beaver Pond Ditch (Figure 3). This culvert drains the forested area, and portions of the adjacent farm field south of the road into the forested area north of the road, which then discharges into Beaver Pond Ditch via the culvert there. The invert elevation of the road culvert is about 124.0 m (406.8 ft), which is higher than that of the Beaver Pond Ditch culvert. If the latter culvert is removed and replaced with a spillway at a higher elevation, then water would likely back up the road culvert, flooding the forested area south of the road, and possibly the adjacent agricultural field. On the other hand, keeping the invert elevation of the Beaver Pond Ditch culvert lower than that of the road culvert would likely result in an area of inundation north of the road smaller than the area that could potentially support wetland hydrology. Therefore, the road culvert will have to be removed, elevated, or replaced with a culvert that discharges westward directly into Beaver Pond Ditch. Removing the culvert altogether or raising its elevation will likely increase saturation south of the road in an area that is not being acquired by IDOT, and landowner agreement would be needed for any alteration at all.

Effect of Pumping

The Consolidated Drainage District operates a pumping station (Figure 3) just south of the site that drains Beaver Pond Ditch and surrounding farm fields. Although no pumping records are available, the drainage district manager stated that the pumps are typically switched on only during floods that occur within the growing season, usually mid-March through November (Gene Marenholtz personal communication).

Comparison of the Embarras River stage with stage in Beaver Pond Ditch during 2010 shows the signature of when pumping occurred (see Figure 11). Usually, the hydrograph of Beaver Pond Ditch stage is smooth and similar, except in magnitude, to the hydrograph of Embarras River stage (e.g., see March and April 2010). In addition, peaks in the stage of Beaver Pond Ditch tend to occur on the same day as peaks in the stage of the Embarras River. However, when Beaver Pond Ditch is being pumped, the hydrograph of the ditch is truncated, which can be seen in June and July 2010 (Figure 11). A flood event was occurring on the Embarras River, and pumping at the site was confirmed during a site visit on June 22, 2010. The pumping prevented the inundation of the site, and, as a result, saturation mostly did not occur. Depth-to-groundwater data show that, in June 2010, saturation occurred only at monitoring well 6S (Appendix A), and for several brief periods at monitoring well 10S (Figure 13). These brief periods corresponded to precipitation events that caused saturation, but it lasted for a day or less.

Wetland Hydrology

In 2010, only small areas of the site satisfied the criteria wetland hydrology (Environmental Laboratories 1987, U. S. Army Corps of Engineers 2010, Figure 17). It was estimated that a total of 2.4 ha (6.0 ac) satisfied the wetland hydrology criteria for 14 or more consecutive days during the growing season, and that 1.5 ha (3.8 ac) and 1.3 ha (3.3 ac) satisfied the wetland hydrology criteria for 5% and 12.5% of the growing season, respectively (Miner et al. 2010). In contrast, in 2011 it was estimated that about 15.8 ha (39.1 ac) of the site satisfied the wetland hydrology criteria for 14 or more consecutive days during the growing season (Figure 18), and that 26.2 ha (64.7 ac) and 15.7 ha (38.8 ac) satisfied the wetland hydrology criteria for 5% and 12.5% of the growing season, respectively.

In 2010, precipitation and PET were about average, though comparing seasonal totals reveals that winter precipitation was more than twice winter PET (Table 3). There were eight action stage events during the year, and the Embarras River was at or above action stage a total of 35 days. The average duration of the events was 4.4 days, which was typical, because 36.0% of the events that have occurred during the period of record (U.S. Geological Survey 2011) have lasted 5 days or less. Almost all of the action stage events resulted in the water levels in Beaver Pond Ditch being high enough to at least submerge the culverts and prevent drainage of the site for periods ranging from < 2 days to about 18 days.

In 2011, precipitation and PET were not as close to average as 2010 (Table 2), but the area and duration of wetland hydrology in 2011 were both much greater than in 2010. This was due primarily to the two unusual flood events that occurred on the Embarras River (Figure 16), and included levee breaks and widespread flooding. These events both lasted more than 20 days, and only a total of 6 such events have occurred since river monitoring began in 2002 (U.S. Geological Survey 2011). The provisional peak stages of these events were 10.94 m (35.89

Figure 17. Area of wetland hydrology in 2010 (Miner et al. 2010)

Figure 18. Area of wetland hydrology in 2011 (Miner et al. 2011).

ft), and 12.44 m (40.82 ft). If these become the final peak stages, then they will be among the top 10 ever recorded there (Advanced Hydrologic Prediction Service 2011).

	Precipitation Percent of 30-year (1971-2000) average			Potential Evapotranspiration Percent of 20-year (1991-2010) average			PPT vs PET Percent of seasonal totals	
	Year	Winter	Spring	Year	Winter	Spring	Winter	Spring
2010	91.6	100.6	99.0	103.1	100.0	107.2	263.5	105.9
2011	na	69.1	138.7	na	110.1	97.8	164.9	162.6

Table 3: Climate statistics

CONCLUSIONS

Wetland hydrology mostly occurs at this site as the result of inundation. However, under current drainage conditions, only small areas of the site are expected to satisfy wetland hydrology criteria in an average year. Therefore, in order to increase area and duration of inundation and saturation on the site, the following hydrologic modifications suggested. We anticipate 25.4 ha (62.7 ac) of the site, which includes 13.3 ha (32.8 ac) of delineated wetland, and 12.1 ha (29.9 ac) currently used for agriculture, could satisfy wetland hydrology criteria in an average year:

- Excavate the portions of the site shown on figure 5, thereby allowing the greater volume of water retained on the site to inundate a larger area.
- Remove the two culverts and replace them with spillways set at a higher elevation, and remove the drain tile, causing more water to be retained in the excavations.
- Raise the banks of the ditch to a higher elevation in order to retain additional surface water. There are currently a few spots along the banks that are near or lower in elevation than the recommended spillway elevation. These could become focal points for drainage, perhaps resulting in damage to the banks.
- If drainage from the site is prevented (e.g., by removing the culverts, the drainage tile, and installing spillways), then late winter and early spring floods and precipitation events should supply enough water to restore wetland. However, in years in which a flood does not occur, or flooding events occur after the start of pumping, then wetland hydrology acreage may not achieve the target acreage goals.

Pumping of Beaver Pond Ditch is likely to have the greatest impact on the potential for wetland restoration at this site. Nevertheless, the following suggests that even this can be overcome:

- The pumping of Beaver Pond Ditch generally starts about mid-March, and ends in October or November.
- Soil temperatures collected at the site reveal that the growing season can begin in February, that is, before the start of the pumping season.

- Flood frequency analysis reveals that the month in which action stage events are most likely to occur is March, which is the start of the pumping season.

- Even if only one action stage event occurs after the start of the growing season, but before the start of the pumping season, then it is likely that the target wetland acreage can be achieved if the recommended modifications are made to the site. However, if the event occurs during the pumping season, and the water level in Beaver Pond Ditch remains below bank-full, thereby preventing flooding of the site, then the area satisfying wetland hydrology criteria would likely be smaller than expected.

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Appendix A: Depth to groundwater below land surface (meters)

Read_Date	Well 1S	Well 2S	Well 3S	Well 4S	Well 5S	Well 6S	Well 7S	Well 9S	Well 10S
11/5/2009	0.224	0.402	0.465	dry	0.019	0.198	0.235	0.433	n.i.
12/2/2009	0.294	0.543	0.448	0.631	-0.006	0.180	0.202	0.360	n.i.
1/7/2010	frozen	frozen	frozen	0.443	-0.785	frozen	frozen	frozen	n.i.
2/2/2010	-0.181	-0.139	0.194	0.476	frozen	frozen	0.052	0.187	n.i.
3/8/2010	0.427	0.533	0.522	0.446	0.038	0.098	0.212	0.425	n.i.
3/22/2010	0.173	0.165	0.297	0.263	-0.052	0.015	0.111	0.183	n.i.
4/8/2010	-0.023	0.183	0.286	0.217	-0.040	-0.005	0.097	0.150	dry
4/14/2010	0.151	0.479	0.464	0.375	0.092	0.141	0.250	0.282	dry
4/20/2010	0.395	0.660	0.585	0.506	0.443	0.448	0.385	0.488	dry
4/29/2010	0.452	0.607	0.643	0.541	0.055	0.141	0.287	0.563	0.432
5/4/2010	0.085	0.023	0.537	0.480	0.059	0.121	0.106	0.512	0.349
5/12/2010	0.177	0.506	0.610	0.671	0.277	0.366	0.101	0.674	0.504
5/18/2010	0.189	0.399	0.554	0.564	0.054	0.227	0.427	dry	0.418
5/26/2010	0.393	0.269	0.515	0.652	0.361	missed	0.450	mud	0.454
6/1/2010	0.533	0.539	0.588	dry	0.632	0.539	0.549	dry	0.552
6/8/2010	dry	dry	0.690	dry	dry	0.651	dry	dry	dry
6/22/2010	0.321	0.344	0.452	not read	0.482	0.203	0.435	0.535	not read
7/13/2010	0.292	0.615	0.595	0.481	0.364	0.573	0.437	0.543	0.582
8/10/2010	0.555	0.661	dry	0.516	0.520	dry	0.531	dry	dry
9/8/2010	dry	dry	dry	dry	dry	dry	dry	dry	dry
10/5/2010	dry	dry	dry	dry	dry	dry	dry	dry	dry
11/9/2010	dry	destroyed	dry	dry	dry	dry	dry	dry	dry
12/14/2010	0.348		dry	0.579	not read	not read	not read	0.524	dry
1/13/2011	0.447		dry	dry	0.192	0.259	0.496	0.515	0.632
2/10/2011	0.308		dry	dry	ice	0.195	0.249	0.280	0.588
2/28/2011	flooded		flooded	dry	flooded	flooded	-0.742	-0.287	0.618
3/8/2011	flooded		flooded	dry	flooded	flooded	flooded	flooded	flooded
3/15/2011	flooded		flooded	0.522	flooded	flooded	flooded	flooded	flooded
3/21/2011	-0.341		-0.185	0.303	-0.080	not read	-0.112	-0.140	0.060
3/28/2011	-0.070		0.293	0.334	-0.018	0.047	0.171	0.134	0.444
4/5/2011	0.175		0.352	0.415	-0.036	0.079	0.172	0.276	0.502
4/19/2011	0.050		0.322	0.253	-0.052	0.106	0.150	0.196	0.482
5/5/2011	flooded		flooded	flooded	flooded	flooded	flooded	flooded	flooded
5/16/2011	flooded		flooded	-0.253	flooded	flooded	flooded	-0.622	-0.506
5/24/2011	-0.062		0.116	0.274	-0.029	0.157	0.267	0.261	0.068
5/31/2011	flooded		-0.047	0.417	0.043	0.025	0.275	0.384	0.133

n.i. = not yet installed

grey box = saturation/inundation

Appendix A: Depth to groundwater below land surface (meters)

Read_Date	Well 11S	Well 12S	Well 13S	Well 14S	Well 15S	Well 16S	Well 17S
11/5/2009	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
12/2/2009	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
1/7/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
2/2/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
3/8/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
3/22/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
4/8/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
4/14/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
4/20/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
4/29/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
5/4/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
5/12/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
5/18/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
5/26/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
6/1/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
6/8/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
6/22/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
7/13/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
8/10/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
9/8/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
10/5/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
11/9/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
12/14/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
1/13/2011	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
2/10/2011	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
2/28/2011	0.545	**-0.175**	flooded	dry	**-0.523**	**-0.074**	**-0.047**
3/8/2011	**-0.016**	flooded	flooded	dry	**-0.909**	flooded	flooded
3/15/2011	**-0.005**	flooded	flooded	dry	flooded	flooded	flooded
3/21/2011	**0.131**	**0.114**	**-0.426**	dry	**-0.662**	**-0.064**	**0.116**
3/28/2011	0.640	0.334	**-0.016**	dry	**-0.302**	dry	dry
4/5/2011	dry	**0.220**	0.428	dry	**0.074**	dry	dry
4/19/2011	dry	**0.120**	0.491	dry	**0.115**	dry	dry
5/5/2011	flooded	flooded	flooded	flooded	flooded	flooded	flooded
5/16/2011	**-0.105**	flooded	flooded	0.578	flooded	flooded	flooded
5/24/2011	**0.298**	**0.154**	**0.021**	dry	**-0.363**	dry	not found
5/31/2011	0.454	0.514	**0.113**	dry	**-0.306**	0.475	dry

n.i. = not yet installed

grey box = saturation/inundation

Appendix B: Groundwater and surface-water elevations (meters)

Read_Date	Well 1S	Well 2S	Well 3S	Well 4S	Well 5S	Well 6S	Well 7S	Well 9S	Well 10S	Well 11S
11/5/2009	123.867	123.702	123.826	dry	124.320	123.962	124.029	124.077	n.i.	n.i.
12/2/2009	123.797	123.561	123.843	124.461	124.345	123.980	124.062	124.150	n.i.	n.i.
1/7/2010	frozen	frozen	frozen	124.649	125.124	frozen	frozen	frozen	n.i.	n.i.
2/2/2010	124.272	124.243	124.097	124.616	frozen	frozen	124.212	124.323	n.i.	n.i.
3/8/2010	123.664	123.571	123.769	124.646	124.301	124.062	124.052	124.085	n.i.	n.i.
3/22/2010	123.918	123.939	123.994	124.829	124.391	124.145	124.153	124.327	n.i.	n.i.
4/8/2010	124.114	123.921	124.005	124.875	124.379	124.165	124.167	124.360	dry	n.i.
4/14/2010	123.940	123.625	123.827	124.717	124.247	124.019	124.014	124.228	dry	n.i.
4/20/2010	123.696	123.444	123.706	124.586	123.896	123.712	123.879	124.022	dry	n.i.
4/29/2010	123.639	123.497	123.648	124.551	124.284	124.019	123.977	123.947	124.120	n.i.
5/4/2010	124.006	124.081	123.754	124.612	124.280	124.039	124.158	123.998	124.203	n.i.
5/12/2010	123.914	123.598	123.681	124.421	124.062	123.794	124.163	123.836	124.048	n.i.
5/18/2010	123.902	123.705	123.737	124.528	124.285	123.933	123.837	dry	124.134	n.i.
5/26/2010	123.698	123.835	123.776	124.440	123.978	missed	123.814	mud	124.098	n.i.
6/1/2010	123.558	123.565	123.703	dry	123.707	123.621	123.715	dry	124.000	n.i.
6/8/2010	dry	dry	123.601	dry	dry	123.509	dry	dry	dry	n.i.
6/22/2010	123.770	123.760	123.839	not read	123.857	123.957	123.829	123.975	not read	n.i.
7/13/2010	123.799	123.489	123.696	124.611	123.975	123.587	123.827	123.967	123.970	n.i.
8/10/2010	123.536	123.443	dry	124.576	123.819	dry	123.733	dry	dry	n.i.
9/8/2010	dry	dry	dry	dry	dry	dry	dry	dry	dry	n.i.
10/5/2010	dry	dry	dry	dry	dry	dry	dry	dry	dry	n.i.
11/9/2010	dry	destroyed	dry	dry	dry	dry	dry	dry	dry	n.i.
12/14/2010	123.743		dry	124.513	not read	not read	not read	123.986	dry	n.i.
1/13/2011	123.644		dry	dry	124.147	123.901	123.768	123.995	123.920	n.i.
2/10/2011	123.783		dry	dry	ice	123.965	124.015	124.230	123.964	n.i.
2/28/2011	flooded		flooded	dry	flooded	flooded	125.016	124.794	123.965	124.451
3/8/2011	flooded		flooded	dry	flooded	flooded	flooded	flooded	flooded	125.012
3/15/2011	flooded		flooded	124.550	flooded	flooded	flooded	flooded	flooded	125.001
3/21/2011	124.428		124.478	124.769	124.408	not read	124.386	124.647	124.523	124.865
3/28/2011	124.157		124.000	124.738	124.346	124.084	124.103	124.373	124.139	124.356
4/5/2011	123.912		123.941	124.657	124.364	124.052	124.102	124.231	124.081	dry
4/19/2011	124.037		123.971	124.819	124.380	124.025	124.124	124.311	124.101	dry
5/5/2011	flooded		flooded	flooded	flooded	flooded	flooded	flooded	flooded	flooded
5/16/2011	flooded		flooded	125.325	flooded	flooded	flooded	125.129	125.089	125.101
5/24/2011	124.149		124.177	124.798	124.357	123.974	124.007	124.246	124.515	124.698
5/31/2011	flooded		124.340	124.655	124.285	124.106	123.999	124.123	124.450	124.542

n.i.= not yet installed

Appendix B: Groundwater and surface-water elevations (meters)

Read_Date	Well 12S	Well 13S	Well 14S	Well 15S	Well 16S	Well 17S	Gauge A	Gauge B
11/5/2009	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	dry	n.i.
12/2/2009	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	dry	n.i.
1/7/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	frozen	n.i.
2/2/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	frozen	n.i.
3/8/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	dry	n.i.
3/22/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	123.820	n.i.
4/8/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	not read	n.i.
4/14/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	123.896	n.i.
4/20/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	dry	n.i.
4/29/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	dry	n.i.
5/4/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	124.253	n.i.
5/12/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	123.869	n.i.
5/18/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	123.723	n.i.
5/26/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	123.701	n.i.
6/1/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	dry	n.i.
6/8/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	dry	n.i.
6/22/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	124.015	n.i.
7/13/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	123.854	n.i.
8/10/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	dry	n.i.
9/8/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	dry	n.i.
10/5/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	dry	n.i.
11/9/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	dry	n.i.
12/14/2010	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	dry	n.i.
1/13/2011	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	dry	n.i.
2/10/2011	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	dry	n.i.
2/28/2011	124.997	flooded	dry	124.593	124.810	125.018	flooded	124.081
3/8/2011	flooded	flooded	dry	124.979	flooded	flooded	flooded	124.407
3/15/2011	flooded	flooded	dry	flooded	flooded	flooded	flooded	124.651
3/21/2011	124.708	124.869	dry	124.732	124.800	124.855	flooded	124.693
3/28/2011	124.488	124.459	dry	124.372	dry	dry	124.137	124.657
4/5/2011	124.602	124.015	dry	123.996	dry	dry	123.845	124.388
4/19/2011	124.702	123.952	dry	123.955	dry	dry	123.695	124.407
5/5/2011	flooded	flooded	flooded	flooded	flooded	flooded	flooded	flooded
5/16/2011	flooded	flooded	125.243	flooded	flooded	flooded	flooded	flooded
5/24/2011	124.668	124.422	dry	124.433	dry	not found	124.168	flooded
5/31/2011	124.308	124.330	dry	124.376	124.261	dry	flooded	flooded

n.i.= not yet installed

Appendix C: Well construction

Well#	installation date	borehole depth (m)	well length (m)	stick-up (m)	total well depth (calculated) (m)	screen length (m)	screened interval relative to ground surface (m)	sand pack (m)	bentonite seal (m)
1	10/20/2009	0.75	1.896	1.152	0.744	0.312	0.712-0.400	0.712-0.270	0.270-0.000
2	10/20/2009	0.75	1.888	1.148	0.740	0.299	0.708-0.409	0.708-0.280	0.280-0.000
3	10/20/2009	0.76	1.919	1.176	0.743	0.294	0.711-0.417	0.711-0.290	0.290-0.000
4	10/20/2009	0.74	1.848	1.125	0.723	0.309	0.691-0.382	0.691-0.280	0.280-0.000
5	10/20/2009	0.76	1.847	1.083	0.764	0.280	0.732-0.452	0.732-0.280	0.280-0.000
6	10/20/2009	0.77	1.876	1.086	0.790	0.309	0.758-0.449	0.758-0.300	0.300-0.000
7	10/20/2009	0.76	1.877	1.135	0.742	0.295	0.711-0.416	0.711-0.300	0.300-0.000
8	10/20/2009	0.76	1.849	1.088	0.761	0.308	0.729-0.421	0.729-0.300	0.300-0.000
9	10/21/2009	0.74	1.886	1.080	0.806	0.304	0.775-0.471	0.775-0.300	0.300-0.000
10	4/8/2010	0.75	1.750	1.025	0.725	0.294	0.693-0.399	0.693-0.295	0.295-0.000
11	2/22/2011	0.76	1.705	0.911	0.794	0.313	0.762-0.449	0.762-0.300	0.300-0.000
12	2/22/2011	0.77	1.742	0.954	0.788	0.304	0.756-0.452	0.756-0.210	0.210-0.000
13	2/22/2011	0.75	1.697	0.927	0.770	0.251	0.738-0.487	0.738-0.300	0.300-0.000
14	2/22/2011	0.75	1.705			0.302		0.300	0.300-0.000
15	2/22/2011	0.75	1.700	0.940	0.760	0.310	0.728-0.418	0.728-0.300	0.300-0.000
16	2/23/2011	0.73	1.700	0.955	0.745	0.335	0.713-0.378	0.713-0.270	0.270-0.000
17	2/23/2011	0.74	1.699	0.969	0.730	0.310	0.698-0.388	0.698-0.260	0.260-0.000

Appendix D: NWI Wetland Determination (U.S. Fish and Wildlife Service 2009). Map based on Lawrence, NE and SE digital orthophoto quarter quadrangles (Illinois State Geological Survey 2006).

Appendix E: NRCS wetland determination

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
2812 West Haven Road
Lawrenceville, IL 62439
Phone: 618.943.2621 Ext 3 Fax: 618.943.5613

RECEIVED
AUG 24 2009
I.D.O.T. - DISTRICT 7

August 18, 2009

Dear USDA Participant:

Per your request we have completed the Wetland Determination.

The non-cropland (woodland) that is adjacent to the Prior Converted (PC) fields is potentially wetlands please do not install perforated tile within 100 feet of the non-cropland (woodland) area. If you would like to tile closer to the woodland please completed a new 1026 request indicating this.

This determination has been conducted for the purpose of implementing the wetland conservation provisions of the Food Security Act of 1985. This determination may not be valid for identifying the Army Corps of Engineers' (COE) Clean Water Act jurisdiction for this site. If you intend to conduct any activity that constitutes a discharge of dredged or fill material into wetlands or other waters, you should request a jurisdictional determination from the local office of the COE prior to starting the work.

Attached you will find an NRCS-CPA-026E and a Map for your records.

If you have any questions please contact the office.

Respectfully,

Jeremy Bennett
District Conservationist
Lawrenceville Field Office (Lawrence and Wabash Counties)

Phone: (618) 943-2621 ext.3
Fax: (618) 943-5613

cc: case file

Helping People Help the Land

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Appendix E: continued

United States Department of Agriculture

Natural Resources Conservation Service

NRCS-CPA-026E
9/2000

HIGHLY ERODIBLE LAND AND WETLAND CONSERVATION DETERMINATION

Name Address:	Bart Pals 270 CO RD 950 E Jewett, IL 62436	Request Date:	7/14/09	County:	Lawrence
Agency or Person Requesting Determination:	Bart Pals	Tract No:	647	FSA Farm No.:	61

Section I - Highly Erodible Land

Is a soil survey now available for making a highly erodible land determination?	Yes
Are there highly erodible soil map units on this farm?	Yes

Fields in this section have undergone a determination of whether they are highly erodible land (HEL) or not; fields for which an HEL Determination has not been completed are not listed. In order to be eligible for USDA benefits, a person must be using an approved conservation system on all HEL.

Field(s)	HEL(Y/N)	Sodbust(Y/N)	Acres	Determination Date
1	N	N	12.1	8/18/09
2	N	N	13.0	8/18/09
3	N	N	5.7	8/18/09
4	N	N	38.7	8/18/09
	-	-		

The Highly Erodible Land determination was completed in thefield .

Section II - Wetlands

Are there hydric soils on this farm?	Yes

Fields in this section have had wetland determinations completed. See the Definition of Wetland Label Codes for additional information regarding allowable activities under the wetland conservation provisions of the Food Security Act and/or when wetland determinations are necessary to determine USDA program eligibility.

Field(s)	Wetland Label*	Occurrence Year (CW)**	Acres	Determination Date	Certification Date
1	PC		12.1	8/18/09	8/18/09
2	PC		13.0	8/18/09	8/18/09
3	PC		5.7	8/18/09	8/18/09
4	PC		38.7	8/18/09	8/18/09
	-				

The wetland determination was completed in the -Field It was -mailed to the person on 8/18/09.

Remarks: If you tile the Prior Converted Cropland (PC) fields please do not install perforated tile within 100 feet of the Woodland area because the woodland is a potential wetland.

This wetland determination was completed only for the specific area(s) or field(s) listed above. Other wetlands may occur on this tract. Please request a determination for other areas before clearing, draining or performing other activities that may impact or cause a conversion of wetlands.

I certify that the above determinations are correct and were conducted in accordance with policies and procedures contained in the National Food Security Act Manual.

Signature Designated Conservationist	Date
Jerry B. Bennett	8/18/09

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Appendix E: continued

***DEFINITIONS OF WETLAND LABEL CODES**

AW	Artificial Wetland. An area that is artificial or irrigation induced wetland. These wetlands are not subject to the wetland conservation provision.
AW/FW	An area that contains both AW and FW.
AW/W	An area that contains both AW and W.
CC	Commenced Conversion exemption.
CPD	Corps Permit Decision. Corps of Engineers permit decisions regarding section 404 of the Clean Water Act will be relied upon to satisfy the wetland conservation provisions of the Food Security Act of 1985, as amended.
CMW	An area that receives a Categorical Minimal Effect determination.
CW	Converted Wetlands. An area converted between December 23, 1985 and November 28, 1990. IN any year that an agricultural commodity is planted on these converted wetlands, you will ineligible for USDA benefits.
**CW+year	An area converted after November 28, 1990. You will be ineligible for USDA program benefits until this wetland is restored.
CWNA	Converted Wetland Non-Agricultural use. A wetland area converted to other than agricultural commodity production.
CWTE	Converted Wetland Technical Error. An area converted or commenced based on an incorrect NRCS determination or misinformation from a NRCS or FSA employee.
FW	Farmed Wetland. An area that is farmed wetland; was manipulated and planted before December 23, 1985, but still meets wetland criteria. These may be farmed and maintained in the same manner as long as they are not abandoned.
FWP	Farmed Wetlands Pasture. An area that is pasture or hayland, manipulated before December 23, 1985 but still meets wetland criteria. These may be farmed and maintained in the same manner as long as they are not abandoned.
MIW	Mitigation Wetlands. Wetlands on which a person is actively mitigating a frequently cropped area or a wetland converted between December 23, 1985 and November 28, 1990. A converted wetland, farmed wetland, or farmed wetland pasture on which functions and values were lost are compensated for through wetland restoration, enhancement or creation.
MW	Minimal effect Wetland. An area determined to be minimal effect. These wetlands are to be farmed according to the minimal-effect agreement signed at the time the minimal-effect determination was made,
MWM	An area determined to be minimal effect with mitigation.
NI	Not Inventoried – No wetland determination has been completed.
NW	Non-Wetland. An area that does not contain a wetland.
NW/NAD	An area determined to be a non-wetland resulting from a decision from the National Appeals Division.
OW	Other Waters of the U.S. Area that fall under the jurisdiction of the Clean Water Act.
PC	Prior Converted cropland, which was drained filled, or manipulated before December 23, 1985; was cropped prior to December 23, 1985; was not abandoned; and does not meet FW criteria. These are not subject to the wetland conservation provision unless the area reverts to wetland as a result of abandonment.
PC/NW	An area that contains both PC and NW.
TP	Third Party Exemption.
W	Wetlands. An area meeting wetland criteria, including wetland farmed under natural conditions. If you plan to clear, drain, fill, level or manipulate these areas, contact NRCS and the Army Corp of Engineers prior to any such activity.
WX	A wetland area that has been manipulated after December 23, 1985, but was not, for the purpose of making production possible and production was not made possible. These include wetlands manipulated by drainage maintenance agreements.

COPY

Appendix E: continued

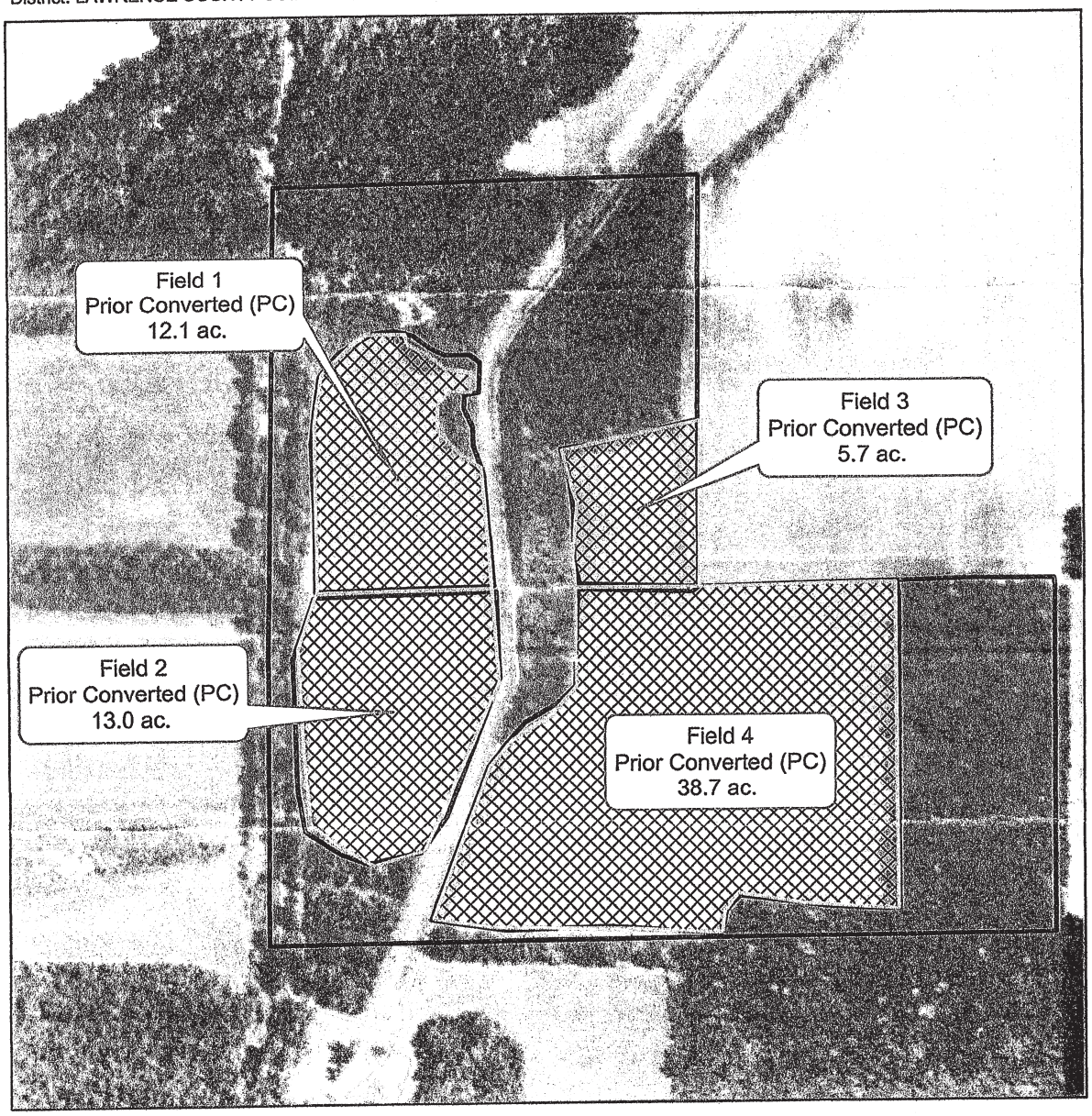
Determination MAP

Customer(s): BART C PALS

District: LAWRENCE COUNTY SOIL & WATER CONSERVATION DISTRICT

Field Office: LAWRENCEVILLE SERVICE CENTER

Map prepared by Jeremy Bennett



Legend

Prior Converted (PC)

T 647

300 0 300 600 900 1,200 Feet

N

Agency: NRCS

Date: 8/18/2009

Appendix F. Photographs of flooding at the proposed wetland bank.

These photographs were taken on January 7, 2010 in the forest north of the agricultural field west of Beaver Pond Ditch, and show evidence of recent inundation. This was likely the result of Beaver Pond Ditch overtopping its banks on December 29 and 30, 2009 which was likely due to a flood event on the Embarras River that was occurring at the same time (Figure 11).

Appendix F. Continued.

These photographs were taken March 22, 2010 and show Beaver Pond Ditch in a bank-full condition (top), inundation in the forested are west of the ditch (top), and inundation in the south end of the agricultural field west of Beaver Pond Ditch (bottom). This inundation was likely due to an action stage event that occurred on the Embarras River on March 15, 2010.

Appendix F. Continued.

These photographs show flooding at the site on March 15, 2011 (top) and May 3, 2011 (bottom). The view in both is looking southeastward towards the farm field west of Beaver Pond Ditch from the top of the Russell-Allison Levee that forms the western boundary of the site. In the top photograph, the surface water is 0.6-0.9 m (2.0-3.0 ft) deep, and extends south to well 11S (Figure 6), and in the bottom photograph it is 1.8-2.4 m (6.0-8.0 ft) deep, and covers the entire site.

Part A. Pre-construction hydrology monitoring. See document section IV. D. Specifications, Figure 10, and Exhibit A in this appendix.

Part. B. Drainage tile/culvert search. See document section IV. D. Specifications

Part C. Control weedy and invasive vegetation.

Initial mowing. This work shall consist of mowing the existing turf in the entire field areas prior to interseeding and tree planting as shown in the plans, or as directed by the Engineer. The equipment used shall be capable of shredding all regeneration of brush 2 inches diameter or less as identified by the Engineer. The completed mowed turf shall be 3" (max.) in height. All areas that have been burned, contain sparse vegetation, or short thick vegetation (less than 2' in height) will not require mowing prior to seeding and will be required to be plowed under as part of the seeding pay item(s). These areas will be determined by the Engineer and will not be measured for payment.

Weed control, non-selective and non-residual. This work shall consist of the application of a non-selective and non-residual herbicide (Rodeo or equal) to kill all existing vegetation at designated areas within the wetland bank site. This item will be used prior to seeding at the direction of the Engineer wherever stands of weeds are present. It will also be used as a spot spray application if weeds persist in subsequent seasons.

Materials: The non-selective and non-residual herbicide (Rodeo or equal) shall have the following formulation:

A. Active Ingredient	
*Glyphosate, N- (phosphonomethyl) glycine, in the form of its isopropylamine salt	53.8%
B. Inert Ingredients (including surfactant)	46.2%
TOTAL	100.00%

*Contains 5.4 pounds per gallon glyphosate, isopropylamine salt (4 pounds per gallon glyphosate acid).

The Contractor shall submit a certificate, including the following, prior to starting work:

1) The chemical names of the compound and the percentage by volume of the ingredients which must match the above specified formulation.
2) A statement that the material is in a solution which will form a satisfactory emulsion for use when diluted with water for normal spraying conditions.

3) A statement that the Rodeo or equal, when mixed with water, will be completely soluble and dispersible and remain in suspension with continuous agitation.

4) A statement describing the products proposed for use when the manufacturer of Rodeo or equal requires that surfactants, drift control agents, or other additives

be used with the product. These tank mix additives shall be used as specified by the manufacture. Required additives will not be paid for separately.

All material shall be brought to the spray area in the original, unopened containers supplied by the manufacturer.

Scheduling: Spraying will not be allowed when temperatures exceed 90º F or under 60º F, when wind velocities exceed fifteen (15) miles per hour, when foliage is wet or rain is eminent, when visibility is poor or during legal holiday periods.

Application Rate: The Rodeo or equal non-selective and non-residual herbicide shall be applied at the rate of one 5 pints per acre.

Five pints of Rodeo or equal formulation shall be diluted with a minimum of 50 gallons of water and applied as a mixture. Water for dilution of the mixture will not be paid for separately.

Part D. Excavate wetland creation areas.

Excavation activities related to wetland creation and levee removal will proceed according to IDOT Standard Specifications for Road and Bridge Construction, Section 201 Clearing, Tree Removal and Protection Care and Repair of Existing Plant Material, and Section 202—Earth and Rock Excavation.

Clearing vegetation. See IDOT Standard Specifications Section 201—Clearing, Tree Removal, and Protection, Care and Repair of Existing Plant Material.

Prior to starting excavation operations in any area, all clearing, tree removal, and protection of existing plant material in that area shall be performed according to Section 201. This work shall consist of the satisfactory removal and disposal of all existing trees, shrubs, brush, etc. from the proposed earth excavation and embankment areas, construction limits, as shown in the plans and as directed by the Engineer in accordance with applicable portions of Section 201 of the Standard Specifications. Approximately 90% of the site was farmed in 2006 and only narrow strips of woody vegetation occur along the stream margins and site boundaries. It shall be the Contractor's responsibility to visit the site prior to bidding to determine the exact work involved with this item of work.

Earth excavation and removal. See also IDOT Standard Specifications Section 202— Earth and Rock Excavation.

This work shall consist of the excavation of earth in planned wetland creation areas, the excavation of earth in existing berms and the excavation of earth in existing levees as shown in the plans, and the transportation of suitable excavated material to embankment locations throughout the limits of the contract; or the excavation, transportation, and disposal of excavated material. This work does not include excavation for structures or channel excavation.

Basins shall be excavated according to the lines, grades, and cross sections shown on the plans.

There shall be no topsoil stockpiling and backfilling. However, suitable excavated materials shall not be wasted without permission of the Engineer. The Contractor shall dispose of all surplus, unstable, and unsuitable materials and organic waste in such a manner that public or private property will not be damaged or endangered.

Part E. Culvert removal and spillway installation.

Culvert or tile removal. Where culverts or tile enter a stream or ditch excavation will begin away from the stream (at the landward end of the pipe) and the culvert will be removed after it is exposed along its full length to minimize disturbance of the stream bank. After removal, the remaining trench will be backfilled with materials equivalent to those in unaltered areas surrounding the trench. Backfill materials should be compacted as they are placed to prevent the piping and sapping through the stream bank.

After the trench is backfilled it will immediately be covered with at least 2 inches of local top soil and seeded with nurse crop grasses. An erosion control fabric or geotextile will be installed and stapled to protect the seeding while vegetation becomes established.

Spillway installation. Spillways will be built according to guidelines and plans in the USDA-NRCS Engineering Field Manual, Chapter 6. (U.S. Department of Agriculture 1984). Excavation, preparation of the substrate and erosion control measures will be employed in accordance with Section 200 of the IDOT Standard Specifications Manual.

Part F. Levee reconstruction.

The following guidelines will be used to reconstruct the existing levees:

1) Where added material is needed to build the levee to the design elevation, the constructed elevation of the levee top will exceed the design elevation by 0.5 feet to allow for settling of the placed material.
2) After the levee is constructed, it will immediately be covered with top soil and seeded with nurse crop grasses.

See also IDOT Standard Specifications Section 205—Embankment. Articles 205.03, 205.04, 205.05 are summarized below:

205.03 Preparation of Existing Ground Surface. Before any embankment is placed, all clearing and tree removal over the entire area shall be performed according to Section 201, and the top 150 mm (6 in.) of the existing ground surface shall be disked and then compacted to the satisfaction of the Engineer. Snow and ice shall be removed from the area to be covered by the embankment. Embankment shall not be placed on frozen earth. When construction is resumed after any winter shutdown period, the top 200 mm (8 in.) of all partially completed embankments shall be reprocessed and compacted to the minimum specified density prior to placing

more fill material on the embankment. When embankments are to be constructed on hillsides or slopes, or if existing embankments are to be widened or included in new embankments, the existing slopes shall be plowed deeply. If additional precautions for binding the fill materials together are justified, steps shall be cut into the existing slopes before the construction of the embankment is started.

205.04 Placing Material. Embankments shall be constructed of materials that will compact and develop a stability satisfactory to the Engineer. No sod, frozen material or any material which, by decay or otherwise, might cause settlement, shall be placed or allowed to remain in embankments. Embankments shall be constructed to the height and width deemed necessary to provide for shrinkage during compaction. Upon completion, the embankments shall conform to the lines, grades and cross sections shown on the plans. When embankments are constructed of materials specified in Article 202.03, such materials shall be well distributed, and sufficient earth, or other fine material shall be incorporated with them when they are deposited to fill the interstices and provide solid embankment. No rock, stones or broken concrete shall be permitted within the subgrade for such construction. So far as practicable, each layer of material shall extend the entire length and width of the embankment. The material shall be leveled by means of bulldozers, blade graders or other equipment approved by the Engineer. Each layer shall be not more than 200 mm (8 in.) thick when in loose condition, uniform in cross section, and thoroughly compacted before the next layer is started.

205.05 Compaction. Each layer of the embankment material shall be disked sufficiently to break down oversized clods, secure a uniform moisture content, and ensure uniform density and compaction. The embankment shall be sprinkled with water when it is necessary to increase the moisture content of the soil to permit the embankment to be constructed to the appropriate densities. Compacting equipment and compacting operations shall be coordinated with the rate of placing embankment so that the required density is obtained. Special care shall be exercised in compacting embankments adjacent to structures and in sharp depressions. Where such areas are inaccessible to the compacting equipment being used, the material shall be placed in 200 mm (8 in.) horizontal layers and uniformly compacted with suitable mechanical equipment.

Part G. Seeding and tree planting.

Interseeding, Class 2 (Special) All work, materials and equipment shall conform to Section 250 and 1081 of the Standard Specifications except as modified herein. The Engineer shall be notified 48 hours prior to beginning the seeding operations so that the Engineer may be present.

Seed Mixture for Seeding, Class 2 (Special) shall include annual and native plant seeds consisting of the following:

<u>Annuals</u>
Redtop (Agrostis alba) 3 lbs/acre
Timothy (Phleum pratense) 3 lbs/acre
Annual rye (Secale cereale) 50 lbs/acre

Native Plants
Stout wood reed (Cinna arundinacea) 0.1 lbs/acre
Virginia wild rye (Elymus virginicus) 1 lbs/acre
Smartweed (Polygonium punctatum) 0.5 lbs/acre
Goldenglow / Cut-leaf Coneflower (Rudbeckia laciniata) 0.1 lbs/acre

Mulch will not be required.

Tree planting procedures – containerized stock This work shall consist of digging and preparing plant holes, shrub beds, and of furnishing, transporting, and planting trees and shrubs shown on the plans, as directed by the Engineer, and in accordance with applicable portions of Section 253 of the Standard Specifications, except as follows:

Fertilizer: The fertilizer for the backfill mix shall be controlled slow release fertilizer tablets. The tablets shall be 16 gram briquettes containing 4.9% water soluble urea nitrogen and water insoluble nitrogen as expressed in the following formulation:

14% nitrogen, 3% available phosphoric acid, and 3% water-soluble potash (14-3-3 analysis) plus trace elements

When placing the prepared backfill, the fertilizer nutrient tablet shall be uniformly spread in the planting hole around the root ball and within the top 1/3 of the backfill mix.

The rate of application and placement shall be governed by the manufacturer's recommendation or the following table, if none is given, for all trees:

a. 3 tablets in bottom of hole
b. 2 tablets per foot of height to a maximum of 30 tablets

The cost of the fertilizer tablets will not be paid for separately, but shall be considered as included in the contract unit price(s) per each for the trees, intermediates, and shrubs of the various kinds and sizes specified in this contract.

Weed Barrier: Weed barrier mat is required. Each mat shall be 4’ x 4’ around each individual tree made of polypropylene, thickness 16 mils, water permeable, held down with 9 staples (6” x1” x 6” non-coated steel) per mat.

Bracing: No bracing will be required.

Tree Wrap: No tree wrap will be required, but tree trunk protection will be required as specified elsewhere herein.

Tree planting procedures – seedling stock. This work shall consist of furnishing, transporting, and planting trees and shrubs shown on the plans, as directed by the Engineer, and in accordance with applicable portions of Section 253 of the Standard Specifications, except as follows:

Fertilizer: No fertilizer will be required.

Weed Barrier: No weed barrier will be required.

Tree Wrap: No tree wrap will be required.

Tree trunk predator protection. Tree trunk predator protection will only be used if 3-gallon containerized tree stock is chosen to plant at the site. This work shall consist of providing the necessary personnel, material and equipment to install predator protection to all trees and shrubs from the ground line to a height of 4 feet.

Material: The contractor shall use a 19-gauge hardware cloth with a one-half inch square mesh design. Steel staples, also known as pig rings, shall be used to fasten hardware cloth together. Six foot wooden stakes shall be used to hold cloth upright and 6 inch long staples, such as those used to secure erosion control blanket, shall be used to secure cloth to the ground.

Method: The predator protection shall be 14 inches in diameter with a 4 inch overlap. The hardware cloth shall be secured to itself with a minimum of four pig rings. Each mesh tube shall be supported with two 6 foot wooden stakes and secured to the ground with four 6 inch long staples.

For two years following the tree planting (during the tree care cycles), the Contractor shall remove and replace any damaged predator protection as determined by the Engineer. Any predator protection damaged due to Contractor operations shall be replaced immediately at the Contractor's expense.

Extended tree maintenance items. The purpose of the following items is to extend the care given to the plants after the final inspection has been made and all work has been completed as required in Article 253.14 of the Standard Specifications. This work shall begin the following spring after all final inspection items have been completed and shall extend to June 30 for two growing seasons.

A. Tree Care Cycle: All trees and intermediates shall receive the following care:

1. Desucker and prune dead and broken branches.

2. Remove weeds and grass from within saucer area and shrub beds.

3. Remove dead plants.

4. Replace weed barrier mat, if not in place and working properly.

5. Repair, replace, or reinstall tree trunk protector as necessary, and trim branches as necessary.

First Cycle: Items 1, 2, 3, 4, and 5 shall be performed between June 15 and June 30 of the first year.

Second Cycle: Items 1, 2, 3, 4, and 5 shall be performed between June 15 and June 30 of the second year.

B. Tree and Intermediate Watering: Beginning in July, all shade and intermediate trees shall receive five (5) gallons of water and each container grown (C.G.) plant shall receive one (1) gallon of water for each watering as directed by the Engineer. The method of watering shall be by injection and approved by the District Landscape Architect.

Watering must be completed in a timely manner. When the Engineer directs the Contractor to do supplemental watering, the Contractor must begin the watering operation within 48 hours of notice. A minimum of 10 units of water per day must be applied until the work is complete. Damage to plant material that is a result of the Contractor's failure to water in a timely way must be repaired or replaced at the Contractor's expense.

Source of Water: The Contractor shall notify the Engineer of the source of water used and provide written certification that the water does not contain chemicals harmful to plant growth.

Maintenance mowing. This work shall consist of mowing the existing turf in the entire field areas after the proposed tree planting as shown in the Schedule of Work, or as directed by the Engineer. The equipment used shall be capable of adequately mowing areas around the existing planted trees and shredding all regeneration of brush 2 inches diameter or less to the satisfaction of the Engineer. The trees are to be planted in rows at 25' centers; therefore, a grid pattern of mowing shall be utilized.

Maintenance mowing shall be completed twice a year, between July 1 and August 30, for two years after the year of tree establishment as directed by the Engineer. The mowed turf shall be approximately 3" in height or as approved by the Engineer.

SECTION 214. GRADING AND SHAPING DITCHES

214.01 Description. This work shall consist of grading and shaping existing ditches.

CONSTRUCTION REQUIREMENTS

214.02 General. All surplus, unstable, and unsuitable material shall be disposed of according to Article 202.03.

214.03 Method of Measurement. This work will be measured for payment in feet (meters) along the centerline of the ditch.

The volume of any unstable and/or unsuitable material removed will be measured for payment according to Article 202.07.

214.04 Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for GRADING AND SHAPING DITCHES.

Removal and disposal of unstable and/or unsuitable material will be paid for according to Article 202.08.

LANDSCAPING

SECTION 250. SEEDING

250.01 Description. This work shall consist of preparing the seed bed and placing the seed and other materials required in seeding operations on the shoulders, slopes, and other areas.

250.02 Materials. Materials shall be according to the following.

	Item	Article/Section
(a)	Seeds	1081.04
(b)	Agricultural Ground Limestone	1081.07
(c)	Fertilizer	1081.08

250.03 Equipment. Equipment shall be according to the following.

	Item	Article/Section
(a)	Disk	1101.08(a)
(b)	Slope Harrow	1101.08(b)
(c)	Hydraulic Seeder	1101.08(c)
(d)	Cultipacker	1101.08(d)
(e)	Broadcast Seeders	1101.08(e)
(f)	Tractor Drawn or Tractor Mounted Drop Seeders	1101.08(f)
(g)	Rangeland Type Grass Drill and Interseeding Attachment	1101.08(g)
(h)	Slit Seeder	1101.08(h)

CONSTRUCTION REQUIREMENTS

250.04 Fertilizer and Agricultural Ground Limestone Application. When specified for bare earth areas, fertilizer nutrients and agricultural ground limestone shall be uniformly spread over the designated areas immediately prior to seed bed preparation.

When specified for existing turf areas, fertilizer nutrients and agricultural ground limestone shall be uniformly spread over the designated areas during the spring, late summer, or early fall seasons. The Contractor shall restore any existing turf areas damaged by improper application of fertilizer nutrients or agricultural ground limestone.

When fertilizer is specified, 270 lb (300 kg) of fertilizer nutrients per acre (hectare) shall be applied at 1:1:1 ratio as follows.

Nitrogen Fertilizer Nutrients	90 lb/acre (100 kg/ha)
Phosphorus Fertilizer Nutrients	90 lb/acre (100 kg/ha)
Potassium Fertilizer Nutrients	90 lb/acre (100 kg/ha)

When agricultural ground limestone is specified, it shall be applied at a rate of 2 tons/acre (4.5 metric tons/ha) multiplied by the source correction factor.

250.05 Seed Bed Preparation. For bare earth seeding, seed bed preparation shall not be started until all stones, boulders, debris, and similar material larger than 3 in. (75 mm) in diameter have been removed and all other requirements of Section 212 have been completed. The area to be seeded shall be worked to a minimum depth of 3 in. (75 mm) with a disk tiller or other equipment approved by the Engineer, reducing all soil particles to a size not larger than 2 in. (50 mm) in the largest dimension. The prepared surface shall be relatively free from weeds, clods, stones, roots, sticks, rivulets, gullies, crusting, and caking. No seeds shall be sown until the seed bed has been approved by the Engineer.

Seed bed preparation will not be required for Class 7 Seeding if the soil is in a loose condition. Light disking shall be done if the soil is hard or caked.

For areas in which a stand of winter wheat exists, as a result of temporary erosion control seeding, disking will be required.

250.06 Seeding Methods. No seed shall be sown during high winds or when the ground is not in a proper condition for seeding, nor shall any seed be sown until the purity test has been completed for the seeds to be used, and shows that the seed meets the noxious weed seed requirements. All equipment shall be approved by the Engineer prior to being used. Prior to starting work, seeders and interseeders shall be calibrated and adjusted to sow seeds at the required seeding rate. Equipment shall be operated in a manner to ensure complete coverage of the entire area to be seeded or interseeded. The Engineer shall be notified 48 hours prior to beginning the seeding operations so that the Engineer may determine by trial runs that a calibration of the seeder will provide uniform distribution at the specified rate per acre (hectare). When seed or fertilizer is applied with a hydraulic seeder, the rate of application shall be not less than 1000 gal (9500 L) of slurry per acre (hectare). This slurry shall

contain the proper quantity of seed or fertilizer nutrients specified per acre (hectare). When using a hydraulic seeder, the fertilizer nutrients and seed shall be applied in two separate operations.

All legumes (clover and alfalfa) shall be inoculated with the proper bacteria in the amounts and manner recommended by the manufacturer of the inoculant before sowing or being mixed with other seeds for sowing. The inoculant shall be furnished by the Contractor and shall be approved by the Engineer. The seed shall be sown as soon as possible after inoculation. Seed that has been standing more than 24 hours after inoculation shall be reinoculated before sowing. If legumes are applied by a hydraulic seeder, three times the normal amount of inoculant shall be used.

(a) Bare Earth Seeding. Bare earth seeding shall be done using the following methods unless otherwise specified or directed by the Engineer.

(1) Seeding Classes 1, 2, and 6 shall be sown with a machine that mechanically places the seed in direct contact with the soil, packs, and covers the seed in one continuous operation.

(2) Seeding Class 4 shall be sown with a rangeland type grass drill.

(3) Seeding Class 3 may be sown with a hydraulic seeder.

(4) Seeding Classes 5 and 7 shall be sown with a hydraulic seeder or rangeland type grass drill.

Broadcasting or hydraulic seeding will be allowed as approved by the Engineer on steep slopes (over 1:3 (V:H)) or in inaccessible areas where use of the equipment specified is physically impossible. When broadcast seeders are used for Seeding Class 3 or 4, the individual seeds comprising the seeding mixture shall be sown separately. When Seeding Class 7 is used as an erosion control measure to establish temporary cover, hand broadcasting of the seed or other methods approved by the Engineer will be allowed.

(b) Interseeding. Interseeding is the seeding of areas of existing turf. Prior to interseeding, all areas of existing turf to be interseeded, except as listed below, shall be mowed one or more times to a height of not more than 3 in. (75 mm). The equipment used shall be capable of completely severing all growth at the cutting height and distributing it evenly over the mowed area. The cut material shall not be windrowed or left in a lumpy or bunched condition. Additional mowing may be required, as directed by the Engineer, on certain areas in order to disperse the mowed material and allow penetration of the seed. The Contractor will not be required to mow within 1 ft (300 mm) of the right-of-way fence, continuously wet ditches and drainage ways, slopes 1:3 (V:H) and greater, or areas which may be designated as not mowable by the Engineer.

Debris encountered during the mowing and interseeding operations which hamper the operation or are visible from the roadway shall be removed and disposed of according to Article 250.05. Damage to the right-of-way and

turf, such as ruts or wheel tracks more than 2 in. (50 mm) in depth, shall be repaired to the satisfaction of the Engineer prior to the time of interseeding.

All seeding classes shall be interseeded using a rangeland type grass drill with an interseeding attachment, except the following.

(1) When specified in the plans or directed by the Engineer, a slit seeder shall be used to interseed Class 1 or Class 2 seed.

(2) Broadcasting or hydraulic seeding will be allowed as approved by the Engineer on steep slopes (1:3 (V:H) or steeper) or in inaccessible areas where use of the equipment specified is physically impossible. Sufficient water shall be applied to these areas to wash the seed down to the soil.

When broadcast seeders are used for Seeding Class 3 or 4, the individual seeds comprising the seeding mixture shall be sown separately.

250.07 Seeding Mixtures. The classes of seeding mixtures and combinations of mixtures will be designated in the plans.

When an area is to be seeded with two or more seeding classes, those mixtures shall be applied separately on the designated area within a seven day period. All seeding shall occur prior to placement of mulch cover. A Class 7 mixture can be applied at any time prior to applying any seeding class or added to them and applied at the same time.

Art. 250.07 Seeding

TABLE 1 - SEEDING MIXTURES			
Class - Type		Seeds	lb/acre (kg/hectare)
1	Lawn Mixture 7/	Ky Bluegrass	100 (110)
		Perennial Ryegrass	60 (70)
		Creeping Red Fescue	40 (50)
1A	Salt Tolerant Lawn Mixture 7/	Bluegrass	60 (70)
		Perennial Ryegrass	20 (20)
		Audubon Red Fescue	20 (20)
		Rescue 911 Hard Fescue	20 (20)
		Fults Salt Grass 1/	60 (70)
1B	Low Maintenance Lawn Mixture 7/	Fine Leaf Turf-Type Fescue 3/	150 (170)
		Perennial Ryegrass	20 (20)
		Red Top	10 (10)
		Creeping Red Fescue	20 (20)
2	Roadside Mixture 7/	Inferno Tall Fescue or Tarheel II Tall Fescue	100 (110)
		Perennial Ryegrass	50 (55)
		Creeping Red Fescue	40 (45)
		Red Top	10 (10)
2A	Salt Tolerant Roadside Mixture 7/	Inferno Tall Fescue or Tarheel II Tall Fescue	60 (70)
		Perennial Ryegrass	20 (20)
		Audubon Red Fescue	30 (35)
		Rescue 911 Hard Fescue	30 (35)
		Fults Salt Grass 1/	60 (70)
3	Northern Illinois Slope Mixture 7/	Elymus Canadensis (Canada Wild Rye)	5 (5)
		Perennial Ryegrass	20 (20)
		Alsike Clover 2/	5 (5)
		Desmanthus Illinoensis (Illinois Bundleflower) 2/, 5/	2 (2)
		Andropogon Scoparius (Little Bluestem) 5/	12 (12)
		Bouteloua Curtipendula (Side-Oats Grama)	10 (10)
		Fult Salt Grass 1/	30 (35)
		Oats, Spring	50 (55)
		Slender Wheat Grass 5/	15 (15)
		Buffalo Grass (Cody or Bowie) 4/, 5/, 9/	5 (5)
3A	Southern Illinois Slope Mixture 7/	Perennial Ryegrass	20 (20)
		Elymus Canadensis (Canada Wild Rye) 5/	20 (20)
		Panicum Virgatum (Switchgrass) 5/	10 (10)
		Andropogon Scoparius (Little Blue Stem) 5/	12 (12)
		Bouteloua Curtipendula (Side-Oats Grama) 5/	10 (10)
		Petalostemum Candidum (White Prairie Clover) 5/	5 (5)
		Rudbeckia Hirta (Black-Eyed Susan) 5/	5 (5)
		Oats, Spring	50 (55)

Class - Type		Seeds	lb/acre (kg/hectare)
4	Native Grass 6/, 8/	Andropogon Gerardi (Big Blue Stem) 5/	4 (4)
		Andropogon Scoparius (Little Blue Stem) 5/	5 (5)
		Bouteloua Curtipendula (Side-Oats Grama) 5/	5 (5)
		Elymus Canadensis (Canada Wild Rye) 5/	1 (1)
		Panicum Virgatum (Switch Grass) 5/	1 (1)
		Sorghastrum Nutans (Indian Grass) 5/	2 (2)
		Annual Ryegrass	25 (25)
		Oats, Spring	25 (25)
		Perennial Ryegrass	15 (15)
4A	Low Profile Native Grass 6/, 8/	Andropogon Scoparius (Little Blue Stem) 5/	5 (5)
		Bouteloua Curtipendula (Side-Oats Grama) 5/	5 (5)
		Elymus Canadensis (Canada Wild Rye) 5/	1 (1)
		Sporobolus Heterolepsis (Prairie Dropseed) 5/	0.5 (0.5)
		Annual Ryegrass	25 (25)
		Oats, Spring	25 (25)
		Perennial Ryegrass	15 (15)
4B	Wetland Grass and Sedge Mixture 6, 8/	Annual Ryegrass	25 (25)
		Oats, Spring	25 (25)
		Wetland Grasses (species below)	6 (6)

Species:	% By Weight 5/
Calamagrostis Canadensis (Blue Joint Grass)	12
Carex lacustris (Lake-Bank Sedge)	6
Carex slipata (Awl-Fruited Sedge)	6
Carex stricta (Tussock Sedge)	6
Carex vulpinoidea (Fox Sedge)	6
Eleocharis aciculoris (Needle Spike Rush)	3
Eleocharis obtusa (Blunt Spike Rush)	3
Glyceria striata (Fowl Manna Grass)	14
Juncus effusus (Common Rush)	6
Juncus tenuis (Slender Rush)	6
Juncus torreyi (Torrey's Rush)	6
Leersia oryzoides (Rice Cut Grass)	10
Scirpus acutus (Hard-Stemmed Bulrush)	3
Scirpus atrovirens (Dark Green Rush)	3
Scirpus fluviatilis (River Bulrush)	3
Scirpus validus (Softstem Bulrush)	3
Spartina pectinata (Cord Grass)	4

Art. 250.07 Seeding

Class - Type		Seeds	lb/acre (kg/hectare)
5	Forb with Annuals Mixture	Annuals Mixture (Below) 6/, 8/	1 (1)
		Forb Mixture (Below) 6/, 8/	10 (10)

Annuals Mixture - Mixture not exceeding 25 % by weight of any one species, of the following:

Coreopsis lanceolata (Sand Coreopsis)
Chrysanthemum maximum (Shasta Daisy)
Gaillardia pulchelle (Blanket Flower)
Ratibida columnitera (Long-Headed Coneflower)
Rudbeckia hirta (Black-Eyed Susan)

Forb Mixture - Mixture not exceeding 5 % by weight PLS of any one species, of the following:

Amorpha canescens (Lead Plant) 2/
Anemone cylindrica (Thimble Weed)
Asclepias tuberosa (Butterfly-Weed)
Aster azureus (Sky Blue Aster)
Aster laevis (Smooth Aster)
Aster novae-angliae (New England Aster)
Baptisia leucantha (White Wild Indigo) 2/
Coreopsis palmata (Prairie Coreopsis)
Echinacea pallida (Pale Purple Coneflower)
Eryngium yuccifolium (Rattlesnake Master)
Helianthus mollis (Downy Sunflower)
Heliopsis helianthoides (Ox-Eye)
Liatris aspera (Rough Blazing Star)
Liatris pyscostachya (Prairie Blazing Star)
Monarda fistulosa (Prairie Bergamont)
Parthenium integrifolium (WildQuinine)
Petalostemum candidum (White Prairie Clover) 2/
Petalostemum purpureum (Purple Prairie Clover) 2/
Physostegia virginiana (False Dragonhead)
Potentilla arguta (Prairie Cinquefoil)
Ratibida pinnata (Yellow Coneflower)
Rudbeckia subtomentosa (Fragrant Coneflower)
Silphium laciniatum (Compass Plant)
Silphium terebinthinaceum (Prairie Dock)
Solidago rigida (Rigid Goldenrod)
Tradescantia ohiensis (Spiderwort)
Veronicastrum virginicum (Culver's Root)

Class - Type		Seeds	lb/acre (kg/hectare)
5A	Large Flower Native Forb Mixture 6/, 8/	Forb Mixture (see below)	5 (5)
		Species:	% By Weight 5/
		Aster novae-angliae (New England Aster)	5
		Echinacea pallida (Pale Purple Coneflower)	10
		Helianthus mollis (Downy Sunflower)	10
		Heliopsis helianthoides (Ox-Eye)	10
		Liatris pyscostachya (Prairie Blazing Star)	10
		Ratibida pinnata (Yellow Coneflower)	5
		Rudbeckia hirta (Black-Eyed Susan)	10
		Silphium laciniatum (Compass Plant)	10
		Silphium terebinthinaceum (Prairie Dock)	20
		Solidago rigida (Rigid Goldenrod)	10
5B	Wetland Forb	Forb Mixture (see below) 6/, 8/	2 (2)
		Species:	% By Weight 5/
		Acorus calamus (Sweet Flag)	3
		Angelica atropurpurea (Angelica)	6
		Ascelepias incarnata (Swamp Milkweed)	2
		Aster puniceus (Purple Stemmed Aster)	10
		Bidens cernua (Beggarticks)	7
		Eupatorium maculatum (Spotted Joe Pye Weed)	7
		Eupatorium perfoliatum (Boneset)	7
		Helenium autumnale (Autumn Sneeze Weed)	2
		Iris virginica shrevei (Blue Flag Iris)	2
		Lobelia cardinalis (Cardinal Flower)	5
		Lobelia siphilitica (Great Blue Lobelia)	5
		Lythrum alatum (Winged Loosestrife)	2
		Physostegia virginiana (False Dragonhead)	5
		Polygonium pensylvanicum (Pennsylvania Smartweed)	10
		Polygonum lapathifolium (Curlytop Knotweed)	10
		Pychanthemum virginianum (Mountain Mint)	5
		Rudbeckia laciniata (Cut-leaf Coneflower)	5
		Solidago riddellii (Riddell Goldenrod)	2
		Sparganium eurycarpum (Giant Burreed)	5
6	Conservation Mixture	Andropogon scoparius (Little Blue Stem) 5/	5 (5)
		Elymus canadensis (Canada Wild Rye) 5/	2 (2)
		Buffalo Grass (Cody or Bowie) 4/, 5/, 9/	5 (5)
		Vernal Alfalfa 2/	15 (15)
		Oats, Spring	48 (55)
6A	Salt Tolerant Conservation Mixture	Andropogon scoparius (Little Blue Stem) 5/	5 (5)
		Elymus canadensis (Canada Wild Rye) 5/	2 (2)
		Buffalo Grass (Cody or Bowie) 4/, 5/, 9/	5 (5)
		Vernal Alfalfa 2/	15 (15)
		Oats, Spring	48 (55)
		Fults Salt Grass 1/	20 (20)
7	Temporary Turf Cover Mixture	Perennial Ryegrass	50 (55)
		Oats, Spring 4/	64 (70)

Notes:

1/ Fults pucinnellia distans.
2/ Legumes - inoculation required.
3/ Specific variety as shown in the plans or approved by the Engineer.
4/ Other seeds may be used if approved by the Engineer.
5/ PLS = Pure Live Seed to be used.
6/ Fertilizer not required.
7/ In Districts 1 through 6, the planting times shall be April 1 to June 15 and August 1 to November 1. In Districts 7 through 9, the planting times shall be March 1 to June 1 and August 1 to November 15. Seeding may be performed outside these dates provided the Contractor guarantees a minimum of 75 percent uniform growth over the entire seeded area(s) after one growing season. The guarantee shall be submitted to the Engineer in writing prior to performing the work. After one growing season, areas not sustaining 75 percent uniform growth shall be interseeded or reseeded, as determined by the Engineer, at no additional cost to the Department.
8/ Planting times May 15 to June 30 and October 15 to December 1.
9/ Seed shall be primed with KNO_3 to break dormancy and dyed to indicate such.

Variation in the Class 4 or 5 seed quantities or varieties will be allowed in the event of a crop failure or other unforeseen conditions. The Contractor shall provide for the approval of the Engineer a written description of the changed Class 4 or 5 Mixture, the reasons for the change, and the name of the seed supplier.

250.08 Selective Mowing Stakes. Selective mowing stakes shall be installed to delineate areas to be seeded or interseeded with Class 4 or 5 mixtures. Selective mowing stakes shall be steel posts as described in Article 1081.13(a). The selective mowing stakes shall be driven into the ground to a height of 3 1/2 ft (1.1 m) above the ground at locations shown on the plans and as directed by the Engineer.

250.09 Method of Measurement. This work will be measured for payment as follows.

(a) Contract Quantities. The requirement for use of contract quantities shall be according to Article 202.07(a).

(b) Measured Quantities. Seeding of the class specified and mowing will be measured in acres (hectares) of surface area seeded or mowed.

The exact locations of seeding and mowing will be determined in the field by the Engineer, and the quantities will be adjusted accordingly. Fertilizer will be measured by weight in pounds (kilograms) of actual nutrients. The percent of nutrients equals the guaranteed analysis on the bag. The following formula will be used to determine the pounds (kilograms) of fertilizer nutrients applied.

(Total pounds (kilograms) of mixed fertilizer)
X
(Percentage of each nutrient in the fertilizer applied)
= pounds (kilograms) of each fertilizer nutrient

Agricultural Ground Limestone will be measured by weight in tons (metric tons) of Agricultural Ground Limestone having an effective neutralizing value of 67.5 (four year base, a source correction factor of 1.0). Applied quantity shall be the plan quantity multiplied by the source correction factor. The pay quantity will be the applied quantity divided by the source correction factor.

Payment will not be made for fertilizer nutrients in excess of 103 percent or agricultural ground limestone in excess of 108 percent of the amounts specified by the Engineer.

Selective mowing stakes will be measured as each in place.

250.10 Basis of Payment. This work will be paid for at the contract unit price per acre (hectare) for SEEDING or INTERSEEDING of the Class specified; at the contract unit prices per pound (kilogram) for NITROGEN FERTILIZER NUTRIENT, PHOSPHORUS FERTILIZER NUTRIENT and POTASSIUM FERTILIZER NUTRIENT; and at the contract unit price per ton (metric ton) for AGRICULTURAL GROUND LIMESTONE.

Mowing will be paid for at the contract unit price per acre (hectare) for MOWING. Only the initial mowing will be paid for. Any subsequent mowing required to obtain a height of not more than 3 in. (75 mm) or to disperse mowed material will be considered as included in the cost of the initial mowing.

Selective Mowing Stakes will be paid for at the contract unit price per each for SELECTIVE MOWING STAKES.

SECTION 251. MULCH

251.01 Description. This work shall consist of furnishing, transporting, and placing mulch or erosion control blanket over seeded areas.

251.02 Materials. Materials shall be according to the following.

	Item	Article/Section
(a)	Compost	1081.05(b)
(b)	Mulch	1081.06(a)
(c)	Chemical Mulch Binder	1081.06(a)(3)
(d)	Chemical Compost Binder	1081.06(a)(4)
(e)	Excelsior Blanket	1081.10(a)
(f)	Knitted Straw Mat	1081.10(b)
(g)	Heavy Duty Erosion Control Blanket	1081.10(c)
(h)	Wire Staples	1081.10(d)
(i)	Wood Stakes	1081.10(e)
(j)	Coconut Fiber	1081.10(f)

TOOLS

A Simplified Soil-Zone Monitoring Well

by James J. Miner and Scott D. Simon

A new device is proving useful in work with wetlands in Illinois.

Wetlands are fundamentally a hydrologic feature (Winter, 1992), and variations in hydrologic conditions are a major factor controlling the distribution of wetland vegetation (Gosselink and Turner, 1978; Niering, 1987a; Niering, 1987b; Weller, 1987). Measuring various aspects of site hydrogeology is an increasingly common practice in wetland restoration and management projects. However, because past hydrogeologic studies often did not focus on wetlands, as several authors have noted (see for example Gosselink and Turner, 1978; LaBaugh, 1986; Doss, 1995), the standard techniques used in hydrogeology are not well known to wetland managers. Also, in hydrogeologic studies, each site commonly requires an individualized approach (Nielsen, 1991), so that the design of a monitoring well and methods for its installation are generally determined at each well site by a hydrogeologist. Natural-areas workers without training in hydrogeology are generally not aware of the pitfalls that can adversely affect water-level measurements if adjustments in design are not made.

Because many of the hydrogeologic conditions that complicate well design occur at depth, wells designed to measure water levels in the soil zone avoid many hydrogeologic complications, and can be installed using standard designs. This in turn makes it possible for natural-areas workers with little training in hydrogeology to measure water levels in the root zone, which is often the only hydrogeologic data required to make restoration and management decisions, without needing to alter the construction of each well. Another advantage of a standard design is that identically constructed wells allow direct comparison of water-level changes at different sites.

While carrying out a number of wetland studies in Illinois over the last several years (Miner *et al.*, 1994; Miner *et al.*, 1996; Miner *et al.*, 1997; Simon *et al.*, in press), we developed a monitoring well for the specific purpose of measuring the elevation of the water table in the soil zone. We designed the wells to be as shallow as possible while still containing the standard features that ensure the integrity of a well (see for example ASTM, 1990; Nielsen, 1991). In designing them we took advantage of several distinctive features of soil-zone hydrology. The most important of these is that, in the soil-zone, there is less chance of encountering the complex hydrogeologic conditions, such as confined aquifers, that often occur at depth. Also the soil zone typically includes many interconnected macropores, such as root channels and soil structures, which permit the free flow of water through the soil. Wells that intercept these macropores will accurately reflect the level to which soil saturation can occur. These facts lessen the need to tailor wells to the specific geologic conditions of the site, so that a standard design can be used. To test our well in the field, we compared water levels in a well at one site to the saturation measured in a set of nested tensiometers installed nearby, and found that the data showed similar levels and trends.

Data collected from these wells can be used in planning and monitoring the restoration or management of natural areas.

For example, as part of an ongoing study of the relationships between the hydrology and the distribution of vegetation communities in wet prairies, sedge meadows, and deep and shallow marshes (Simon *et al.*, in press), we installed soil-zone monitoring well in each type of wetland along a transect through nature preserves, and collected data on the vegetation along an adjacent, parallel transect. Figure 1 shows the different depths to the water table measured through time in each wetland type at one preserve. These data can be used to characterize the hydrologic regimes required to restore or create wetlands of each type.

While other attempts have been made to describe well-installation methods for wetlands (see for example Sprecher, 1993), there is still a lack of awareness among natural-areas workers of proper installation techniques. The installation method proposed here primarily differs from that described in Sprecher (1993) by advocating a standard design for all wells of this type, by modifying for frost heave experienced in the northern climates and for areas with larger water-level fluctuations, and by using different methods to seal the well. However, this design may need to be adapted for use in geologic or climatic areas other than the glaciated Midwestern United States.

Well Design and Installation

This section describes the methods we use to construct and install soil-zone monitoring wells. These methods are only appropriate for measuring the water table. For studies that require more extensive hydrogeologic data, such as deeper water levels, water levels in confined aquifers, or vertical ground-water flow, different types of monitoring wells are needed, and must be designed specifically for the hydrogeology of each site.

Materials used in the construction and installation of our monitoring wells can be purchased from local well-drilling supply companies or directly from manufacturers. We construct wells from 2.54-cm (1-in.) diameter, threaded, Schedule 40 polyvinyl chloride (PVC) well casing and screen (see Figure 2 for well terminology and construction details). With threaded PVC, the pieces join by screwing together instead of using glued, slip-together couplers that are larger in diameter than the PVC casing, and can impede backfilling of the well annulus during installation.

Well screens are lengths of PVC casing that are perforated (slotted) to allow water to flow into the well. Screens made by a manufacturer are uniform, so that each well has the same number and width of openings. Figure 3, a close-up view of a manufactured well screen, shows the uniformity of the slots. When perforations are made by cutting or drilling holes in a piece of casing, the well screen is likely to have less open area than a manufactured screen, causing the well to respond more slowly and less efficiently. Also, each home-made screen will have a different open area, and therefore will respond to a water-level change at different rates. In addition, large or irregular holes made with a drill or hacksaw allow sediment to enter and accumulate in the well through time. In fact, home-made screens are a common cause of well malfunctioning (Nielsen, 1991), so that a manufactured screen is worth the extra cost.

Although American Society for Testing and Materials (ASTM) standards suggest choosing the width of the slots in relation to the grain size of the sediments on site, this is impractical for most natural-areas workers. Therefore, we recommend buying screens with slots 0.25-mm (0.010-in.) wide, which will work in a wide variety of sediments. In cases where finer materials do enter the well through the slots, sediment can be pumped out as needed, as discussed later. However, we have not encountered any conditions that cause sig-

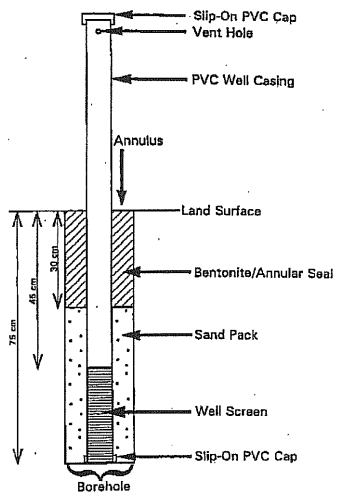


Figure 2. Diagram of soil-zone monitoring well shows features of design discussed in text.

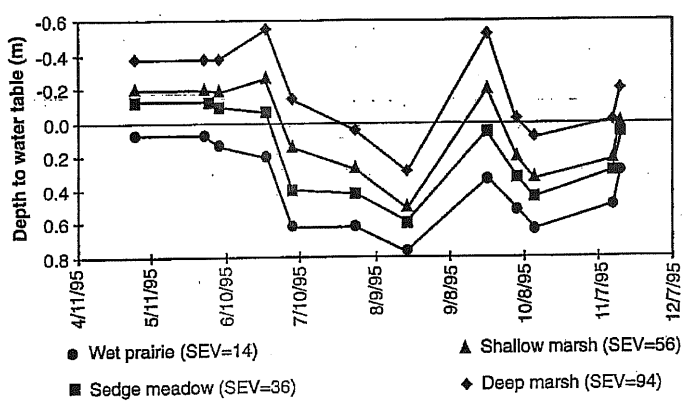


Figure 1. Depths to water table measured in four wetland types at Wadsworth Prairie Nature Preserve near Wadsworth, Illinois (Simon *et al.*, in press). Negative values indicate water levels above land surface.

nificant sedimentation in the wells, even in peat or clay-rich sediments.

To make a well, cut a 30-cm (1-ft) long piece off each end of a 75-cm (2.5-ft) long, manufactured, 2.5-cm (1-in) diameter well screen, so that each piece has threads on one end and not on the other. Each of the two pieces is used to make a well, and the remaining 15-cm (0.5-ft) long piece of screen with no threads can be used for other projects. Screw the threaded end of one piece of the screen onto a 1.5-m (5-ft) long piece of threaded, unperforated PVC casing. To prevent sediment from entering the well from the bottom, glue a slip-on cap on the cut end of the screen using PVC cement. Drill a small hole in the bottom cap so that water does not become trapped in the well during dry periods, producing false readings. After installation, place a removable slip-on cap on the top of the well between measurements to keep rain and debris out of the well.

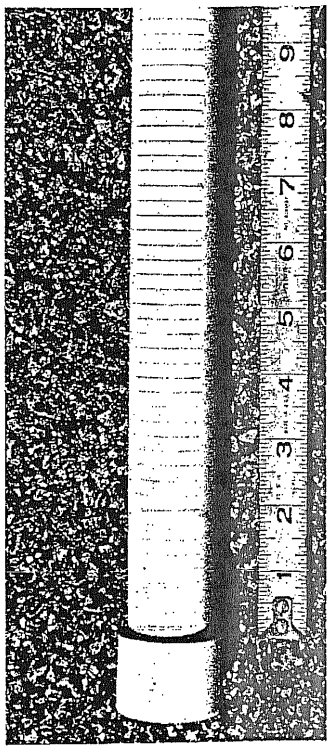


Figure 3. Close-up of a manufactured well screen shows uniform width of water-admitting slots, an advantage over hand-made well screens, which tend to be less regular and to have less open space and register changes in water level more slowly.

Install the well in a 75-cm (2.5-ft.) deep, 7.5-10-cm (3-4-in.) diameter borehole made with a hand auger or post-hole digger (Figure 4). Although wells can be driven directly into the ground, installing the well in an open borehole has a number of advantages. One is that it provides an opportunity to examine the sediments removed from the borehole, which can be helpful in interpreting the behavior of water levels in the well. For example, the time expected for water levels to change in clay is much greater than in sand; also, the range of the water table can sometimes be estimated from soil features. Another advantage is that the well screen can clog with sediment if the well is driven directly into the ground. Finally, sediments provide clues to potential problem situations such as perched water tables and confined aquifers, which will be discussed below.

We chose a borehole depth of 75 cm on the basis of observations of water levels common in Illinois wetlands during most of the year. Basically, this is the minimum amount of space required to include each well component as discussed below. Although deeper wells may occasionally be needed to intercept the water table during the driest months, we do not recommend them because they increase the chance of cross-connecting two geologic beds with greatly differing porosity or hydraulic conductivity. This may cause ground water to flow through the well from a more saturated part of the soil zone to a less saturated part, thus affecting water levels. If measurements are needed in the driest periods of the year, it will be necessary to install additional, deeper wells designed for the specific geologic conditions of the site.

Center the well in the borehole, then fill the annulus around the well screen with quartz sand 0.5 -1.0 mm (0.020-0.040 in.) in diameter to 30 cm below the land surface. This buries the uppermost slot in the screen beneath 15 cm of sand. The sand prevents the borehole wall from collapsing, filters out soil particles that might eventually clog the screen or fill the well, and effectively increases the screened interval to within 30 cm of land surface. Also, the extra sand above the top slot helps prevent the annular seal, which is described next, from clogging the screen. Larger-or smaller-diameter sand may also be used, but finer sand may fall through the slots, and larger sand may allow more sediment into the well.

Next, place medium-sized (1 cm or 0.375 in.) bentonite gravel, which swells into a sticky clay on contact with water, above the sand pack up to land surface to seal the annulus. Once swollen, this prevents surface water from entering the well directly and altering water levels. If the wells are installed during a dry season, add water to the bentonite to facilitate swelling and sealing of the annulus. The seal tends to dehydrate and crack at the land surface during dry periods, but the cracks do not extend through the seal and they rehydrate and heal rapidly when precipitation begins again. If the recommended size of bentonite is not available, other types also work, with the exception of powdered bentonite. In regions where the water table drops below the annular seal for several months at a time, or where bentonite doesn't swell efficiently (for example, in areas where ground water is high in dissolved salts), investigate an alternative to pure bentonite such as grout (see for example Sprecher, 1993).

Vent the well near the top of the casing by drilling a small hole with a drill, or making a small cut with a hacksaw. Without a vent, air may become trapped in the well and prevent water from entering or leaving.

Well Development

Traditionally, monitoring wells are developed after installation. This normally involves surging ground water back and forth through the sand pack using a variety of methods, then pumping the wells out to remove any trapped sediment. Because surging often increases turbidity in wells installed in fine-grained sediments such as the silts and clays (Nielsen, 1991) that are often found in wetlands, we do not recommend surging for soil-zone wells. How-

ever, wells should always be pumped. Pumping removes sediment, helping the well to respond quickly to changes in water levels. Also, pumping provides a way to check whether the well is functioning properly. If after pumping the water level in the well returns to near its previous level, then the well is functioning properly. The time required for water levels to recover depends on the type of sediments encountered. Wells in sandy sediments may take minutes to refill, but wells in clay-rich sediments may take days to refill, yet be functioning properly. Again, a geologic description of the sediments can help in predicting and interpreting the behavior of a well. Hand-operated pumps can be found in hardware stores. Peristaltic pumps found in field-supply catalogs are expensive, but they can easily pump the sediment-laden water without damage. Inexpensive PVC bailers, which can be also found in field-supply catalogs, can also be used to bail water out of a well and can work as well as pumping.

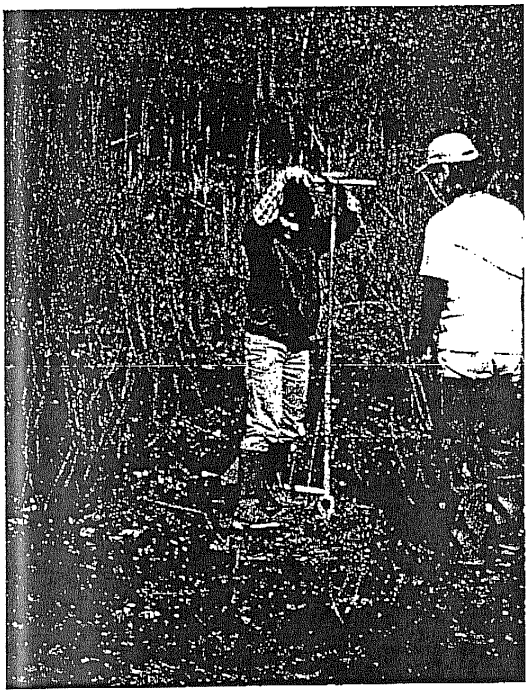


Figure 4. "Although wells can be driven directly into the ground, installing the well in an open borehole has a number of advantages." Here researcher Martha Cardona uses a hand auger to bore a hole for a well in a wet prairie. *Photo courtesy of James Miner*

Water-level Measurement and Surveying

Water levels in wells can be measured in a number of ways. Expensive, but easy-to-operate electronic water-level indicators that are lowered into the well make sound or light up when they contact water. Or, if you are working on a small budget, simply rub a block of chalk on a steel surveyor's tape and lower it into the well; the chalk will be removed below the water surface. (Klaus Richter of the King County Department of Natural Resources in Seattle, Washington [personal communication] suggests using a transparency marker rather than chalk to place a water-soluble stripe on a retractable, metal measuring tape.) Do not submerge the tape any more than is required to contact the water, because the tape will displace water and cause well levels to rise slightly. Whether using chalk or marker, wipe the tape off after each use; Richter suggests using a thin sponge used by swimmers. All of these items can be ordered from a field-supply catalog or be found locally, possibly at a surveying-supply store.

This method measures water levels in the well below the top of the casing. In order to convert that measurement to a depth below land surface, measure the length of the well casing that protrudes above land surface (also called the stick-up). Subtract the stick-up from the depth-to-water measurement to obtain the depth below land surface. Remember that water levels in the wells are occasionally higher than land surface (a negative depth), sometimes showing that ground water is flowing upward to the land surface. The stick-up of the well changes often due to frost heaving, vandalism, erosion or sedimentation around the well and other factors, so measure the stick-up at the same place during every well reading.

For more-complex hydrogeologic purposes, such as finding ground-water flow directions, the elevation of the water in the well must be known. To determine this, wait two or three weeks after installation to allow the well to settle into place,then use a surveyor's level to measure the elevation of the top of the well. Repeat this measurement annually following the spring thaw or as needed. Between surveys, recalculate the elevation of the top of the well when a measurement of the stick-up suggests that a change has occurred. If heaving has occurred, push the well down to the original 75 cm depth during the annual survey to prevent the screen from rising enough to contact the annular seal, which can clog the slots. Any wells that are pushed down should be surveyed or remeasured afterward. Never pull up on a well that appears to have sunk into the ground. Using a paint marker, draw a line on the casing at land surface to indicate when heaving has occurred, and to help reset the well to its original depth. Paint markers are available at hardware or hobby stores, and are the only type of permanent marking that lasts outdoors.

Record Keeping

Keep detailed measurements of each well during installation to allow reconsideration of data in the future should a problem arise. Make measurements of the exact total length of the well, the length and location of the screened interval in the well, the length of the sand pack and bentonite seal in the annulus, and the stick-up. Mark an identification number on the casing with a paint marker.

Potential Problems

These well-installation techniques do not work well in some geologic situations. Installing wells in sand and gravel below the water table is difficult because the boring may collapse rapidly. In these cases, make a boring to 75 cm and push the well to

depth through the softer, collapsed sediment. Gentle tapping with a rubber mallet is sometimes required to vibrate the screen to depth if necessary, but care should be taken to prevent deformation of the screen and closure of the slots. Add sand only if the top of the collapsed sediments is below 30 cm in depth. Additional pumping may be required in this type of installation to remove sediment from the well. When possible, install wells during the dry season to avoid this situation.

Interpreting water levels can sometimes be difficult. Water can enter the well from any saturated bed below the annular seal that is penetrated by the well, so that it is not possible to know where the water is coming from in sharply layered sediments. Also, because these wells are intended to measure the position of the water table, penetration of a geologic bed that is under water pressure (a confined unit) can result in misleading data. If a unit is confined, the water in a well will rise above the top surface of the geologic unit. This level is not the water table, and may not show the level to which sediments higher in the soil zone are saturated if the sediments above have greatly different hydrogeologic properties. Also, perched water tables are of concern, especially if the well penetrates completely through the unit that is impeding downward flow, thus allowing drainage down through the borehole. However, it has been our experience that, within the soil zone, few sediments efficiently perch ground water because soil structure, fractures, and root channels act as conduits for ground-water flow. In Illinois, water tables perched on glacial till commonly rest on the undisturbed till below the soil zone, which impedes infiltration, so that this type of well will not drain a perched water table in this situation. In other climates with different soil structures (for example, caliche in arid climates), this design may not be desirable. Carefully describing the geologic deposits encountered when making a borehole helps indicate when these situations may occur.

Acknowledgments

Martha Cardona prepared Figure 1. Those who assisted in well installation, development, surveying, and water-level measurement for this project include Martha Cardona, Stacy O'Leary, Jeff Stillman, Corey Rubin, Christine Fucciolo, Alison Meanor, and Philip DeMaris. Many people kindly reviewed this manuscript, including coworkers Michael Miller, Christine Fucciolo, Steven Benton, Alison Meanor, Jonathan Goodwin, and David Larson. Klaus Richter reviewed this manuscript and provided helpful suggestions regarding well measurement.

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James Miner is with the Illinois State Geological Survey, 615 E. Peabody Drive, Champaign, IL, 61820-6964, (217) 244-5786, FAX (217) 244-0029, miner@geoserv.isgs.uiuc.edu.

Scott Simon is with The Nature Conservancy, 601 N. University, Little Rock, AR, 72205, (501) 663-6699.

COVENANTS AND RESTRICTIONS

Any activity on or use of the Compensation Site inconsistent with the purposes of this Declaration is prohibited. The Compensation Site shall be maintained in its natural, scenic, and open condition and restricted from any development or use that would impair or interfere with the purposes of this Declaration set forth above. IDOT hereby makes the following covenants and creates the following restrictions on the Compensation Site. These covenants and restrictions shall run with the land, and bind IDOT, and IDOT's successors and assigns and all parties claiming under them:

1. TOPOGRAPHY. There shall be no dredging, filling, excavating, mining, drilling, or removal of any topsoil, sand, gravel, rock, minerals, or other materials unless in accordance with the mitigation measures set forth in the Plan. There shall be no plowing, disking, or any other activity that would alter the topography of the preserved and planned wetland areas within the Compensation Site except for the express purpose of enhancing or restoring the preserved and planned wetland areas consistent with the Plan. This restriction does not apply to creating walking trails on the site in the areas not delineated as wetlands.
2. DUMPING/DISPOSAL. Dumping of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances, machinery or other unsightly or offensive material, or hazardous substances or toxic or hazardous waste or any placement of underground or aboveground storage tanks or other materials on the Compensation Site is prohibited.
3. AGRICULTURAL USES. There shall be no plowing, tilling, cultivating, planting, grazing, or keeping of cattle, sheep, horses, other livestock or other agricultural activity unless in accordance with the mitigation measures set forth in the Plan.
4. USES. There shall be no commercial or industrial activity undertaken or allowed. This restriction does not include educational purposes.
5. BUILDINGS AND STRUCTURES. There shall be no additional buildings, dwellings, barns, roads, advertising signs, billboards or any other temporary or permanent structure or facility built or placed in the Compensation Site unless in accordance with the provisions set forth in the Plan.
6. VEHICLES. There shall be no operation of any recreational motorized vehicles or equipment including but not limited to all-terrain vehicles, four-wheelers, motorcycles, snowmobiles, dune buggies, etc. within the Compensation Site except as authorized to carry out maintenance and development activities in accordance with the provisions set forth in the Plan.
7. NOXIOUS WEEDS. IDOT or IDOT's successors and assigns and all parties claiming under them is responsible for compliance with all federal, state, and local laws governing the control of noxious weeds within the compensation site.
8. VEGETATION. Except in conjunction with the authorized uses set forth in Paragraph 7 above, there shall be no removal, cutting, mowing, or alteration

of any vegetation or change in the natural habitat in any manner unless in accordance with the mitigation measures set forth in the Plan.

9. There shall be no utility lines placed overhead or within the Compensation Site including but not limiting to: telephone or other communication lines, electrical, gas, water or sewer. Existing lines and easements may remain but any maintenance work to said lines or easements requiring intrusion into the Compensation Site shall require prior authorization by IDOT or IDOT's successors.
10. This Declaration may be modified or waived only by the written approval of IDOT.

RESERVED RIGHTS

Nothing herein shall be construed as limiting the right of IDOT to manipulate the site for remedial reasons including but not limiting to the construction of water control structures, grading for hydrology corrections, removal of unwanted vegetation and addition of desirable vegetation.

If IDOT should transfer title of the Compensation Site, IDOT will retain the exclusive rights to the established wetland credits within this Compensation Site for IDOT's use on current and future transportation projects. Furthermore, after said transfer, IDOT will have right of access to ensure maintenance and conduct monitoring of the Compensation Site.

GENERAL PROVISIONS

This Declaration of Covenants and Restrictions shall run with and burden the Compensation Site in perpetuity.

IDOT agrees that the terms, conditions, covenants, and restrictions set forth in this Declaration will be inserted in any subsequent conveyance of any interest in the Compensation Site.

IDOT may assign or transfer this Declaration of Covenants and Restrictions and the rights and obligations contained herein to any federal, state or local agency or private conservation organization for management and enforcement.

IDOT shall register the existence of this Declaration of Covenants and Restrictions with St. Clair County or other appropriate office charged with the responsibility for maintaining records of title to or interest in real property.

IN WITNESS WHEREOF, the Illinois Department of Transportation has caused this Declaration of Covenants and Restrictions to be executed by its duly authorized officer, and its seal affixed hereto, as of the day and year set forth below his respective signature.

Illinois Department of Transportation

Memorandum

To:	Roger Driskell	Attn:	Gene Beccue
From:	Charles Ingersoll	By:	J. A. Walthall
Subject:	Cultural Resource Concurrence		
Date:	May 8, 2009		

Lawrence County
Wetland
Seq. #14912

Attached is a letter of concurrence from the State Historic Preservation Officer indicating that the proposed project referenced above will have no effect on significant cultural resources.

This completes the necessary coordination relative to evaluating the impact of this project on significant cultural resources.

J A Walthall

Attachment

JAW:km

Illinois Department of Transportation
2300 South Dirksen Parkway / Springfield, Illinois / 62764

April 28, 2009

Lawrence County
Potential Wetland Bank
4 mi East of Lawrenceville

IDOT Seq. # 14912
ITARP# 09008

FEDERAL 106 PROJECT

Ms. Anne Haaker
Deputy State Historic Preservation Officer
Illinois Historic Preservation Agency
Springfield, Illinois 62701

Dear Ms. Haaker:

Attached is a report from the Illinois Transportation Archaeological Research Program concerning the results of survey of the 125 acre project area referenced above. No archaeological, architectural, or historic sites were identified within the proposed project rights-of way.

In accordance with the established procedure for coordination of proposed Illinois Department of Transportation projects, we request the concurrence of the State Historic Preservation Officer in our determination that no historic properties, subject to protection under Section 106 of the National Historic Preservation Act of 1966 as amended, will be affected by the proposed construction activities.

Very truly yours,

John A. Walthall, PhD
Cultural Resources Unit

CONCUR

By: Anne E. Haaker
Deputy State Historic Preservation Officer
Date: JJH 4/29/09

Illinois Historic
Preservation Agency

1 Old State Capitol Plaza • Springfield, Illinois 62701-1512 • www.illinois-history.gov

PLEASE REFER TO: IHPA LOG #023022210

Lawrence County
Lawrenceville
Beaver Pond Ditch
COELV-LRL-2009-914-r9r
120.0-acre Wetland Bank

March 3, 2010

Mr. Russell Retherford, CELRL-OP-FW
US Army Corps of Engineers, Louisville District
Post Office Box 489
Newburgh, Indiana 47629

Gentlemen:

We have reviewed the documentation submitted for the referenced project(s) in accordance with 36 CFR Part 800.4. Based upon the information provided, no historic properties are affected. We, therefore, have no objection to the undertaking proceeding as planned.

Please retain this letter in your files as evidence of compliance with section 106 of the National Historic Preservation Act of 1966, as amended. This clearance remains in effect for two (2) years from date of issuance. It does not pertain to any discovery during construction, nor is it a clearance for purposes of the Illinois Human Skeletal Remains Protection Act (20 ILCS 3440).

If you are an applicant, please submit a copy of this letter to the state or federal agency from which you obtain any permit, license, grant, or other assistance.

Sincerely,

Anne E. Haaker

Anne E. Haaker
Deputy State Historic
Preservation Officer

AEH