PROSPECTUS FOR

CUB CREEK STREAM MITIGATION BANK

SUBMITTED BY

UT EXTENSION
INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE

MAY 2019

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1.0 OWNER AND AGENTS

The University of Tennessee's Institute of Agriculture proposes to develop and sponsor the Cub Creek Stream Mitigation Bank in Hardeman County, Tennessee. The bank site is located on the University of Tennessee's 1,200-acre Lone Oaks Farm south of Bolivar, Tennessee. The sponsor proposes to restore approximately 23,357 linear feet of stream channel along Cub Creek and several unnamed tributaries. The existing streams are degraded due to decades of hydrologic alterations, channelization, unrestricted cattle access, and cleared riparian buffers. Cub Creek is on the Tennessee Department of Environment and Conservation's Division of Water Pollution Control 303(d) list for low flow alterations, physical substrate habitat alterations, alteration in stream-side or littoral vegetative covers, and iron. Known pollutant sources include upstream impoundments, channelization, and grazing in riparian or shoreline zones.

The project is proposed to take place on one parcel owned by the State of Tennessee. The sponsor is partnering with the Tennessee Wildlife Federation, West TN River Basin Authority (WTRBA), and Civil and Environmental Consultants, Inc. (CEC) on project design and construction. Together, the WTRBA and CEC have implemented over 14 miles of stream restoration in Tennessee. This prospectus provides a brief description of the site, current stream conditions, proposed improved ecological stream functions, and conceptual plan for stream mitigation activities. <u>A more detailed mitigation design plan, stream quantification tool condition assessment, performance standards, credit release schedule, financial assurances, adaptive management plan, property assessment and warranty, and monitoring and maintenance plan will be provided in the mitigation banking instrument for the project, pending review of this proposal by the IRT</u>.

2.0 PROJECT LOCATION

The proposed site is situated in the Southeastern Plains Physiographic Province and Ecoregion (65) in Hardeman County. The site location is described more specifically in **Table 1**.

Table 1. Cub Creek Stream Mitigation Bank Summary

Level III Ecoregion:	Southeastern Plains (65)
Watershed (8-digit HUC):	Lower Hatchie River (HUC 08010208)
Watershed (12-digit HUC):	Cub Creek (HUC 0 HUC 080102080204)
Location:	10000 Lake Hardeman Road, Middleton, TN 38052
303(d) Status:	Cub Creek is listed (see Section 1.0)
Existing Total Length (feet)	23,357
Proposed Total Length (feet)	29,385
Mitigation Area:	Approximately 100 acres
Coordinates (Centroid):	35.113; -88.971

3.0 PROPERTY ACCESS

The project site is located on public property managed by the University of Tennessee's Institute of Agriculture.

4.0 PROJECT GOALS AND OBJECTIVES

The goals of the project are to restore a functional stream ecosystem within the Cub Creek sub-watershed of the Hatchie River, provide compensatory stream mitigation to offset permitted impacts to waters of the United States as authorized under Section 404 of the Clean Water Act, and offer educational opportunities to the STEM Education curricula at Lone Oaks Farm. The existing streams are degraded from historic habitat alterations, channelization, channel modifications, excessive sediment due to bank erosion, unrestricted cattle access, and riparian buffers being managed for hay and pasture. Past land use and management activities have contributed to the physical, chemical, and biological degradation of stream ecological functions within the mitigation area.

The objectives of the stream mitigation are to improve aquatic and riparian habitat, reduce sediment inputs, decrease bank erosion, and provide for the recovery of natural stream functions. Function-based goals for the stream restoration components of the project include improving stream hydrology, promoting more frequent floodplain inundation and storage of flood waters, supporting sediment transport continuity, and providing for riparian forest succession. Project objectives aim to improve stream function-based parameters that include groundwater/surface water exchange, floodplain connectivity, lateral stability, bedform diversity, and riparian vegetation. See Table 2 for quantitative objectives. Proposed activities that will be implemented to address the causes of stream degradation and achieve project objectives include:

- Re-construct dynamically stable stream channels in order to improve bedform diversity, lateral stability, and floodplain connectivity along project streams that have been channelized and trampled by livestock;
- Remove hydrologic modifications (impoundments) in order to improve overland and subsurface water exchange and sediment transport continuity;
- Increase channel sinuosity in order to reduce flow velocities, promote the formation of natural riffles and pools, and improve lateral and vertical stability;
- Permanent cessation of mowing and livestock production activities from the mitigation area in order to reduce excessive nutrients and pollutants;
- Re-establish riparian buffers on both banks of all project streams, to be composed of planted native bottomland hardwood forest species;
- Permanently protect the mitigation area with land use restrictions.

Table 2. Cub Creek Stream Mitigation Bank Quantitative Objectives

Functional Category	Goal	Objectives	Metric Method
Hydrology	Increase lag time of flood wave	Create more opportunity for infiltration in the floodlpain and reduce flooding impacts downstream by creating longer flow duration at a lower magnitude.	Stream Depth Monitoring
Hydraulics	Improve floodplain connectivity and vertical stabilty	Reconnect channel to the floodplain by constructing new channel with appropriate dimensions and grade; Reduce BHR to 1 and increase entrenchment ratio to >2.2	BHR and Entrenchment Ratio; Connection Frequency from Gauging
Geomorphology	Improve bedform diversity	Install structures for bed stability and increase pool depth ratio from <1.5 to >1.5; establish riffles, runs, pools and glides, restore meander patterns and increase belt width	Stream Survey - X Sections and Long. Profile; As-built, 3yr, 5yr.
	Improve lateral stability	Reduce dominant BEHI score from high to moderate or less	BEHI Score or We could use Ft/Yr and use benchmarked cross sections.
	Improve riparian vegetation buffer width and protection	Increase RBP buffer width scores from 1 to 8 and vegetation protection scores from 1 to 8.	Buffer Width Score
	Restore Natural Sinuosity	Return channelized stream segments to a natural plan and profile. Target sinuosity 1.5 > k > 1.1	Sinuosity>1.1, Based on Relationship of Valley Slope and Stream Friction Slope (WTNRC)
Biology	Improve reach connectivity	Reduce the impact of vertical grade separation through installation of engineered structures that allow for passage of aquatic organisms. Including removal of two culverts and alterations to the Cub Creek flood control structure.	Visual assessment of removed obstacles. Fish sampling at reconnected reaches.

5.0 SITE CONTRAINTS

No site constraints that would limit the restoration potential of the project have been observed.

6.0 BASELINE CONDITIONS

6.1 Proposed Service Area

The proposed primary service area for the bank includes the Lower Hatchie River watershed (HUC 08010208). The proposed secondary service area includes the following watersheds: Wolf River (HUC 08010210), Loosahatchie River (HUC 08010209), Horn Lake – Nonconnah Creek (HUC 08010211), Upper Hatchie River (HUC 08010207), Lower Mississippi River (HUC 08010100), and South Fork Forked Deer River (HUC 08010205). The primary threats to aquatic resources throughout this geographic service area include incompatible agricultural practices in the floodplain of the service area's major rivers, channelization of streams, and urbanization in close proximity to large urban areas.

6.2 Summary of Site Selection Criteria

The following characteristics were evaluated as part of a watershed approach to siting a project in the Lower Hatchie River watershed:

- Location of 303(d) listed streams.
- Ability to accomplish aquatic resource goals outlined in the Lower Hatchie River Watershed Management Plan (TDEC 2003).
- Opportunities to restore stream habitat within the same landscape setting and aquatic resource type as recently impacted streams or planned development projects.
- Compatibility of the site with surrounding land uses, including hydrologic and terrestrial connectivity.
- Potential of degraded aquatic resources to achieve significant ecological value.
- Effect the mitigation project will have on ecologically important habitats or rare species.
- The extent to which the site has potential to contribute to the protection or restoration of watershed processes and improve water quality.
- The potential of the site to accommodate timely implementation with few constraints.

6.3 Existing Conditions and Land Use

Land uses in the floodplain and riparian zone in the mitigation area are highly degraded from historic channelization, impoundments, and active livestock production activities. The upstream end of the mitigation area flows into a lake built by NRCS in the 1960's. According to the previous landowner, streams below the impoundment have been repeatedly channelized and moved for livestock production. Land use in the immediate surrounding area is an equal mix of livestock production in the lower elevations and forested habitat in the uplands. Land use/land cover within the watershed is composed of pasture/agriculture, hardwood forest and some low-density rural residential development.

Bank erosion and sediment deposition are pervasive throughout the mitigation area. Historic channelization, dredging, realignment and straightening have left the streams unstable with vertical, eroding banks, poor bed form diversity, unstable patterns and incised conditions that have disconnected the stream reaches from their floodplains.

The mitigation area contains 26,357 linear feet of stream mostly located in a low slope, alluvial valley with a wide floodplain (**Table 3**). The existing stream types are generally indicative of C and E channels according to the Rosgen classification system. Cub Creek at the lower limit of the project has a drainage area of approximately 6.61 square miles. UT16 is largest tributary with a watershed area of 1.59 square miles. Other tributary drainage areas range from 0.05 to 0.07 square miles. The likely channel evolution sequence suggests that without restoration efforts, the streams will remain unstable and continue to contribute excessive sediment loads to the Hatchie River system for the foreseeable future.

Table 3. Streams in the Mitigation Area

Feature	Length (ft)	Proposed Length (ft)
UT - 1	1,833	1,737
UT - 3	2,366	3,133
UT - 4	710	710
UT - 6	979	1,283
UT - 8	74	344
UT - 13	1,158	1,670
UT - 16	4,779	6,556
UT - 20	4,405	4,306
UT - 25	1,459	1,888
UT - 26	2,418	2,418
UT - 28	1,670	1,670
Cub Creek	1,468	3,670
Total	**23,357**	**29,385**

Field investigations revealed emergent and forested jurisdictional wetlands adjacent to Cub Creek and several unnamed tributaries. Thirteen wetlands were delineated within the mitigation area (See Appendix A). Wetland hydrology is generally maintained by subsurface flow and runoff from surrounding hillsides. The palustrine, emergent, seasonally flooded (PEM1) wetland areas are dominated by soft rush (*Juncus effusus*). Palustrine, forested, seasonally flooded wetland areas (PFO1) are dominated by sweet gum (*Liquidambar styraciflua*) and red maple (*Acer rubrum*). More detail for each wetland community is found in the wetland determination data forms located in the Appendices.

According to the Hardeman County Soil Survey (NRCS 1997), soils in the mitigation area are predominantly mapped as the Iuka silt loam (Iu), Enville silt loam, and Chenneby silt loam (Cn). These soils are occasionally flooded and typically found along floodplains of secondary streams. Chenneby silt loam and Enville silt loam often contain hydric inclusions. A detailed NRCS soil report is located in the Appendices. Numerous soil samples were examined to determine the presence of hydric soil. The soils sampled in most wetland areas had low chroma colors within the upper 12 inches.

7.0 MITIGATION APPROACH

Cub Creek and its tributaries have been impounded, channelized, grazed and trampled by cattle for decades, leaving the streams in unstable states and mostly devoid of woody riparian vegetation. As a result of these channel modifications, the stream is currently experiencing lateral and vertical migration evidenced by massive bed and bank erosion, and the deposition of bed and bank material on the floodplain or in the lake created by the impoundment. The project concept is a comprehensive restoration of the entire Cub Creek floodplain, with functional uplifts from improved stream and wetland hydrology, channel hydraulics and sediment transport, riparian buffers, and aquatic and terrestrial habitats.

The approach for each of the unnamed tributaries will focus on improving degraded aquatic habitats, floodplain connectivity, bedform diversity, vertical and lateral stability, and riparian buffers. Restoration practices on Cub Creek and the unnamed tributaries within the mitigation area will include removal of impoundments, construction of new, off-line channel segments, bank sloping and floodplain bench excavation in incised sub-reaches, installation of grade control structures to maintain connectivity to the floodplain, invasive species removal, riparian buffer re-establishment, and livestock exclusion. These practices will improve channel hydraulics, sediment transport, floodplain connectivity, bedform diversity and provide for the recovery of natural stream functions.

The approach for restoration of Cub Creek through the western portion of Cub Creek Lake will focus on creating natural stream and floodplain conditions during storm events at or below the 2-yr, 24-hour threshold. An additional objective of this reach is reconnection of isolated biological populations that have been separate since the construction of Cub Creek Lake. The lake itself will be reconfigured to allow the western half to function as a natural stream and floodplain instead of an impoundment.

Stream restoration measures will be designed using a combination of analytical data and reference reaches from one or more stable reaches found at a site with a similar valley type. Multiple reference reaches for the unnamed tributaries may be used to match geomorphic conditions and valley slopes.

Riparian buffer re-establishment will be accomplished by planting live stakes on the banks, and bare root trees and shrubs within the riparian buffer. These plantings will help increase wood and other organic matter inputs to the system. Cessation of mowing and livestock production within the mitigation area will allow for riparian buffer re-establishment.

Sediment transport analyses will be performed on restored reaches in order to verify the ability of the designed channels to transport the size and mass of sediment supplied to each stream by its watershed. Bankfull dimensions and discharges will be evaluated based on site surveys, regional hydraulic geometry relationships and hydraulic modeling.

The project site has a high likelihood of success for the following reasons:

- Relatively long reaches and sufficient space to address pattern deficiencies;
- Rural landscape that is relatively free of site constraints;
- Lone Oaks Farm will maintain a full-time caretaker for the site;
- Invasive plant species are not abundant in the mitigation area.

8.0 SITE PROTECTION AND LONG TERM MANAGEMENT

The property is owned in fee by the State of Tennessee. Land use restrictions will be placed on the mitigation area to protect the restored streams. A copy of the Army Corps guidelines for land use restrictions is located in the Appendices. A Long-Term Management Fund will be established for future land management after performance standards have been met. Long term management activities include annual monitoring and may include replacing boundary signage and fencing.

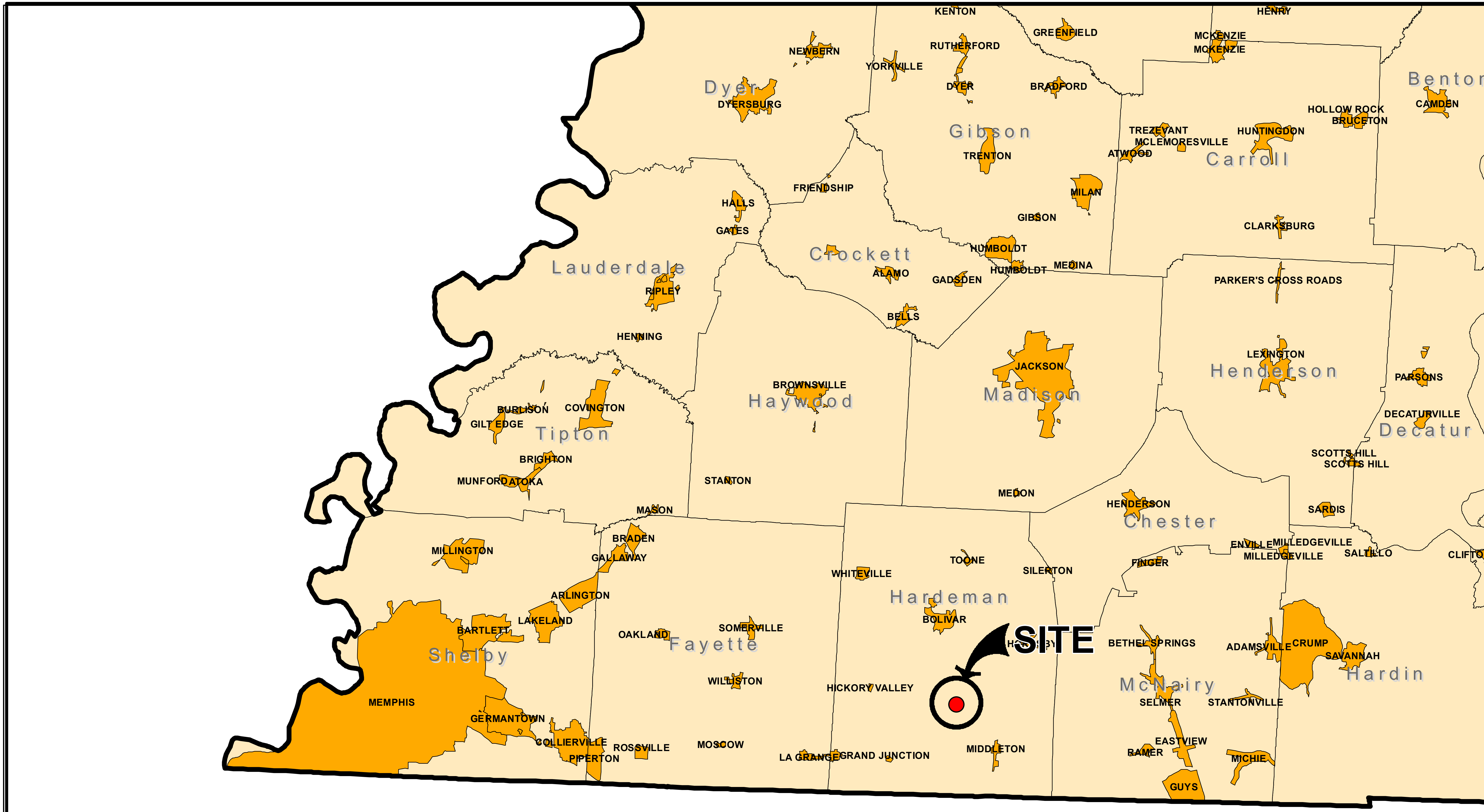
9.0 HISTORIC PROPERTIES AND LISTED SPECIES

A Phase I Cultural Resource Assessment was performed at Lone Oaks Farm by the University of Tennessee's Archeological Research Laboratory in September 2016. The study area included portions of the mitigation area. No historic structures or features were identified during this survey. A copy of the report is included in the Appendices.

The following species are potentially affected by activities at the site: Indiana Bat (*Myotis sodalis)* and Northern Long-eared Bat (*Myotis septentrionalis).* There are no critical habitats designated for either of the two species at the site. The IPAC report from the USFWS website is included in the Appendices.

APPENDICES

APPENDIX A: MAPS



LONE OAKS FARM

10,000 LAKE HARDEMAN ROAD
MIDDLETON, TN 38052
(731) 376-0082
WWW.LONEOAKSFARM.COM

Cub Creek
Stream Mitigation Bank

Figure 1.
Project Location

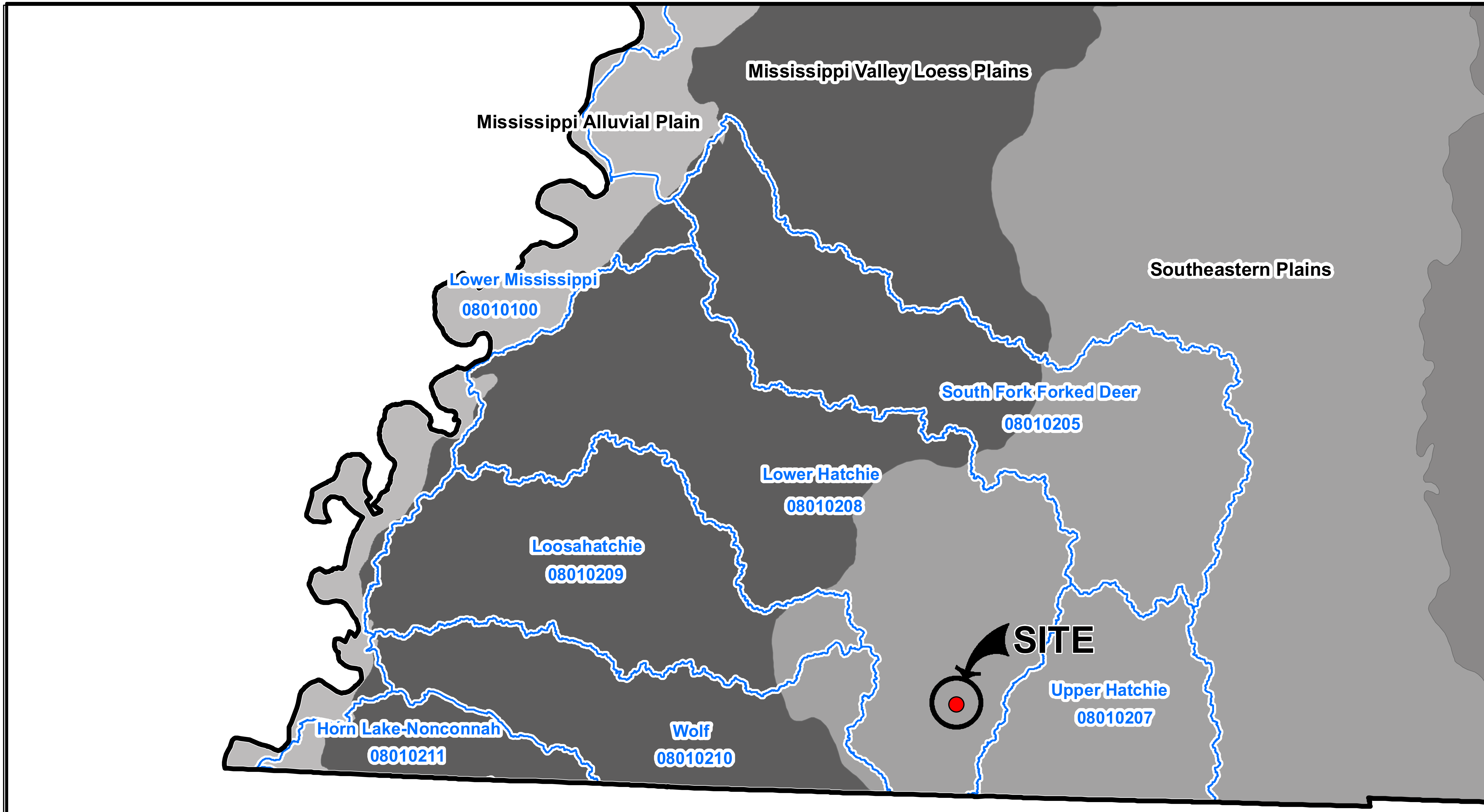


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Figure 2.
Geographic Service Area

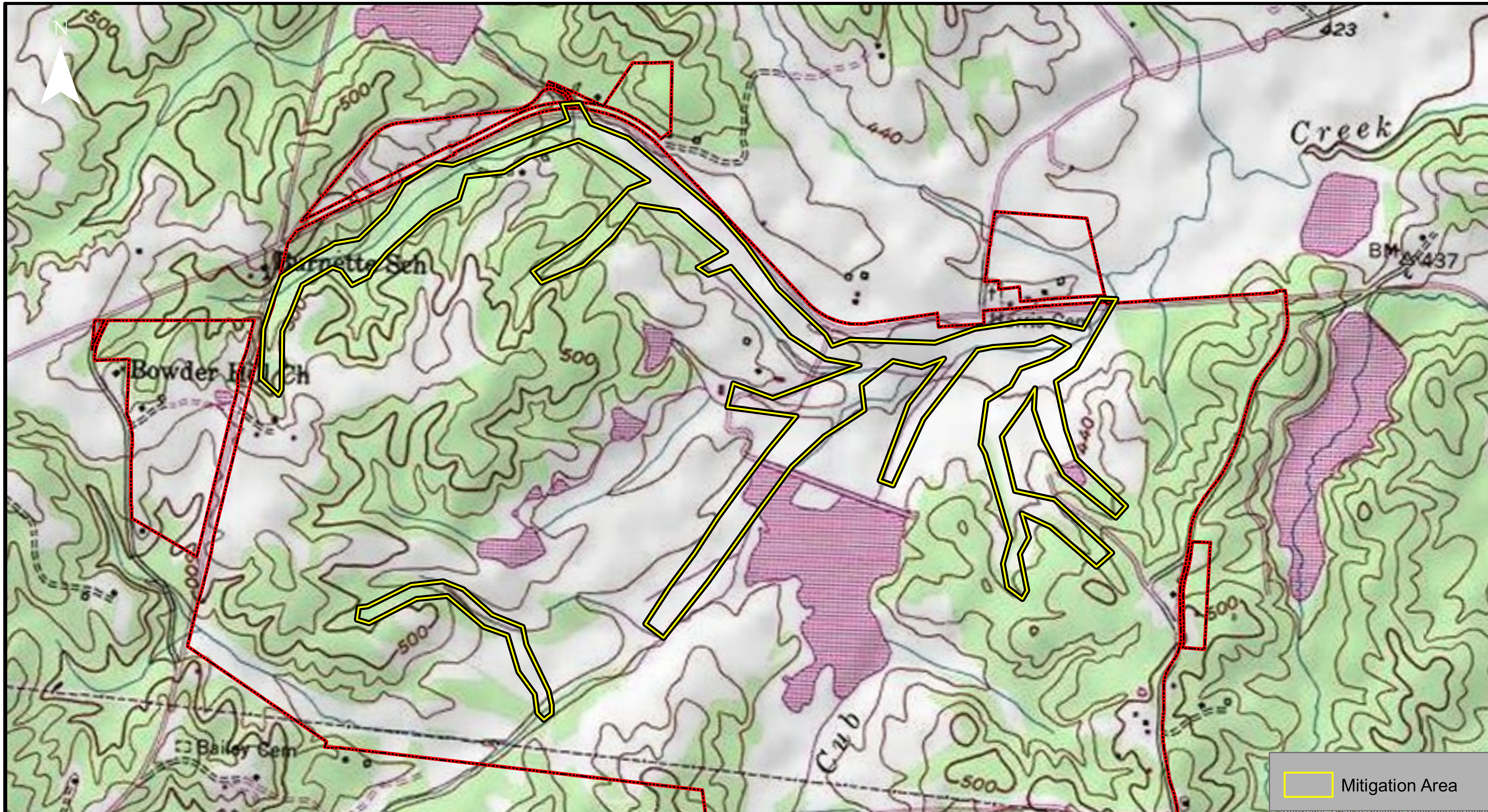

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Figure 3.
Topographic Map

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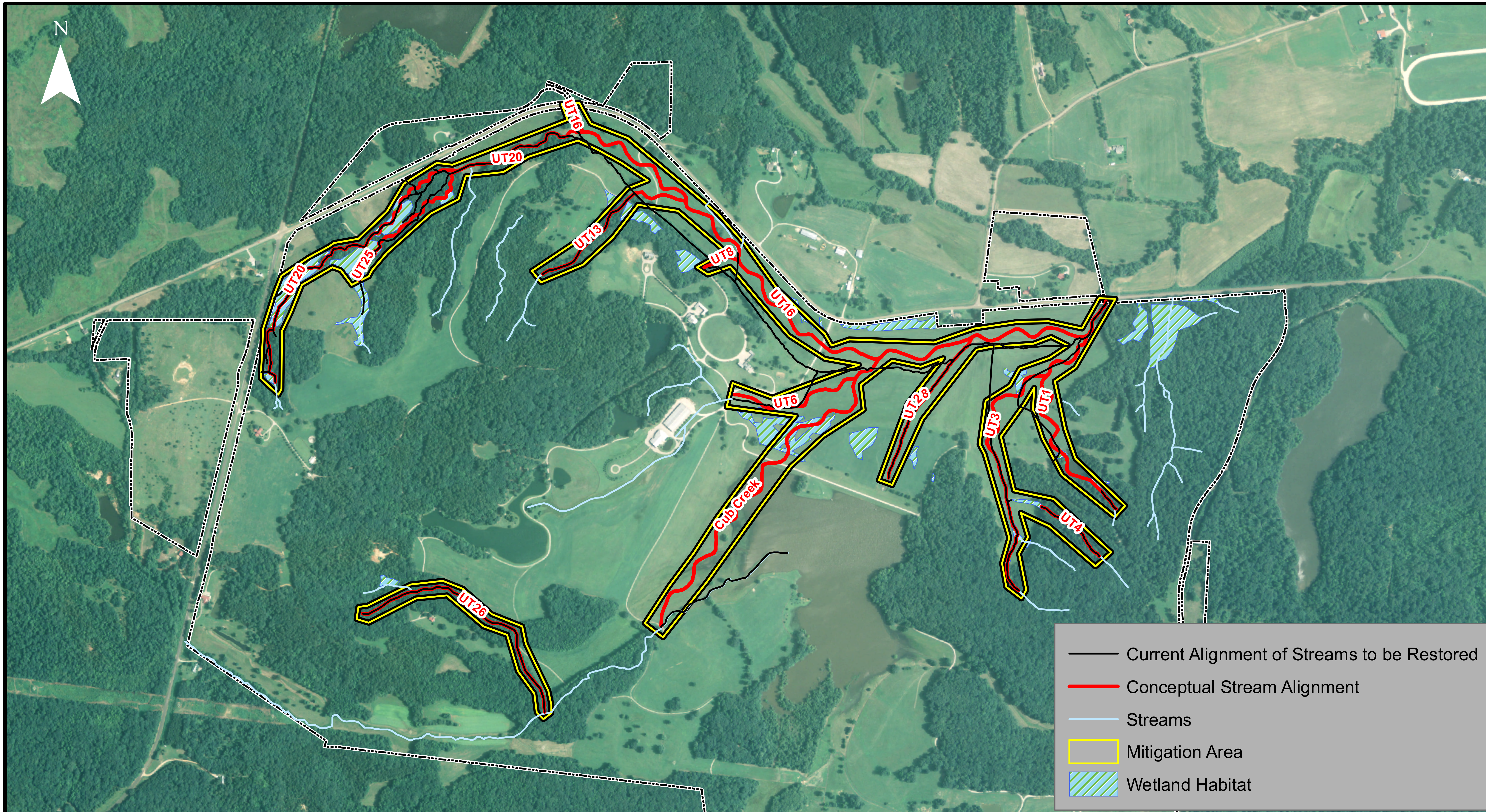
Cub Creek
Stream Mitigation Bank

Figure 4.
Aquatic Resource
Existing Conditions



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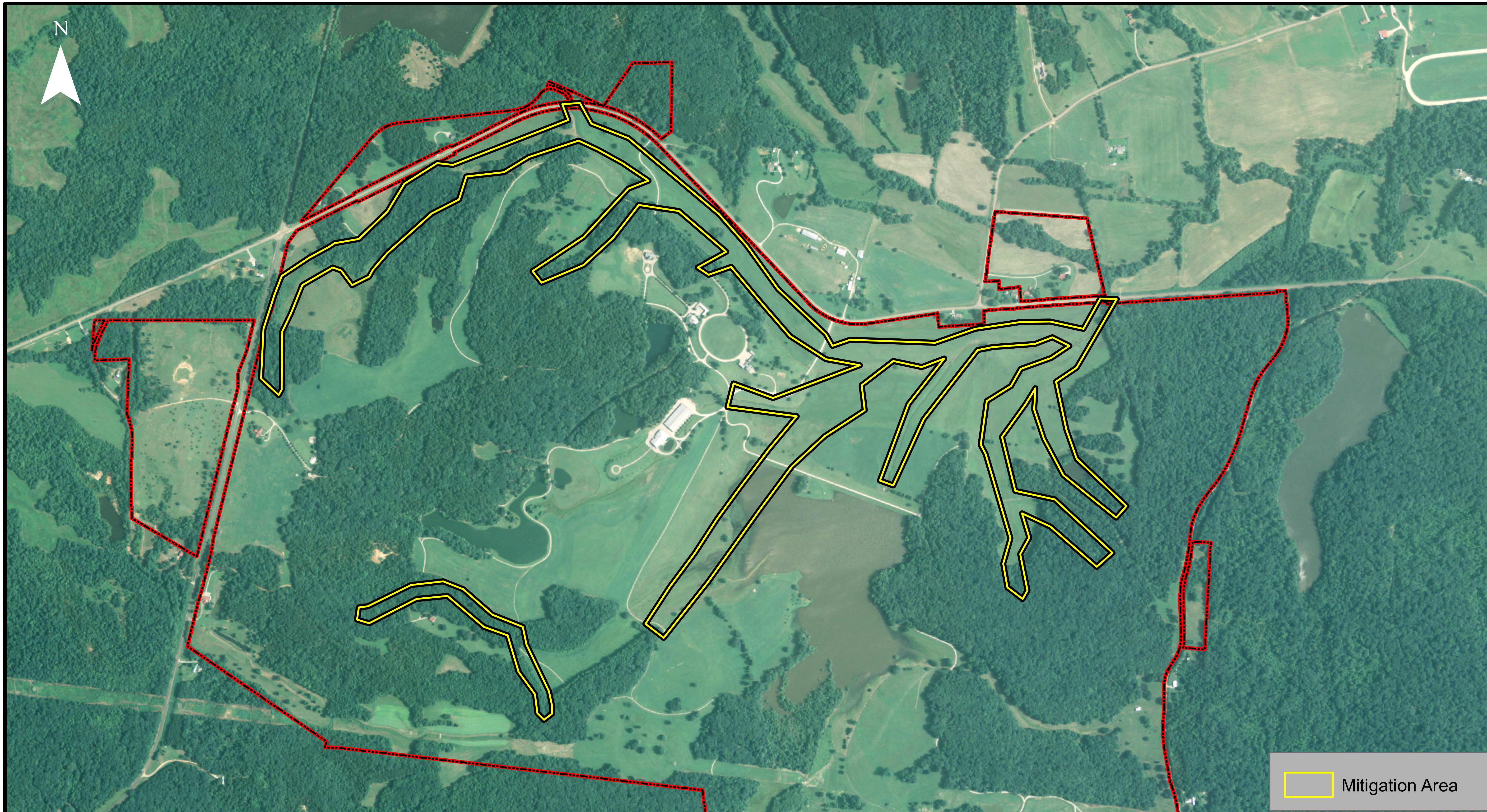
Cub Creek
Stream Mitigation Bank

Figure 5.
Proposed Treatments



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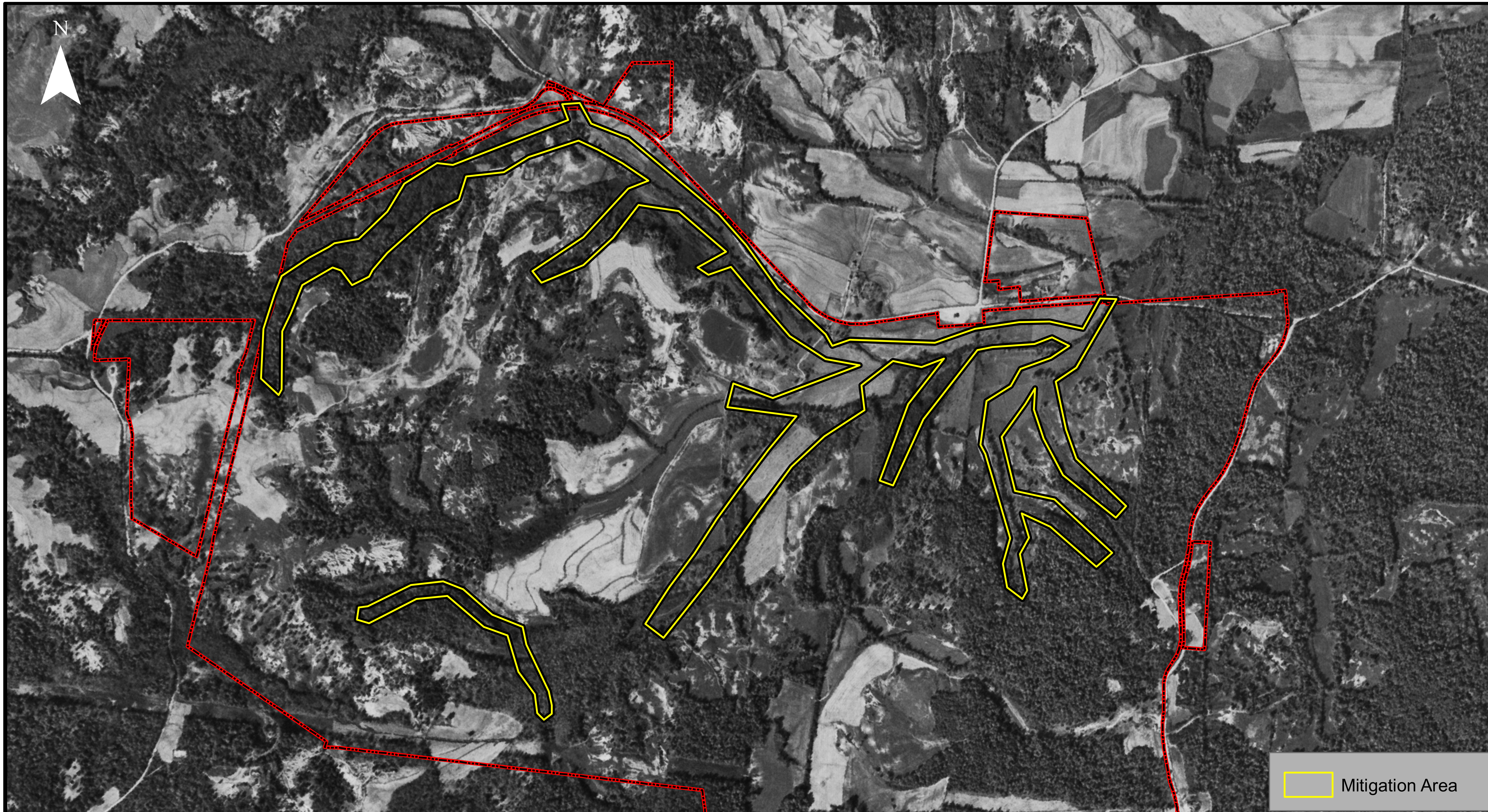
Cub Creek
Stream Mitigation Bank

Figure 6.
2014 Aerial Photograph



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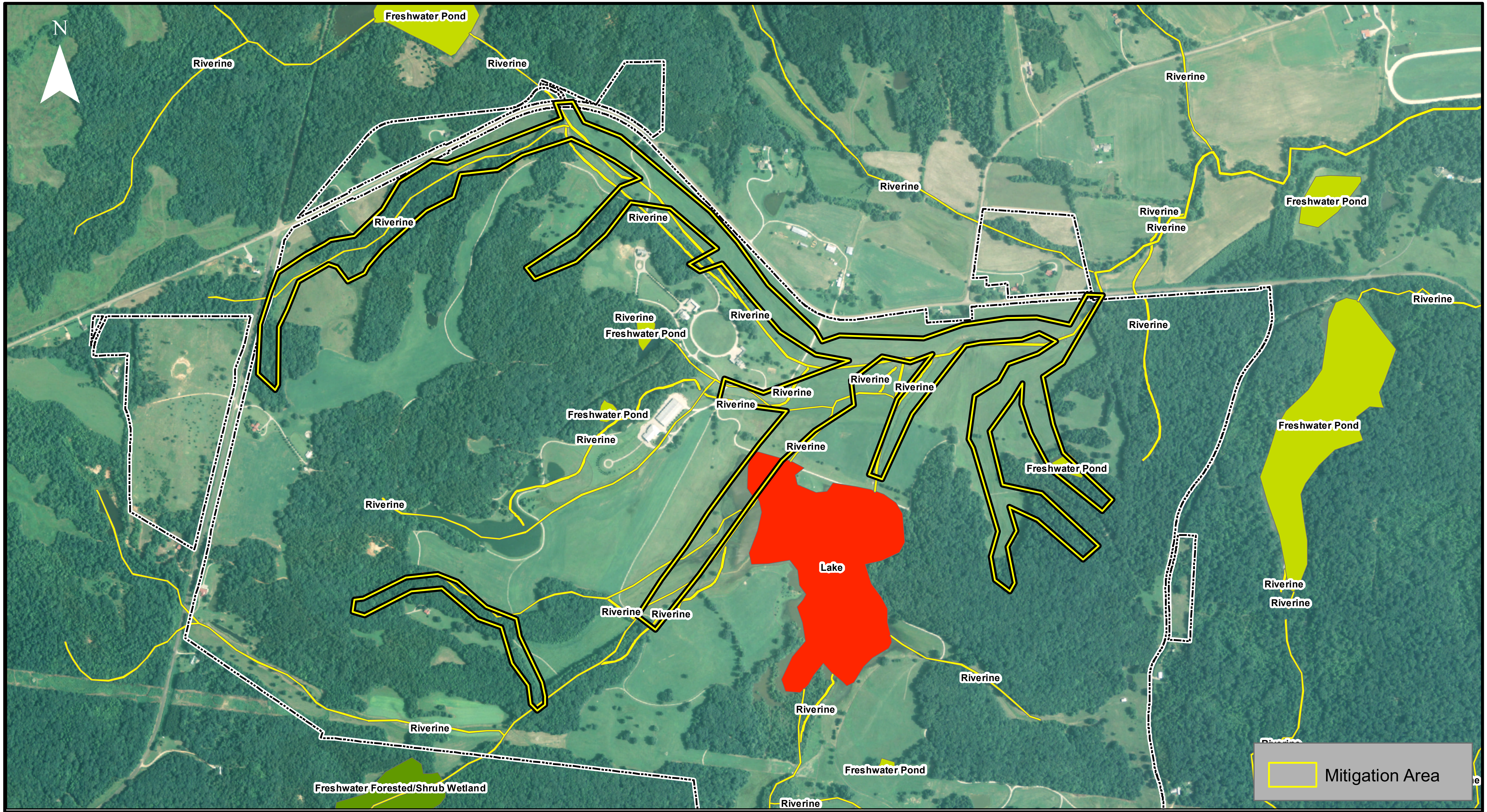
Cub Creek
Stream Mitigation Bank

Figure 7.
1947 Aerial Photograph



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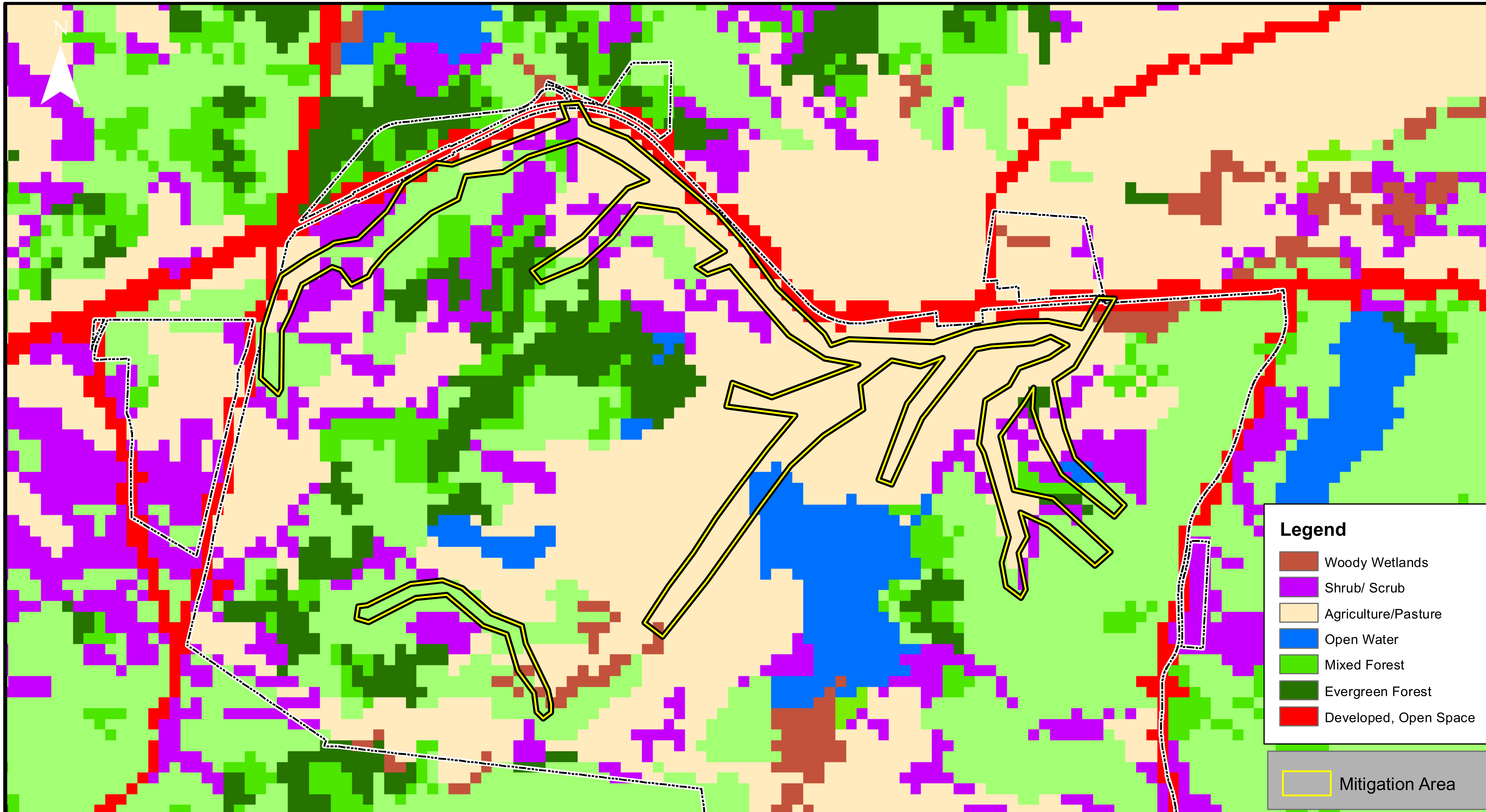
Cub Creek
Stream Mitigation Bank

Figure 8.
NWI Data



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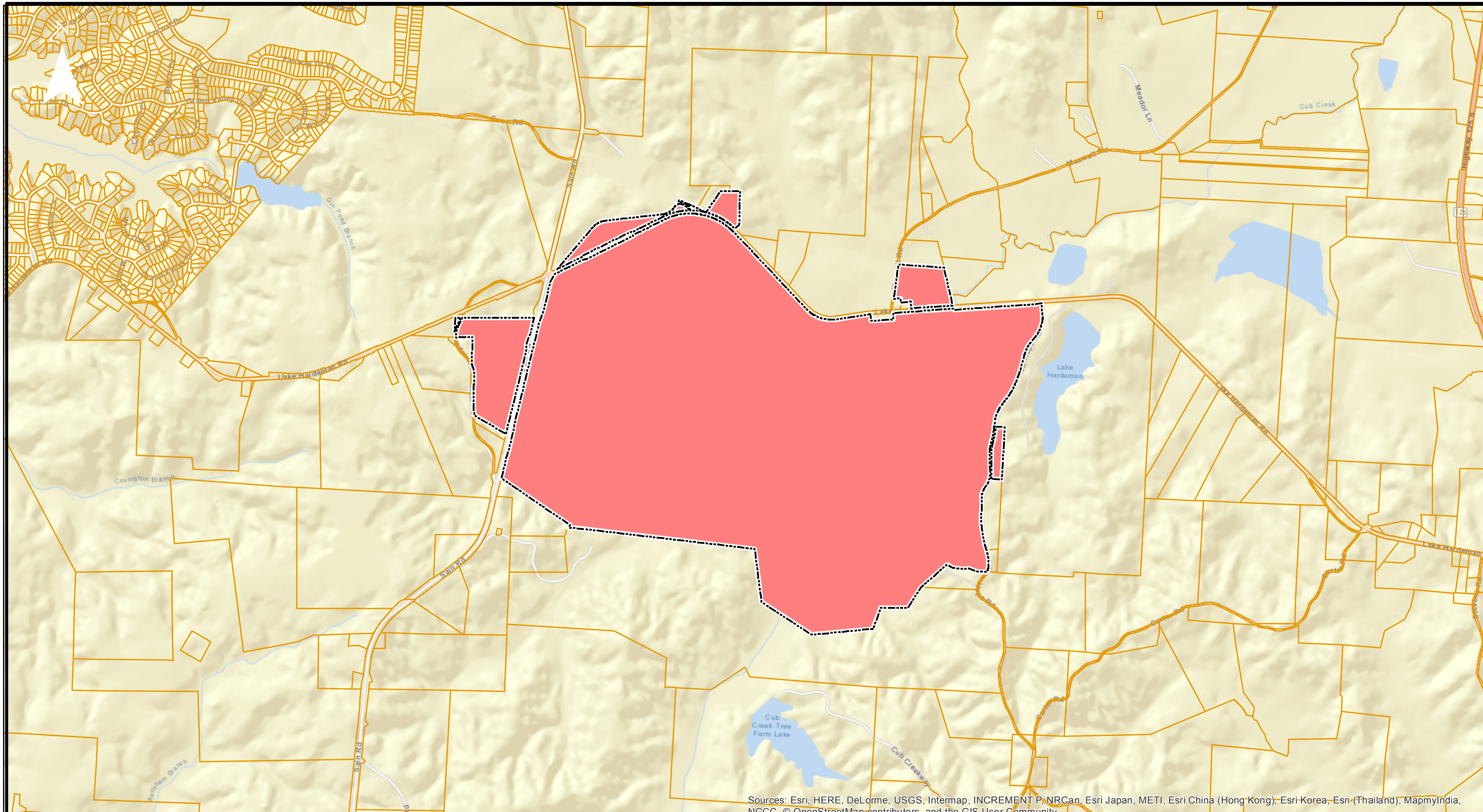
Cub Creek
Stream Mitigation Bank

Figure 9.
Land Use/Land Cover
(2011 NLCD)



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Cub Creek Stream Mitigation Bank

Figure 10.
Parcel Map

APPENDIX B: STREAM AND WETLAND DETERMINATION DATA FORMS AND SITE PHOTOGRAPHS

April 12, 2019

Mr. Damon McDermott, Project Manager
U.S. Army Corps of Engineers
167 N. Main St. Room B-202
Memphis, TN 38103-1894

Dear Mr. McDermott:

Subject: Lone Oaks Farm
Jurisdictional Determination – Cub Creek Mitigation Bank
Middleton, Hardeman County, TN
CEC Project 190-894.0001

Civil & Environmental Consultants, Inc. (CEC) was contracted to perform a jurisdictional determination (JD) within the +/- 574 acre study area boundary noted on Figure 1. The Lone Oaks property is owned and operated by the University of Tennessee Institute of Agriculture and is located at 10000 Lake Hardeman Rd. in Middleton, TN. The site is located at 35.138633; -88.963746. CEC biologists Greg Babbit and Casey Hertwig performed the jurisdictional determination on February 26 through March 1, 2019. The area of interest is depicted on the Middleton (440 SW) USGS 7.5 Minute Topographic Map (Figure 1). The subject site is located in the Cub Creek (HUC-12 – 080102080202) watershed within the Lower Hatchie River (HUC-8 – 08010208) watershed.

The subject property is being evaluated for a proposed mitigation bank. A prospectus for the proposed Cub Creek Mitigation Bank has not been submitted, but is being drafted at this time. The site primarily consists of open hay fields at the lower elevations and forested habitat in the higher elevations (Figure 2). The site is surrounded by forested habitat and rural agricultural farmland. Topography at the site consists of rolling hills with drainage flowing in a northeastern direction. The site was chosen as a prospective mitigation bank for its historic land modifications and degradation due to long-term agricultural practices including livestock, impoundment, and hay production.

Prior to the site visit, a desktop review of the U.S. Fish and Wildlife Service National Wetland Inventory (NWI), the National Resources Conservation Service (NRCS) Web Soil Survey, and the Tennessee Department of Environment and Conservation GIS (TDEC-GIS) website was performed. As depicted on the USGS topographic map (Figure 1), there are seven “blue line” features along with five impoundments within the site boundary. Figure 2 displays the features that were documented during the field survey. The NRCS Soil layer shows that there are two hydric inclusion soils located within the site boundary: Cn - Chenneby Silt Loam and En - Enville Silt Loam (Figure 3). Hydric inclusion soils are soils that contain hydric components but do not have a hydric rating of 100%. Review of the NWI revealed that there were no documented wetlands within the study area boundary. Three ponds and one lake along with several streams are noted on the NWI map. Figure 4 displays the USFWS national wetland inventory layer for the site.

Hydrologic determinations at the proposed site included both a literature review and an on-site evaluation in accordance with the Tennessee Division of Water Resources' "Hydrologic Determination Field Data Sheet". Wetland determinations at the proposed site included both a literature review and an on-site evaluation in accordance with the criteria established in the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: *Atlantic and Gulf Coastal Plains*, Version 2.0. Also included is a photographic summary depicting conditions observed during the site visit. Field data forms for the identified features are attached.

Data were taken from the Community Collaborative Rain, Hail & Snow Network rain gauge located in Somerville, Fayette County TN to determine if rain had fallen in the area within seven days of the site visit. Data was not available for Hardeman County. According to the website, total precipitation in the area from February 19 – March 1, 2019 was 5.59-inches (Table 1).

Table 1. Rainfall Data – TVA Rain Gauge

Date:	2/19 Tue	2/20 Wed	2/21 Thu	2/22 Fri	2/23 Sat	2/24 Sun	2/25 Mon	2/26 Tue	2/27 Wed	2/28 Thu	3/1 Fri
Hardeman County, TN	0.00	1.80	0.14	0.55	2.30	0.78	0.00	0.00	0.00	0.00	0.02

Figure 2 displays the features that were noted by CEC during the field survey on February 26 through March 1, 2019. Tables 2 and 3 below list the jurisdictional features within the JD study area at Lone Oaks Farm.

Table 2. Lone Oaks Farm – Stream Features

Feature	Begin Coordinates	End Coordinates	Length	HD Score
EPH-1	35.13386827; -88.95493068	35.13428373; -88.95486674	153 ft.	15
INT-1	35.13427401; -88.95484446	35.138511; -88.9560891	1,833 ft.	25
EPH-2	35.13660071; -88.95607464	35.13693584; -88.95656688	199 ft.	17.5
EPH-3	35.13169972; -88.95621136	35.13214577; -88.95775344	523 ft.	12
INT-3	35.13214577; -88.95775344	35.13831193; -88.95876154	2,366 ft.	22
EPH-4	35.13230821; -88.95439816	35.13308049; -88.95532849	399 ft.	14
INT-4	35.13308049; -88.95532849	35.13438217; -88.9581885	748 ft.	21.5
EPH-5	35.13269147; -88.95606	35.13354301; -88.95782559	633 ft.	14

PER-6	35.13627023; -88.96928114	35.13749901; -88.96412349	2,091 ft.	*PI# 5, 7
INT-7	35.13795637; -88.96860618	35.13727897; -88.96767414	463 ft.	24
INT-8	35.14003578; -88.96754908	35.14006301; -88.96730908	74 ft.	25
EPH-9	35.1408557; -88.96651416	35.14039172; -88.96666081	176 ft.	13.5
EPH-10	35.14171752; -88.96758355	35.14043377; -88.96667633	587 ft.	13.5
INT-10	35.14043377; -88.96667633	35.13970984; -88.96672839	267 ft.	22
PER-11 (Cub Creek)	35.13488669; -88.96185325	35.13948238; -88.95534218	2,966 ft.	*PI# 5, 6, 7
PER-11 (Cub Creek)	35.13022211; -88.9832424	35.13292205; -88.96485675	6,905 ft.	*PI# 5, 6, 7
EPH-12	35.13845001; -88.9728213	35.13868342; -88.97319619	155 ft.	15
EPH-13	35.13804365; -88.97366063	35.13975921; -88.97262612	714 ft.	15
INT-13	35.13975921; -88.97262612	35.14184107; -88.96991613	1,158 ft.	22.5
EPH-14 (up-gradient)	35.13852895; -88.9743176	35.13919089; -88.97398622	273 ft.	15
INT-14	35.13919089; -88.97398622	35.14063653; -88.97383158	627 ft.	23
EPH-14 (down-gradient)	35.14063653; -88.97383158	35.14120287; -88.97331746	274 ft.	18
EPH-15 (up-gradient)	35.1386244; -88.97597047	35.13873562; -88.97575471	77 ft.	12
INT-15	35.13873562; -88.97575471	35.14080696; -88.97536194	787 ft.	27
EPH-15 (down-gradient)	35.14080696; -88.97536194	35.14235063; -88.9749129	646 ft.	18
PER-16	35.143969; -88.971961	35.137904; -88.960001	4,779 ft.	*PI# 5, 6, 7
INT-17	35.14229775; -88.97605992	35.14222299; -88.97588343	61 ft.	21
INT-18	35.14094175; -88.97696578	35.14171312; -88.97642634	353 ft.	27
INT-19	35.14200376; -88.97690091	35.14167392; -88.97651507	183 ft.	22
EPH-20a	35.13614176; -88.98047677	35.13683739; -88.98072118	272 ft.	14

EPH-20b	35.13615641; -88.98073	35.13644098; -88.98067321	118 ft.	14
INT-20	35.136837; -88.980721	35.143185; -88.971547	4,405 ft.	*PI# 7
INT-21	35.13705975; -88.98115129	35.13707085; -88.98092431	68 ft.	*PI# 7
INT-22	35.13727975; -88.98099813	35.13770411; -88.98093973	164 ft.	*PI# 7
INT-23	35.13797084; -88.98074238	35.13814728; -88.98083381	71 ft.	*PI# 7
INT-24	35.13893009; -88.98084004	35.13931161; -88.98021918	238 ft.	*PI# 7
EPH-25	35.1376417; -88.97784401	35.13860157; -88.97812756	383 ft.	14
INT-25	35.13860157; -88.97812756	35.14220069; -88.97558911	1,773 ft.	*PI# 7
INT-26	35.13106201; -88.97782738	35.12873613; -88.97216338	2,418 ft.	*PI# 7
EPH-27	35.13158464; -88.97781038	35.13175992; -88.97722992	189 ft.	17.5
INT-27	35.13175992; -88.97722992	35.13166048; -88.97631876	293 ft.	*PI# 7
EPH-28	35.13353968; -88.95353197	35.13538396; -88.95339642	705 ft.	17.5
INT-28	35.13538396; -88.95339642	35.13963711; -88.95331916	1,670 ft.	*PI# 7
EPH-29	35.13385702; -88.95387025	35.13420608; -88.95369458	140 ft.	14
EPH-30	35.13499285; -88.95285646	35.13549368; -88.95325878	223 ft.	17.5
EPH-31	35.13577578; -88.95228839	35.13585663; -88.95318935	274 ft.	14
EPH-32	35.13712243; -88.95342912	35.13731682; -88.95346802	77 ft.	14
EPH-33	35.13623876; -88.95403175	35.13722165; -88.95409774	361 ft.	14
INT-33	35.13722165; -88.95409774	35.13788242; -88.95397516	252 ft.	*PI# 7
EPH-34	35.13673793; -88.95433123	35.13692681; -88.95410754	97 ft.	17.5
EPH-35	35.13739479; -88.95434236	35.13746017; -88.95412594	70 ft.	14
EPH-36	35.139283; -88.95194397	35.13912577; -88.95245398	165 ft.	14

EPH-37	35.13932541; -88.95128781	35.13952878; -88.95190414	202 ft.	14
INT-38	35.13386849; -88.97286626	35.13670276; -88.96706827	2,207 ft.	*PI# 7
INT-39	35.13576665; -88.9684114	35.13604115; -88.96811947	134 ft.	*PI# 7
(EPH = Ephemeral Stream, INT = Intermittent Stream, PER = Perennial Stream)				

*PI – Primary Indicator

Table 3. Lone Oaks Farm – Wetland and Pond Features

Feature	Coordinates	Cowardin Classification	Size	Sampling points
PND-1	35.135216; -88.956184	PUBHh	~1.03 ac.	NA
PND-2	35.132451; -88.963624	L2UBHh	~40.37 ac.	NA
PND-3	35.138177; -88.969093	PUBHh	~1.88 ac.	NA
PND-4	35.136084; -88.969985	PUBHh	~1.46 ac.	NA
PND-5	35.135543; -88.968625	PUBHh	~0.16 ac.	NA
PND-6	35.133274; -88.973649	PUBHh	~7.98 ac.	NA
PND-7	35.138416; -88.97581	PUBHh	0.31 ac.	NA
WTL-1	35.134916; -88.955406	PFO1E	~0.21 ac.	WTP-1/UPT-1
WTL-2	35.135601; -89.956581	PEM1E	~0.12 ac.	WTP-2/UPT-2
WTL-3	35.137502; -88.95801	PEM1E	~0.46 ac.	WTP-3/UPT-3
WTL-4	35.134368; -88.957522	PEM1E	~0.20 ac.	WTP-4/UPT-4
WTL-5	35.133366; -88.957865	PEM1E	~0.52 ac.	WTP-5/UPT-5
WTL-6	35.135991; -88.964997	PEM1E	~3.48 ac.	WTP-6/UPT-6
WTL-7	35.135805; -88.962677	PEM1E	~1.08 ac.	WTP-7/UPT-7
WTL-8	35.134914; -88.96048	PEM1E	~0.03 ac.	WTP-8/UPT-8
WTL-9	35.135435; -88.961077	PEM1E	~0.19 ac.	WTP-9/UPT-9

WTL-10	35.140185; -88.968202	PFO1E	~0.72 ac.	WTP-10/UPT-10
WTL-11	35.141241; -88.969734	PFO1E	~0.83 ac.	WTP-11/UPT-11
WTL-12	35.138728; -88.961716	PEM1E	~1.26 ac.	WTP-12/UPT-12
WTL-13	35.138869; -88.964482	PEM1E	~0.34 ac.	WTP-13/UPT-13
WTL-14	35.141854; -88.968015	PEM1E	~0.08 ac.	WTP-14/UPT-14
WTL-15	35.141632; -88.970584	PEM1E	~0.31 ac.	WTP-15/UPT-15
WTL-16	35.141064; -88.97719	PFO1E	~1.22 ac.	WTP-16/UPT-16
WTL-17	35.14158; -88.975604	PFO1E	~0.30 ac.	WTP-17/UPT-17
WTL-18	35.136952; -88.980914	PFO1E	~0.21 ac.	WTP-18/UPT-18
WTL-19	35.139203; -88.980293	PEM1E/PSS1E/PFO1E	~2.27 ac.	WTP-19/UPT-19
WTL-20	35.139445; -88.978266	PEM1E/PFO1E	~3.14 ac.	WTP-20/UPT-20
WTL-21	35.131894; -88.977072	PFO1E	~0.26 ac.	WTP-21/UPT-21
WTL-22	35.138919; -88.954336	PFO1E	~0.94 ac.	WTP-22/UPT-22
WTL-23	35.138843; -88.953421	PFO1E	~3.45 ac.	WTP-23/UPT-23
WTL-24	35.139624; -88.952523	PFO1E	~0.38 ac.	WTP-24/UPT-24

CEC appreciates the opportunity to provide you with this determination letter and we look forward to your expeditious review our findings. If you have any questions or need any additional information, please feel free to call me at (615) 333-7797.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Casey Hertwig, QHP
Project Manager

Greg Babbit, PWS, QHP
Principal

Attachments: Figures
Photo Summary
Field Data Forms

cc: Robert Wayne, TDEC

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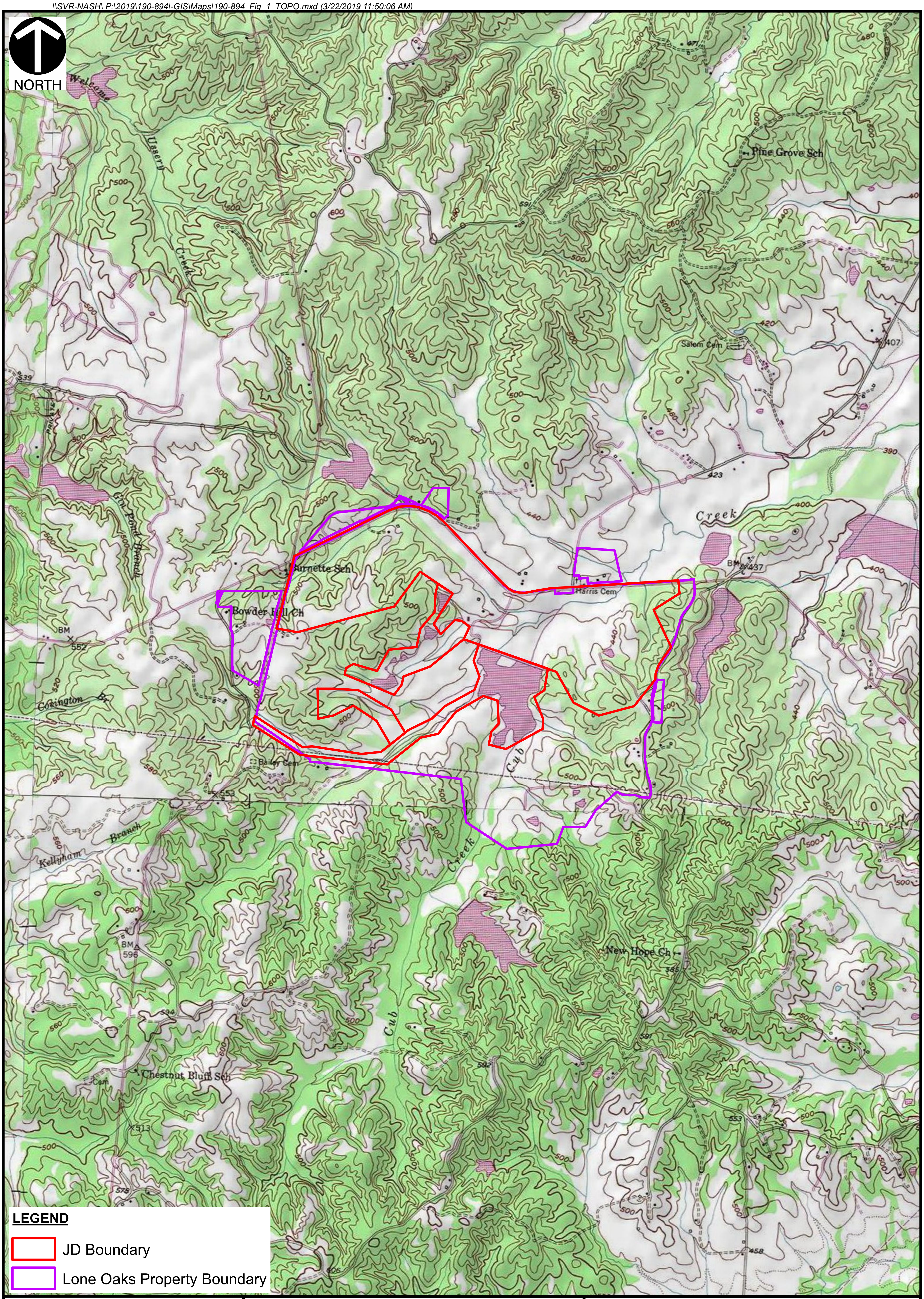

SCALE IN FEET

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REFERENCE

USGS TOPOGRAPHIC MAP/ ARCGIS MAP SERVICE: HTTP://GOTO.ARCGISONLINE.COM/MAPS/USA_TOPO_MAPS, ACCESSED 3/22/2019

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Civil & Environmental Consultants, Inc.

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615-333-7797 · 800-763-2326

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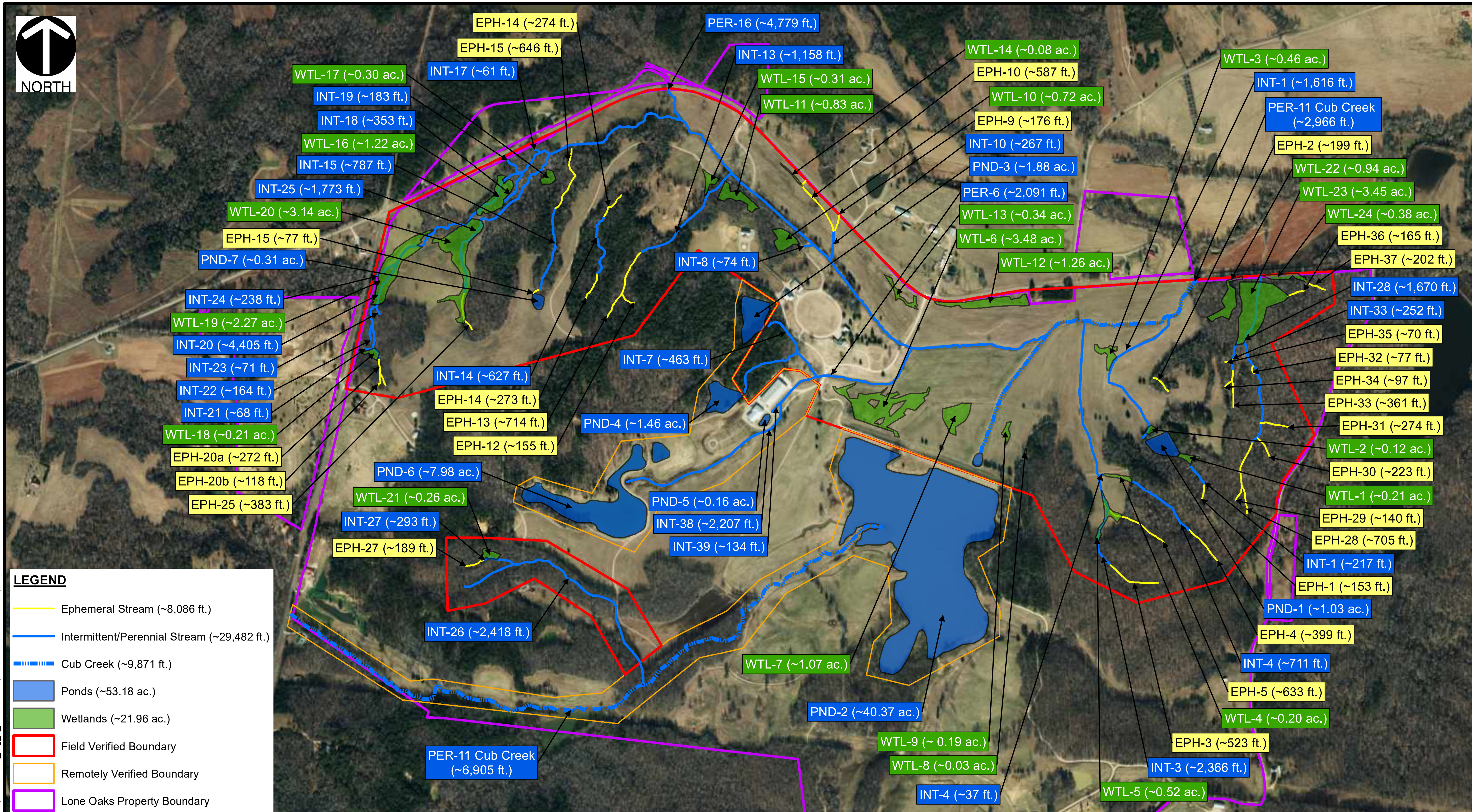
LONE OAKS
CUB CREEK MITIGATION BANK
JURISDICTIONAL DETERMINATION
MIDDLETON, TN

TOPOGRAPHIC MAP
SITE LOCATION MAP

DRAWN BY: CDH	CHECKED BY: BCL	APPROVED BY: GB * Hand signature on file		FIGURE NO:	1
DATE: 3/22/2019	SCALE: 1 " = 2,000 '	PROJECT NO: 190-894.0001			



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HYDROLOGIC FEATURES MAP
AERIAL MAP

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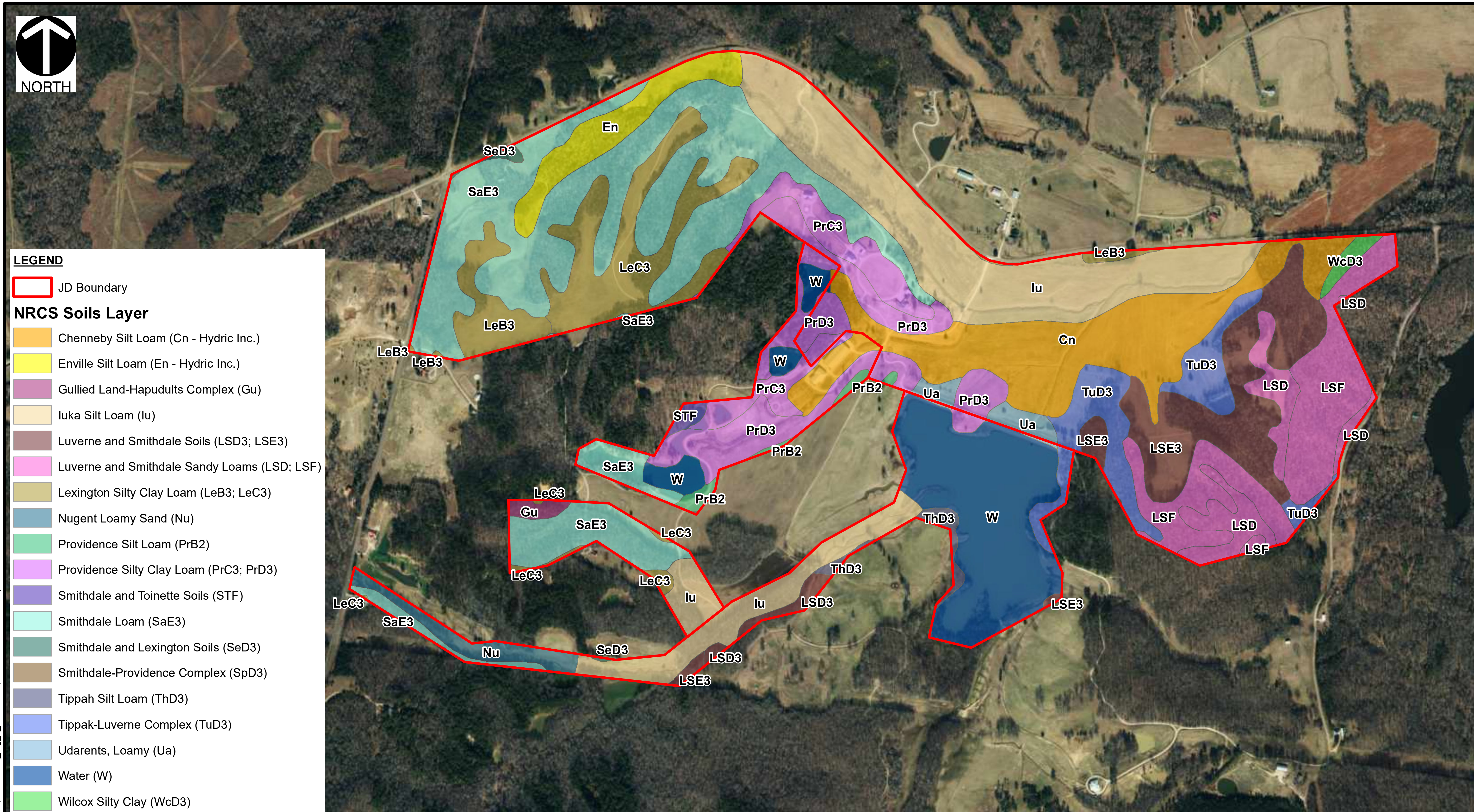
DATE:	3/25/2019	SCALE:	1 " = 850 '	PROJECT NO:	190-894.0001	



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U.S.D.A., N.R.C.S
SOIL SURVEY GEOGRAPHIC (SSURGO) DATABASE FOR
HARDEMAN COUNTY, TN

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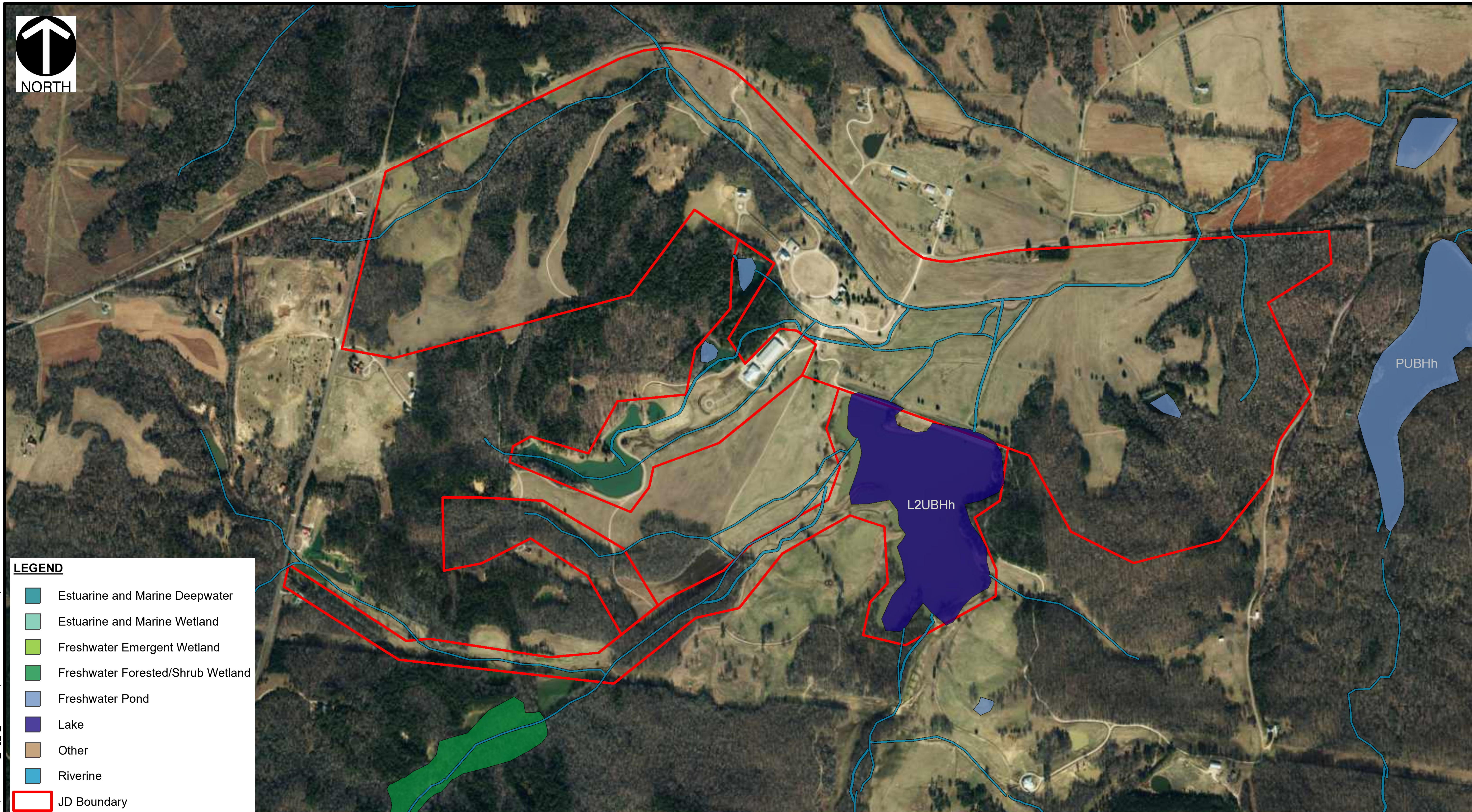
MIDDLETON, TN

NRCS SOILS MAP

DRAWN BY: CDH	CHECKED BY: BCL	APPROVED BY: GB * Hand signature on file	FIGURE NO:		3
DATE: 3/22/2019	SCALE: 1 " = 850 '	PROJECT NO: 190-894.0001			



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U.S. FISH & WILDLIFE SERVICE
NATIONAL WETLANDS INVENTORY (NWI) MAP
MIDDLETON, TN QUADRANGLE

SCALE IN FEET
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NATIONAL WETLAND INVENTORY MAP

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DATE: 3/22/2019	SCALE: 1 " = 850 '	PROJECT NO: 190-894.0001			

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Photo 1. View of the beginning of INT-1.

Photo 2. View of INT-1 looking downstream.

Photo 3. View of EPH-1 looking up-gradient.

Photo 4. View of INT-1 and WTL-1 looking down-gradient.

Photo 5. View of PND-1 looking south.

Photo 6. View of wetland test pit (WTP-2): Matrix – 2.5Y 6/2 with 7.5YR 5/8 redox concentrations.

Photo 7. View of upland test pit (UTP-2): Matrix (0-4") – 10YR 5/3; Matrix (4-12") – 10YR 6/3

Photo 8. View of WTL-2 looking west below the PND-1 berm.

Photo 9. View of INT-1 looking downstream, standing below PND-1.

Photo 10. View of EPH-2 looking down-gradient.

Photo 11. View of the tree line where EPH-2 ends.

Photo 12. View of PER-11 (Cub Creek) looking downstream at the bridge crossing under Lake Hardeman Rd.

Photo 13. View of PER-11 (Cub Creek) looking upstream.

Photo 14. View of INT-1 looking upstream.

Photo 15. View of WTL-3 looking south.

Photo 16. View of wetland test pit (WTP-3): Matrix – 2.5Y 6/1 with 7.5YR 5/8 redox concentrations.

Photo 17. View of upland test pit (UTP-3): Matrix – 2.5Y 5/3 with faint redox concentrations.

Photo 18. View of INT-3 looking upstream.

Photo 19. View of INT-3 looking downstream.

Photo 20. View of EPH-4 looking up-gradient.

Photo 21. View of INT-4 looking down-gradient.

Photo 22. View of INT-4 looking up-gradient.

Photo 23. View of WTL-4 looking north.

Photo 24. View of wetland test pit (WTP-4): Matrix – 2.5Y 6/1 with 7.5YR 4/6 redox concentrations.

Photo 25. View of upland test pit (UTP-4): Matrix – 2.5Y 5/3 with faint redox concentrations.

Photo 26. View of EPH-5 looking up-gradient at begin point.

Photo 27. View of EPH-3 looking up-gradient.

Photo 28. View of INT-3 looking upstream at begin point.

Photo 29. View of wetland test pit (WTP-5): Matrix – 2.5Y 6/1 with 7.5YR 5/8 redox concentrations.

Photo 30. View of upland test pit (UTP-5): Matrix – 10YR 4/3 (100%).

Photo 31. View of WTL-5 looking south.

Photo 32. View of WTL-6 looking east.

Photo 33. View of upland test pit (UTP-6): Matrix – 2.5Y 5/3 with 7.5YR 5/8 redox concentrations. Primary vegetation is fescue and clover.

Photo 34. View of wetland test pit (WTP-6): Matrix – 2.5Y 5/1 with 7.5YR 5/6 redox concentrations.

Photo 35. View of wetland test pit (WTP-7): Matrix – 2.5Y 5/1 with 7.5YR 4/6 redox concentrations.

Photo 36. View of upland test pit (UTP-7): Matrix – 10YR 4/4 (100%).

Photo 37. View of WTL-8 looking south.

Photo 38. View of wetland test pit (WTP-8): Matrix – 2.5Y 5/1 with 7.5YR 4/6 redox concentrations.

Photo 39. View of upland test pit (UTP-8): Matrix – 10YR 5/4 (100%).

Photo 40. View of WTL-9 looking north.

Photo 41. View of wetland test pit (WTP-9): Matrix – 2.5Y 5/1 with 7.5YR 5/6 redox concentrations.

Photo 42. View of upland test pit (UTP-9): Matrix – 2.5Y 5/3 (100%).

Photo 43. View of PER-6 looking upstream, standing below the PND-4 outlet.

Photo 44. View of PND-4 looking southwest.

Photo 45. View of INT-7 looking downstream, standing below the PND-3 berm.

Photo 46. View of wetland test pit (WTP-10): Matrix – 2.5Y 5/2 with 7.5YR 4/6 redox concentrations.

Photo 47. View of upland test pit (UTP-10): Matrix (2-10”) – 10YR 5/4 (100%).

Photo 48. View of WTL-10 looking south.

Photo 49. View of INT-8 looking upstream.

Photo 50. View of EPH-9 looking down-gradient.

Photo 51. View of INT-10 looking downstream.

Photo 52. View of EPH-10 looking up-gradient.

Photo 53. View of EPH-10 looking up-gradient at the culvert outlet under Lake Hardeman Rd.

Photo 54. View of wetland test pit (WTP-11): Matrix – 2.5Y 6/2 with 7.5YR 5/8 redox concentrations.

Photo 55. View of upland test pit (UTP-11): Matrix – 7.5YR 4/3 (100%).

Photo 56. View of WTL-11 looking east.

Photo 57. View of EPH-12 looking up-gradient at the headcut where the channel begins.

Photo 58. View of EPH-13 looking up-gradient at the headcut where the channel begins.

Photo 59. View of INT-13 looking upstream.

Photo 60. View of INT-13 looking downstream.

Photo 61. View of WTL-12 looking east.

Photo 62. View of wetland test pit (WTP-12): Matrix – 2.5Y 5/2 with 7.5YR 4/6 redox concentrations.

Photo 63. View of upland test pit (UTP-12): Matrix – 2.5Y 5/3 (100%).

Photo 64. View of upland test pit (UTP-13): Matrix (2-12") – 2.5Y 5/3 with 7.5YR 4/6 redox concentrations.

Photo 65. View of wetland test pit (WTP-13): Matrix – 2.5Y 5/2 with 7.5YR 4/6 redox concentrations.

Photo 66. View of WTL-13 looking east.

Photo 67. View of WTL-14 looking northwest.

Photo 68. View of wetland test pit (WTP-14): Matrix – 2.5Y 6/2 with 7.5YR 5/8 and 4/6 redox concentrations.

Photo 69. View of upland test pit (UTP-14): Matrix – 2.5Y 5/3 with faint redox concentrations.

Photo 70. View of PER-16 looking upstream at the box culvert under Lake Hardeman Rd.

Photo 71. View of PER-16 looking downstream.

Photo 72. View of WTL-15 looking east.

Photo 73. View of wetland test pit (WTP-15): Matrix – 2.5Y 6/2 with 7.5YR 4/6 redox concentrations.

Photo 74. View of upland test pit (UTP-15): Matrix – 7.5YR 4/4 (100%).

Photo 75. View of EPH-14 looking up-gradient at the beginning of the channel.

Photo 76. View of INT-14 looking upstream.

Photo 77. View of EPH-14 looking down-gradient, standing down-gradient of INT-14. Channel has been historically impacted.

Photo 78. View of PND-7 looking southeast.

Photo 79. View of EPH-15 (pond overflow) looking up-gradient.

Photo 80. View of INT-15 looking downstream.

Photo 81. View of severely incised section of INT-15 looking downstream.

Photo 82. View of EPH-15 looking up-gradient, standing down-gradient of INT-15. Channel has been historically impacted.

Photo 83. View of INT-25 looking downstream.

Photo 84. View of INT-25 looking upstream.

Photo 85. View of wetland test pit (WTP-16): Matrix – 2.5Y 6/1 with 5YR 4/6 redox concentrations.

Photo 86. View of upland test pit (UTP-16): Matrix – 7.5YR 5/4 (100%).

Photo 87. View of WTL-16 looking north.

Photo 88. View of INT-18 looking upstream.

Photo 89. View of INT-18 looking downstream.

Photo 90. View of the confluence of INT-18 (left) and INT-20 (right) looking upstream.

Photo 91. View of INT-20 looking downstream.

Photo 92. View of wetland test pit (WTP-17): Matrix – 2.5Y 6/2 with 7.5YR 5/6 redox concentrations.

Photo 93. View of upland test pit (UTP-17): Matrix – 7.5YR 4/6 (100%).

Photo 94. View of WTL-17 looking north.

Photo 95. View of EPH-15 headcut at the confluence with INT-20.

Photo 96. View of INT-17 looking upstream.

Photo 97. View of INT-19 looking downstream.

Photo 98. View of INT-19 looking downstream.

Photo 99. View of INT-20 looking upstream.

Photo 100. View of EPH-20b looking up-gradient.

Photo 101. View of EPH-20a looking up-gradient.

Photo 102. View of WTL-18 looking northeast.

Photo 103. View of wetland test pit (WTP-18): Matrix – 2.5Y 6/2 with 7.5YR 4/6 redox concentrations.

Photo 104. View of upland test pit (UTP-18): Matrix (3-12") – 7.5YR 4/4 (100%).

Photo 105. View of INT-21 looking upstream.

Photo 106. View of INT-22 looking downstream.

Photo 107. View of INT-23 looking downstream.

Photo 108. View of INT-24 looking upstream at the culvert outlet under Sain Rd.

Photo 109. View of INT-24 looking downstream.

Photo 110. View of WTL-19 looking east.

Photo 111. View of WTL-19 looking northeast.

Photo 112. View of INT-20 draining through the middle of WTL-19.

Photo 113. View of EPH-25 looking up-gradient at the beginning of the channel.

Photo 114. View of WTL-20 and where INT-25 begins looking upstream.

Photo 115. View of WTL-20 and INT-25 looking up-gradient.

Photo 116. View of INT-26 looking upstream where the channel begins.

Photo 117. View of INT-26 looking downstream.

Photo 118. View of EPH-27 looking up-gradient.

Photo 119. View of INT-27 looking downstream.

Photo 120. View of INT-27 looking downstream, standing at a new gravel road impoundment.

Photo 121. View of wetland test pit (WTP-21): Matrix – 2.5Y 5/2 with 7/5YR 4/6 redox concentrations.

Photo 122. View of upland test pit (UTP-21): Matrix – 2.5Y 6/4 (100%).

Photo 123. View of WTL-21 looking north.

Photo 124. View of WTL-22 looking south.

Photo 125. View of WTL-22 looking northeast.

Photo 126. View of wetland test pit (WTP-23): Matrix – 2.5Y 5/2 with 7.5YR 4/6 redox concentrations.

Photo 127. View of WTL-23 looking west.

Photo 128. View of WTL-23 looking northeast.

Photo 129. View of INT-28 looking downstream.

Photo 130. View of INT-28 looking upstream.

Photo 131. View of INT-28 looking upstream at the beginning of the channel.

Photo 132. View of EPH-28 looking up-gradient at the beginning of the channel.

Photo 133. View of EPH-29 looking up-gradient at the beginning of the channel.

Photo 134. View of EPH-31 looking down-gradient.

Photo 135. View of EPH-33 looking up-gradient at the beginning of the channel.

Photo 136. View of EPH-33 looking down-gradient.

Photo 137. View of EPH-34 looking up-gradient at the beginning of the channel.

Photo 138. View of INT-33 looking upstream where the channel transitions from ephemeral to intermittent.

Photo 139. View of INT-33 looking downstream where the channel fans out into WTL-23.

Photo 140. View of EPH-35 looking up-gradient at the beginning of the channel.

Photo 141. View of INT-28 looking downstream towards the culvert under Lake Hardeman Rd.

Photo 142. View of EPH-36 looking down-gradient.

Photo 143. View of WTL-24 looking south.

Photo 144. Alternate view of WTL-24 looking east.

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-1
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13386827; -88.95493068; End: 35.13428373; -88.95486674
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		

Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown

Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa

Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luverne and Smithdale Soils		
Surrounding Land Use : Pasture/Forested		

Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) :

Severe Moderate **Slight** Absent

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 15

Justification / Notes :

Secondary Field Indicator Evaluation Project ID: EPH-1

A. **Geomorphology** (Subtotal =)	7	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1.5	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	0	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. **Hydrology** (Subtotal =)	5	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. **Biology** (Subtotal =)	3	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 15

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-1
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13427401; -88.95484446; End: 35.138511; -88.9560891
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown		
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 25 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Tippak-Luverne Complex/Chenneby Silt Loam/Luverne and Smithdale Soils		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A		WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed		Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 25

Justification / Notes :

Secondary Field Indicator Evaluation   Project ID: INT-1

A. Geomorphology (Subtotal =) 11.5		**Absent**	**Weak**	**Moderate**	**Strong**
1. Continuous bed and bank	1.5	0	1	2	3
2. Sinuous channel	1	0	1	2	3
3. In-channel structure: riffle-pool sequences	1.5	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1.5	0	1	2	3
7. Braided channel	1.5	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 8.5		**Absent**	**Weak**	**Moderate**	**Strong**
14. Subsurface flow/discharge into channel	2	0	1	2	3
15. Water in channel and >48 hours since sig. rain	2	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	1	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	1	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 5		**Absent**	**Weak**	**Moderate**	**Strong**
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	1.5	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0.5	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 25

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-2
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13660071; -88.95607464; End: 35.13693584; -88.95656688
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Tippak-Luverne Complex		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 17.5

Justification / Notes :

Secondary Field Indicator Evaluation Project ID: EPH-2

A. Geomorphology (Subtotal =) 7.5		**Absent**	**Weak**	**Moderate**	**Strong**
1. Continuous bed and bank	1.5	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1.5	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	0	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 6.5		**Absent**	**Weak**	**Moderate**	**Strong**
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	2	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 3.5		**Absent**	**Weak**	**Moderate**	**Strong**
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1.5	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	1	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 17.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-3
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13169972; -88.95621136; End: 35.13214577; -88.95775344
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luverne and Smithdale Sandy Loams		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 12

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: EPH-3

A. Geomorphology (Subtotal =) 5.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	0.5	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	0	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 4.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 2		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 12

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet
Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-3
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13214577; -88.95775344; End: 35.13831193; -88.95876154
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : ~ 45 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Chenneby Silt Loam/Luverne and Smithdale Soils		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : **Severe** Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 22

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: INT-3

A. Geomorphology (Subtotal =) 11.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	2	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	2	0	1	2	3
5. Active/relic floodplain	1	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	2	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 6.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	2	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 4		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	1	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 22

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-4
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13230821; -88.95439816; End: 35.13308049; -88.95532849
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luverne and Smithdale Sandy Loams		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe **Moderate** Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 14

Justification / Notes :

Secondary Field Indicator Evaluation Project ID: EPH-4

A. Geomorphology (Subtotal =) 7.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1	0	1	2	3
2. Sinuous channel	1	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 4.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 2		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 14

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-4
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13308049; -88.95532849; End: 35.13438217; -88.9581885
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown		
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luverne and Smithdale Soils/Luverne and Smithdale Sandy Loams		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 21.5

Justification / Notes :

Secondary Field Indicator Evaluation   Project ID: INT-4

A. **Geomorphology** (Subtotal =) 11		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	2	0	1	2	3
2. Sinuous channel	1	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	1	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	1	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. **Hydrology** (Subtotal =) 6.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1.5	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	1	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. **Biology** (Subtotal =) 4		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	1	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 21.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-5
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13269147; -88.95606; End: 35.13354301; -88.95782559
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luverne and Smithdale Soils		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 14

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: EPH-5

A. **Geomorphology** (Subtotal =) 7.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1	0	1	2	3
2. Sinuous channel	1	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. **Hydrology** (Subtotal =) 4.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. **Biology** (Subtotal =) 2		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 14

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: PER-6
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13627023; -88.96928114; End: 35.13749901; -88.96412349
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00 in previous 48 hrs.		

Precipitation this Season vs. Normal : very wet wet average dry drought unknown
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa

Watershed Size : Approximately 180 acres	Photos: Yes	Number :

Soil Type(s) / Geology : Providence Silty Clay Loam/Chenneby Silt Loam

Surrounding Land Use : Forested/Pasture

Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) :
Severe Moderate Slight Absent

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase		Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 0

Justification / Notes : No secondary indicator score needed.

Stream has been channelized.

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-7
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13795637; -88.96860618; End: 35.13727897; -88.96767414
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Chenneby Silt Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : **Severe** Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed		Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 24

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: INT-7

A. Geomorphology (Subtotal =) 9.5		**Absent**	**Weak**	**Moderate**	**Strong**
1. Continuous bed and bank	2	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1.5	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	1	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	0.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 7.5		**Absent**	**Weak**	**Moderate**	**Strong**
14. Subsurface flow/discharge into channel	2	0	1	2	3
15. Water in channel and >48 hours since sig. rain	2	0	1	2	3
16. Leaf litter in channel (January – September)	1.5	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 7		**Absent**	**Weak**	**Moderate**	**Strong**
20. Fibrous roots in channel [1]	2	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	1	0	1	2	3
27. Iron oxidizing bacteria/fungus	1	0	0.5	1	1.5
28.Wetland plants in channel [2]	1	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 24

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-8
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.14003578; -88.96754908; End: 35.14006301; -88.96730908
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luka Silt Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed		Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 25

Justification / Notes :

Secondary Field Indicator Evaluation   Project ID: INT-8

A. Geomorphology (Subtotal =) 9		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	2	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	2	0	1	2	3
4. Sorting of soil textures or other substrate	2	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	0	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	0.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 7.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	2	0	1	2	3
15. Water in channel and >48 hours since sig. rain	2	0	1	2	3
16. Leaf litter in channel (January – September)	1.5	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 8.5		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	2	3	2	1	0
21. Rooted plants in channel [1]	3	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	1	0	1	2	3
26. Filamentous algae; periphyton	1	0	1	2	3
27. Iron oxidizing bacteria/fungus	1.5	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 25

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-9
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.1408557; -88.96651416; End: 35.14039172; -88.96666081
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown		
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luka Silt Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 13.5

Justification / Notes :

Secondary Field Indicator Evaluation Project ID: EPH-9

A. **Geomorphology** (Subtotal =)	4	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	0	0	1	2	3
4. Sorting of soil textures or other substrate	0	0	1	2	3
5. Active/relic floodplain	1	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	0	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	0.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. **Hydrology** (Subtotal =)	6.5	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1.5	1.5	1	0.5	0
17. Sediment on plants or on debris	1	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. **Biology** (Subtotal =)	3	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	1	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 13.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet
Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-10
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.14171752; -88.96758355; End: 35.14043377; -88.96667633
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		

Precipitation this Season vs. Normal : very wet wet average dry drought unknown
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa

Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luka Silt Loam		
Surrounding Land Use : Pasture/Forested		

Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) :
Severe Moderate Slight Absent

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 13.5

Justification / Notes :

Secondary Field Indicator Evaluation   Project ID: EPH-10

A. Geomorphology (Subtotal =) 4		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	0	0	1	2	3
4. Sorting of soil textures or other substrate	0	0	1	2	3
5. Active/relic floodplain	1	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	0	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	0.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 6.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1.5	1.5	1	0.5	0
17. Sediment on plants or on debris	1	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 3		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	1	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 13.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-10
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.14043377; -88.96667633; End: 35.13970984; -88.96672839
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luka Silt Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 22

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: INT-10

A. Geomorphology (Subtotal =) 8		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	2	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	1	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	0.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 7		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	2	0	1	2	3
16. Leaf litter in channel (January – September)	1.5	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 7		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	2	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	2	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 22

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: PER-11 Cub Creek
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13488669; -88.96185325; End: 35.13948238; -88.95534218
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00 in previous 48 hrs.		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : Approximately 1,600 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Chenneby Silt Loam/Luka Silt Loam		
Surrounding Land Use : Forested/Pasture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase		Stream
6. Presence of fish (except *Gambusia*)		Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 0

Justification / Notes : No secondary indicator score needed.

Stream has been channelized and impounded.

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-12
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13845001; -88.9728213; End: 35.13868342; -88.97319619
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown		
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 15

Justification / Notes :

Secondary Field Indicator Evaluation   Project ID: EPH-12

A. **Geomorphology** (Subtotal =) 7		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1.5	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	0	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. **Hydrology** (Subtotal =) 5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. **Biology** (Subtotal =) 3		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 15

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-13
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13804365; -88.97366063; End: 35.13975921; -88.97262612
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate **Slight** Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 15

Justification / Notes :

Secondary Field Indicator Evaluation   Project ID: EPH-13

A. Geomorphology (Subtotal = 7)		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1.5	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	0	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal = 5)		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal = 3)		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 15

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-13
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13975921; -88.97262612; End: 35.14184107; -88.96991613
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : ~ 26 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 22.5

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: INT-13

A. Geomorphology (Subtotal =) 10.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	3	0	1	2	3
2. Sinuous channel	1	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1.5	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 7		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	2	0	1	2	3
16. Leaf litter in channel (January – September)	1.5	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 5		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	2	3	2	1	0
21. Rooted plants in channel [1]	3	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 22.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-14 u/g
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13852895; -88.9743176; End: 35.13919089; -88.97398622
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 15

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: EPH-14 u/g

A. Geomorphology (Subtotal =) 7		**Absent**	**Weak**	**Moderate**	**Strong**
1. Continuous bed and bank	1.5	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	0	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 5		**Absent**	**Weak**	**Moderate**	**Strong**
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 3		**Absent**	**Weak**	**Moderate**	**Strong**
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 15

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-14
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13919089; -88.97398622; End: 35.14063653; -88.97383158
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : ~ 40 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : **Severe** Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 23

Justification / Notes :

Secondary Field Indicator Evaluation   Project ID: INT-14

A. **Geomorphology** (Subtotal =) 12.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	2	0	1	2	3
2. Sinuous channel	1	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	2	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	2	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	2	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. **Hydrology** (Subtotal =) 6.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	2	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. **Biology** (Subtotal =) 4		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	1	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 23

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-14 d/g
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.14063653; -88.97383158; End: 35.14120287; -88.97331746
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 18

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: EPH-14 d/g

A. Geomorphology (Subtotal =) 10		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	2	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	2	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 3		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 18

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-15 u/g
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.1386244; -88.97597047; End: 35.13873562; -88.97575471
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 12

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: EPH-15 u/g

A. Geomorphology (Subtotal =) 4		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1.5	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	0	0	1	2	3
4. Sorting of soil textures or other substrate	0	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	0	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 4		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	0	1	2	3
15. Water in channel and >48 hours since sig. rain	0	0	1	2	3
16. Leaf litter in channel (January – September)	1.5	1.5	1	0.5	0
17. Sediment on plants or on debris	0	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	1	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 4		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	2	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 12

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet
Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-15
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13873562; -88.97575471; End: 35.14080696; -88.97536194
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 40 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 27

Justification / Notes :

Secondary Field Indicator Evaluation   Project ID: INT-15

A. **Geomorphology** (Subtotal =) 14		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	3	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	2	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	3	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	2	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. **Hydrology** (Subtotal =) 8		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	2	0	1	2	3
16. Leaf litter in channel (January – September)	1.5	1.5	1	0.5	0
17. Sediment on plants or on debris	1	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	1	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. **Biology** (Subtotal =) 5		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	2	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	1	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 27

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-15 d/g
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.14080696; -88.97536194; End: 35.14235063; -88.9749129
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 40 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : **Severe** Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 18

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: EPH-15 d/g

A. Geomorphology (Subtotal =) 10		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	2	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	2	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 3		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 18

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/27/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: PER-16
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.143969; -88.971961; End: 35.137904; -88.960001
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00 in previous 48 hrs.		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown		
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : Approximately 1,000 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Enville Silt Loam/Luka Silt Loam		
Surrounding Land Use : Forested/Pasture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase		Stream
6. Presence of fish (except *Gambusia*)		Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 0

Justification / Notes : No secondary indicator score needed.

Stream has been channelized.

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-17
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.14229775; -88.97605992; End: 35.14222299; -88.97588343
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 21

Justification / Notes :

Secondary Field Indicator Evaluation Project ID: INT-17

A. Geomorphology (Subtotal =) 9.5		**Absent**	**Weak**	**Moderate**	**Strong**
1. Continuous bed and bank	2	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	1	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1.5	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	0.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 6.5		**Absent**	**Weak**	**Moderate**	**Strong**
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1.5	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	1	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 5		**Absent**	**Weak**	**Moderate**	**Strong**
20. Fibrous roots in channel [1]	2	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	1	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 21

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-18
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.14094175; -88.97696578; End: 35.14171312; -88.97642634
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		

Precipitation this Season vs. Normal : very wet wet average dry drought unknown
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa

Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Enville Silt Loam		
Surrounding Land Use : Pasture/Forested		

Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) :
Severe Moderate Slight Absent

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 27

Justification / Notes :

Secondary Field Indicator Evaluation   Project ID: INT-18

A. **Geomorphology** (Subtotal =) 13		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	3	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	2	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	2	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	2	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. **Hydrology** (Subtotal =) 9		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	2	0	1	2	3
15. Water in channel and >48 hours since sig. rain	2	0	1	2	3
16. Leaf litter in channel (January – September)	1.5	1.5	1	0.5	0
17. Sediment on plants or on debris	1	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	1	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. **Biology** (Subtotal =) 5		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	2	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	1	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 27

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-19
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.14200376; -88.97690091; End: 35.14167392; -88.97651507
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown		
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Enville Silt Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe **Moderate** Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 22

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: INT-19

A. Geomorphology (Subtotal = 9.5)		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	2	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1.5	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1.5	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal = 7.5)		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	2	0	1	2	3
16. Leaf litter in channel (January – September)	1.5	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	1	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal = 5)		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	2	3	2	1	0
21. Rooted plants in channel [1]	2	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	1	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 22

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-20a
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13614176; -88.98047677; End: 35.13683739; -88.98072118
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		

Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown

Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa

Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Pasture/Forested		

Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) :
Severe Moderate **Slight** Absent

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 14

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: EPH-20a

A. **Geomorphology** (Subtotal =) 7.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. **Hydrology** (Subtotal =) 4.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. **Biology** (Subtotal =) 2		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 14

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-20b
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13615641; -88.98073; End: 35.13644098; -88.98067321
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown		
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 14

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: EPH-20b

A. Geomorphology (Subtotal =) 7.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 4.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 2		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 14

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-20
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.136837; -88.980721; End: 35.143185; -88.971547
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00 in previous 48 hrs.		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : ~190 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam/Enville Silt Loam		
Surrounding Land Use : Forested/Pasture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe **Moderate** Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection		**Stream**
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 0

Justification / Notes : No secondary indicator score needed.

Hydrologic Determination Field Data Sheet
Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-21
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13705975; -88.98115129; End: 35.13707085; -88.98092431
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00 in previous 48 hrs.		

Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa

Watershed Size : < 20 acres	Photos: Yes	Number :

Soil Type(s) / Geology : Smithdale Loam

Surrounding Land Use : Forested/Pasture

Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) :
Severe Moderate **Slight** Absent

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection		**Stream**
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 0

Justification / Notes : No secondary indicator score needed.

Hydrologic Determination Field Data Sheet
Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-22
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13727975; -88.98099813; End: 35.13770411; -88.98093973
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00 in previous 48 hrs.		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown		
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Forested/Pasture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 0

Justification / Notes : No secondary indicator score needed.

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-23
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13797084; -88.98074238; End: 35.13814728; -88.98083381
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00 in previous 48 hrs.		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Forested/Pasture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 0

Justification / Notes : No secondary indicator score needed.

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-24
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13893009; -88.98084004; End: 35.13931161; -88.98021918
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00 in previous 48 hrs.		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : ~ 80 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Forested/Pasture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe **Moderate** Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection		**Stream**
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 0

Justification / Notes : No secondary indicator score needed.

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-25
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.1376417; -88.97784401; End: 35.13860157; -88.97812756
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 14

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: EPH-25

A. Geomorphology (Subtotal = 7.5)		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal = 4.5)		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal = 2)		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 14

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-25
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13860157; -88.97812756; End: 35.14220069; -88.97558911
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00 in previous 48 hrs.		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : ~ 80 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam/Enville Loam		
Surrounding Land Use : Forested/Pasture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 0

Justification / Notes : No secondary indicator score needed.

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-26
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13106201; -88.97782738; End: 35.12873613; -88.97216338
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00 in previous 48 hrs.		

Precipitation this Season vs. Normal : very wet wet average dry drought unknown

Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa

Watershed Size : ~ 30 acres	Photos: Yes	Number :

Soil Type(s) / Geology : Smithdale Loam/Luka Silt Loam

Surrounding Land Use : Forested/Pasture

Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) :
Severe Moderate Slight Absent

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 0

Justification / Notes : No secondary indicator score needed.

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-27
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13158464; -88.97781038; End: 35.13175992; -88.97722992
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown		
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 17.5

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: EPH-27

A. **Geomorphology** (Subtotal =) 7.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1.5	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1.5	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	0	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. **Hydrology** (Subtotal =) 6.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	2	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. **Biology** (Subtotal =) 3.5		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1.5	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	1	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28. Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 17.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 2/28/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-27
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13175992; -88.97722992; End: 35.13166048; -88.97631876
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00 in previous 48 hrs.		

Precipitation this Season vs. Normal : very wet wet average dry drought unknown
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa

Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Smithdale Loam		
Surrounding Land Use : Forested/Pasture		

Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) :
Severe Moderate Slight Absent

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 0

Justification / Notes : No secondary indicator score needed.

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 3/1/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-28
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13353968; -88.95353197; End: 35.13538396; -88.95339642
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luverne and Smithdale Sandy loams		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 17.5

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: EPH-28

A. Geomorphology (Subtotal =) 7.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1.5	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1.5	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	0	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 6.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	2	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 3.5		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1.5	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	1	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 17.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet
Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 3/1/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-28
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13538396; -88.95339642; End: 35.13963711; -88.95331916
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00 in previous 48 hrs.		

Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa

Watershed Size : ~ 45 acres	Photos: Yes	Number :

Soil Type(s) / Geology : Luverne and Smithdale Soils/Luverne and Smithdale Sandy Loams

Surrounding Land Use : Forested/Pasture

Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) :
Severe Moderate **Slight** Absent

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection		**Stream**
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 0

Justification / Notes : No secondary indicator score needed.

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 3/1/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-29
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13385702; -88.95387025; End: 35.13420608; -88.95369458
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown		
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luverne and Smithdale Sandy Loams		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 14

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: EPH-29

A. Geomorphology (Subtotal =) 7.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 4.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 2		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 14

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 3/1/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-30
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13499285; -88.95285646; End: 35.13549368; -88.95325878
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luverne and Smithdale Sandy loams		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate **Slight** Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 17.5

Justification / Notes :

Secondary Field Indicator Evaluation   Project ID: EPH-30

A. **Geomorphology** (Subtotal =)	7.5	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1.5	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1.5	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	0	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. **Hydrology** (Subtotal =)	6.5	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	2	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. **Biology** (Subtotal =)	3.5	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1.5	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	1	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 17.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet
Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 3/1/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-31
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13577578; -88.95228839; End: 35.13585663; -88.95318935
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luverne and Smithdale Sandy Loams		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 14

Justification / Notes :

Secondary Field Indicator Evaluation   Project ID: EPH-31

A. Geomorphology (Subtotal = 7.5)		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal = 4.5)		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal = 2)		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 14

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 3/1/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-32
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13712243; -88.95342912; End: 35.13731682; -88.95346802
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luverne and Smithdale Soils		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate **Slight** Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 14

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: EPH-32

A. Geomorphology (Subtotal = 7.5)		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal = 4.5)		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal = 2)		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 14

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 3/1/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-33
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13623876; -88.95403175; End: 35.13722165; -88.95409774
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luverne and Smithdale Soils		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate **Slight** Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 14

Justification / Notes :

Secondary Field Indicator Evaluation Project ID: EPH-33

A. **Geomorphology** (Subtotal =) 7.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. **Hydrology** (Subtotal =) 4.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. **Biology** (Subtotal =) 2		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 14

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet
Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 3/1/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-33
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13722165; -88.95409774; End: 35.13788242; -88.95397516
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00 in previous 48 hrs.		

Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa

Watershed Size : < 20 acres	Photos: Yes	Number :

Soil Type(s) / Geology : Luverne and Smithdale Soils

Surrounding Land Use : Forested/Pasture

Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) :
Severe Moderate **Slight** Absent

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection		**Stream**
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 0

Justification / Notes : No secondary indicator score needed.

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 3/1/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-34
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13673793; -88.95433123; End: 35.13692681; -88.95410754
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown		
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luverne and Smithdale Sandy loams		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate **Slight** Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 17.5

Justification / Notes :

Secondary Field Indicator Evaluation   Project ID: EPH-34

A. **Geomorphology** (Subtotal =) 7.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1.5	0	1	2	3
2. Sinuous channel	0.5	0	1	2	3
3. In-channel structure: riffle-pool sequences	1.5	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	0	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	0.5	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0.5	0	0.5	1	1.5
12. Natural valley or drainageway	1	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. **Hydrology** (Subtotal =) 6.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	1	0	1	2	3
15. Water in channel and >48 hours since sig. rain	2	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. **Biology** (Subtotal =) 3.5		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1.5	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	1	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points =	17.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 3/1/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-35
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13739479; -88.95434236; End: 35.13746017; -88.95412594
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Luverne and Smithdale Soils		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate **Slight** Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 14

Justification / Notes :

Secondary Field Indicator Evaluation   Project ID: EPH-35

A. **Geomorphology** (Subtotal =) 7.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. **Hydrology** (Subtotal =) 4.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. **Biology** (Subtotal =) 2		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28. Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 14

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet
Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 3/1/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-36
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.139283; -88.95194397; End: 35.13912577; -88.95245398
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown		
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Wilcox Silty Clay/Chenneby Silt Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe **Moderate** Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 14

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: EPH-36

A. Geomorphology (Subtotal =) 7.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. Hydrology (Subtotal =) 4.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. Biology (Subtotal =) 2		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 14

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 3/1/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: EPH-37
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13932541; -88.95128781; End: 35.13952878; -88.95190414
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00" in previous 48hrs		
Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown		
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Wilcox Silty Clay/Chenneby Silt Loam		
Surrounding Land Use : Pasture/Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe **Moderate** Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 14

Justification / Notes :

Secondary Field Indicator Evaluation

Project ID: EPH-37

A. **Geomorphology** (Subtotal =) 7.5		Absent	Weak	Moderate	Strong
1. Continuous bed and bank	1	0	1	2	3
2. Sinuous channel	0	0	1	2	3
3. In-channel structure: riffle-pool sequences	1	0	1	2	3
4. Sorting of soil textures or other substrate	1	0	1	2	3
5. Active/relic floodplain	0	0	1	2	3
6. Depositional bars or benches	1	0	1	2	3
7. Braided channel	0	0	1	2	3
8. Recent alluvial deposits	1	0	0.5	1	1.5
9. Natural levees	0	0	1	2	3
10. Headcuts	1	0	1	2	3
11. Grade controls	0	0	0.5	1	1.5
12. Natural valley or drainageway	1.5	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map		No = 0			

B. **Hydrology** (Subtotal =) 4.5		Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	0	1	2	3
15. Water in channel and >48 hours since sig. rain	1	0	1	2	3
16. Leaf litter in channel (January – September)	1	1.5	1	0.5	0
17. Sediment on plants or on debris	0.5	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0.5	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel		Yes = 1.5			

C. **Biology** (Subtotal =) 2		Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	1	3	2	1	0
21. Rooted plants in channel [1]	1	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0	0.5	1	1.5
23. Bivalves/mussels	0	0	1	2	3
24. Amphibians	0	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	0	1	2	3
26. Filamentous algae; periphyton	0	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0	0.5	1	1.5
28.Wetland plants in channel [2]	0	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 14

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 3/1/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-38
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13386849; -88.97286626; End: 35.13670276; -88.96706827
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00 in previous 48 hrs.		

Precipitation this Season vs. Normal : very wet **wet** average dry drought unknown
Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa

Watershed Size : ~ 130 acres	Photos: Yes	Number :

Soil Type(s) / Geology : Providence Silty Clay Loam/Chenneby Silt Loam

Surrounding Land Use : Forested/Pasture

Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) :
Severe Moderate Slight Absent

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection		**Stream**
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 0

Justification / Notes : No secondary indicator score needed.

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Hardeman	Named Waterbody: N/A	Date/Time: 3/1/19
Assessors/Affiliation: G. Babbit/C. Hertwig; CEC, Inc.		Project ID: INT-39
Site Name/Description: Lone Oaks Farm		
Site Location: Middleton, TN		
USGS quad: Hebron	HUC (12 digit): 080102080202 - Cub Creek	Lat/Long: Begin: 35.13576665; -88.9684114; End: 35.13604115; -88.96811947
Previous Rainfall (7-days) : 5.57" in previous 7 days; 0.00 in previous 48 hrs.		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : https://www.cocorahs.org/Maps/ViewMap.aspx?state=usa		
Watershed Size : < 20 acres	Photos: Yes	Number :
Soil Type(s) / Geology : Chenneby Silt Loam		
Surrounding Land Use : Forested/Pasture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 0

Justification / Notes : No secondary indicator score needed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/27/19

Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-1

Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR P Lat: 35.134916 Long: -88.955406 Datum: NAD83

Soil Map Unit Name: Luverne and Smithdale Soils NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑	No ☐
Hydric Soil Present?	Yes ☑	No ☐
Wetland Hydrology Present?	Yes ☑	No ☐

Is the Sampled Area within a Wetland? **Yes** ☑ **No** ☐

Remarks:

Size: 0.21 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☑ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☑ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		x	
Water Table Present?		x	
Saturation Present? (includes capillary fringe)	x		4-6

Wetland Hydrology Present? **Yes** ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: WTL-1

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	40	Y	FACW
2. *Carpinus caroliniana*	10		FAC
3. *Liquidambar styraciflua*	30	Y	FAC
4.			
5.			
6.			
	80 = Total Cover		
50% of total cover: 40	20% of total cover: 16		

Sapling Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
6.			
	____ = Total Cover		
50% of total cover: ____	20% of total cover: ____		

Shrub Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
6.			
	____ = Total Cover		
50% of total cover: ____	20% of total cover: ____		

Herb Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	____ = Total Cover		
50% of total cover: ____	20% of total cover: ____		

Woody Vine Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
50% of total cover: ____	20% of total cover: ____		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 67% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	40	x 3 =	120
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	80 (A)		200 (B)

Prevalence Index = B/A = 2.5

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6"	2.5Y 5/2	80	7.5YR 5/8	20	C	M		silty clay loam
6-12"	2.5Y 6/2	80	7.5YR 5/8	20	C	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] 2 cm Muck (A10) **(LRR N)**
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7)
- [ ] Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- [ ] Thin Dark Surface (S9) **(MLRA 147, 148)**
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- [ ] Umbric Surface (F13) **(MLRA 136, 122)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 148)**
- [ ] Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- [ ] 2 cm Muck (A10) **(MLRA 147)**
- [ ] Coast Prairie Redox (A16) **(MLRA 147, 148)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____

Depth (inches): ____

Hydric Soil Present? **Yes** ✓ **No** ____

Remarks:
UPL-1 = 2.5Y 5/3
Cedar, hickory, white oak

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/27/19
Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-2
Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2
Subregion (LRR or MLRA): LRR P Lat: 35.135601 Long: -89.956581 Datum: NAD83
Soil Map Unit Name: Tippak-Luverne Complex NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	**Is the Sampled Area within a Wetland?** **Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐	
Wetland Hydrology Present?	Yes ☑ No ☐	

Remarks:
Size: 0.12 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☑ Water Marks (B1)
- ☑ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☑ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☑ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches): ____
Water Table Present?	Yes x	No ____	Depth (inches): 0-6
Saturation Present? (includes capillary fringe)	Yes x	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: WTL-2

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Sapling Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Liquidambar styraciflua*	10	Y	FAC
2.			
3.			
4.			
5.			
6.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Ludwigia alternifolia*	15	Y	OBL
2. *Panicum dichotomiflorum*	20	Y	FACW
3. *Carex sp.*	25	Y	FACW
4. *Cyperus strigosus*	15	Y	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	75 = Total Cover		
50% of total cover: 37.5	20% of total cover: 15		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	15	x 1 = 15
FACW species	60	x 2 = 120
FAC species	10	x 3 = 30
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	85 (A)	165 (B)

Prevalence Index = B/A = 1.94

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: WTL-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 6/2	80	7.5YR 5/8	20	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ☑ No ☐

Remarks: UPL-2 = (0-4") 10YR 5/3 and (4-12") - 10YR 6/3

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/27/19

Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-3

Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR P Lat: 35.137502 Long: -88.95801 Datum: NAD83

Soil Map Unit Name: Chenneby Silt Loam NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑	No ☐
Hydric Soil Present?	Yes ☑	No ☐
Wetland Hydrology Present?	Yes ☑	No ☐

Is the Sampled Area within a Wetland? **Yes** ☑ **No** ☐

Remarks:

Size: 0.46 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☑ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___
Water Table Present?	Yes ___	No x	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0

Wetland Hydrology Present? **Yes** ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: WTL-3

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Sapling Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Juncus effusus*	15		FACW
2. *Panicum dichotomiflorum*	25	Y	FACW
3. *Andropogon virginicus*	40	Y	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80 = Total Cover		
50% of total cover:	40	20% of total cover:	16

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:
OBL species	0	x 1 = 0
FACW species	40	x 2 = 80
FAC species	40	x 3 = 120
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	80 (A)	200 (B)

Prevalence Index = B/A = 2.5

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ☑ **No** ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 6/1	95	7.5YR 5/8	5	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:
UPL-3 = 2.5Y 5/2 with 7.5YR 5/8 redox concentrations.
Vegetation outside the wetland boundary is primarily planted winter rye/fescue

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/27/19
Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-4
Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): Concave Slope (%): 0-2
Subregion (LRR or MLRA): LRR P Lat: 35.134368 Long: -88.957522 Datum: NAD83
Soil Map Unit Name: Luverne and Smithdale Soils NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	**Is the Sampled Area within a Wetland?** **Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐	
Wetland Hydrology Present?	Yes ☑ No ☐	

Remarks:
Size: 0.20 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☑ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___
Water Table Present?	Yes ___	No x	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: WTL-4

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Sapling Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Juncus effusus*	20	Y	FACW
2. *Panicum dichotomiflorum*	40	Y	FACW
3. *Rhexia virginica*	20	Y	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80 = Total Cover		
50% of total cover:	40	20% of total cover:	16

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	80	x 2 = 160
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	80 (A)	160 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6"	2.5Y 6/1	80	7.5YR 4/6	10	C	M		silty clay loam
			7.5YR 6/8	10				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:
UPL-4 = 2.5Y 5/3 with faint 7.5YR 4/6 redox concentrations.
broomsedge and loblolly saplings

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/27/19
Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-5
Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): Concave Slope (%): 0-2
Subregion (LRR or MLRA): LRR P Lat: 35.133366 Long: -88.957865 Datum: NAD83
Soil Map Unit Name: Luverne and Smithdale Soils NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes [ ] No [✓] (If no, explain in Remarks.)
Are Vegetation [ ], Soil [ ], or Hydrology [ ] significantly disturbed? Are "Normal Circumstances" present? Yes [✓] No [ ]
Are Vegetation [ ], Soil [ ], or Hydrology [ ] naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes [✓] No [ ]	**Is the Sampled Area within a Wetland?**	**Yes** [✓] **No** [ ]
Hydric Soil Present?	Yes [✓] No [ ]		
Wetland Hydrology Present?	Yes [✓] No [ ]		

Remarks:
Size: 0.52 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [ ] Surface Water (A1)
- [✓] High Water Table (A2)
- [✓] Saturation (A3)
- [ ] Water Marks (B1)
- [✓] Sediment Deposits (B2)
- [✓] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [✓] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] True Aquatic Plants (B14)
- [ ] Hydrogen Sulfide Odor (C1)
- [✓] Oxidized Rhizospheres on Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [✓] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [✓] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Stunted or Stressed Plants (D1)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] Microtopographic Relief (D4)
- [ ] FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___
Water Table Present?	Yes x	No ___	Depth (inches): 0-6
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes [✓] **No** [ ]

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: WTL-5

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Sapling Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size:)			
1. *Juncus effusus*	20	Y	FACW
2. *Carex sp.*	20	Y	FACW
3. *Rhexia virginica*	20	Y	FACW
4. *Boehmeria cylindrica*	20	Y	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80 = Total Cover		
50% of total cover: 40	20% of total cover: 16		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	80	x 2 = 160
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	80 (A)	160 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

- [x] 1 - Rapid Test for Hydrophytic Vegetation
- [x] 2 - Dominance Test is >50%
- [x] 3 - Prevalence Index is ≤3.0[1]
- [ ] 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6"	2.5Y 6/1	80	7.5YR 5/8	10	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ☑ No ☐

Remarks:
UPL-5 = 10YR 4/3.
broomsedge and fescue

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/27/19

Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-6

Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR P Lat: 35.135991 Long: -88.964997 Datum: NAD83

Soil Map Unit Name: Chenneby Silt Loam NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	**Is the Sampled Area within a Wetland?** **Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐	
Wetland Hydrology Present?	Yes ☑ No ☐	

Remarks:

Size: 3.48 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☑ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		x	
Water Table Present?	x		0-6
Saturation Present? (includes capillary fringe)	x		0

Wetland Hydrology Present? **Yes** ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: WTL-6

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Sapling Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Juncus effusus*	40	Y	FACW
2. *Carex sp.*	30	Y	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	70 = Total Cover		
50% of total cover: 35		20% of total cover: 14	

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	70	x 2 = 140
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	70 (A)	140 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 5/1	80	7.5YR 5/6	20	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:
UPL-6 = 2.5Y 5/2 with faint mottles.
Vegetation is dominated by fescue. This area is mowed repeatedly during the growing season.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/27/19
Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-7
Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2
Subregion (LRR or MLRA): LRR P Lat: 35.135805 Long: -88.962677 Datum: NAD83
Soil Map Unit Name: Chenneby Silt Loam NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes [ ] No [✓] (If no, explain in Remarks.)
Are Vegetation [ ], Soil [ ], or Hydrology [ ] significantly disturbed? Are "Normal Circumstances" present? Yes [✓] No [ ]
Are Vegetation [ ], Soil [ ], or Hydrology [ ] naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes [✓] No [ ]	**Is the Sampled Area within a Wetland?** **Yes** [✓] **No** [ ]
Hydric Soil Present?	Yes [✓] No [ ]	
Wetland Hydrology Present?	Yes [✓] No [ ]	

Remarks:
Size: 1.08 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [ ] Surface Water (A1)
- [✓] High Water Table (A2)
- [✓] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [✓] Drift Deposits (B3)
- [✓] Algal Mat or Crust (B4)
- [✓] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] True Aquatic Plants (B14)
- [ ] Hydrogen Sulfide Odor (C1)
- [✓] Oxidized Rhizospheres on Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [✓] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [✓] Crayfish Burrows (C8)
- [✓] Saturation Visible on Aerial Imagery (C9)
- [ ] Stunted or Stressed Plants (D1)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] Microtopographic Relief (D4)
- [ ] FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___
Water Table Present?	Yes x	No ___	Depth (inches): 0-6
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0

Wetland Hydrology Present? **Yes** [✓] **No** [ ]

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: WTL-7

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Sapling Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Shrub Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Herb Stratum (Plot size: ______)			
1. *Juncus effusus*	40	Y	FACW
2. *Carex sp.*	30	Y	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	70 = Total Cover		
50% of total cover: 35		20% of total cover: 14	

Woody Vine Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	70	x 2 = 140
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	70 (A)	140 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

- [x] 1 - Rapid Test for Hydrophytic Vegetation
- [x] 2 - Dominance Test is >50%
- [x] 3 - Prevalence Index is ≤3.0[1]
- [ ] 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 5/1	80	7.5YR 5/6	20	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: __________

Depth (inches): __________

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:
UPL-7 = 10YR 4/4 no mottles.
Vegetation is dominated by fescue and bermuda grass. This area is mowed repeatedly during the growing season.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/27/19
Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-8
Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2
Subregion (LRR or MLRA): LRR P Lat: 35.134914 Long: -88.96048 Datum: NAD83
Soil Map Unit Name: Tippak-Luverne Complex NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	**Is the Sampled Area within a Wetland?** **Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐	
Wetland Hydrology Present?	Yes ☑ No ☐	

Remarks:
Size: 0.03 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☑ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☑ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___
Water Table Present?	Yes x	No ___	Depth (inches): 0-6
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: WTL-8

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Sapling Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Juncus effusus*	40	Y	FACW
2. *Carex sp.*	30	Y	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	70 = Total Cover		
50% of total cover: 35		20% of total cover: 14	

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	70	x 2 = 140
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	70 (A)	140 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 5/1	80	7.5YR 4/6	20	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:
UPL-8 = 10YR 4/4 no mottles.
Vegetation is dominated by cedar, red oak, white oak

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/27/19

Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-9

Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR P Lat: 35.135435 Long: -88.961077 Datum: NAD83

Soil Map Unit Name: Chenneby Silt Loam NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	**Is the Sampled Area within a Wetland?** **Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐	
Wetland Hydrology Present?	Yes ☑ No ☐	

Remarks:

Size: 0.19 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☑ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☑ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		x	
Water Table Present?	x		0-6
Saturation Present? (includes capillary fringe)	x		0

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: WTL-9

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover: ____	20% of total cover: ____		

Sapling Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover: ____	20% of total cover: ____		

Shrub Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover: ____	20% of total cover: ____		

Herb Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Ranunculus sp.*	40	Y	FACW
2. *Andropogon virginicus*	20	Y	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	60 = Total Cover		
50% of total cover: 30	20% of total cover: 12		

Woody Vine Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover: ____	20% of total cover: ____		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	40	x 2 = 80
FAC species	20	x 3 = 60
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	60 (A)	140 (B)

Prevalence Index = B/A = 2.33

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: WTL-9

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 5/1	80	7.5YR 4/6	20	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:
UPL-9 = 2.5Y 5/3 with no mottles.
Vegetation is dominated by bermuda and fescue

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/27/19

Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-10

Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR P Lat: 35.140185 Long: -88.968202 Datum: NAD83

Soil Map Unit Name: Smithdale and lexington Soils NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	**Is the Sampled Area within a Wetland?** **Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐	
Wetland Hydrology Present?	Yes ☑ No ☐	

Remarks:

Size: 0.72 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☑ Water Marks (B1)
- ☑ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☑ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☑ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes x	No ___	Depth (inches): 0-6"
Water Table Present?	Yes x	No ___	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: WTL-10

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	60	Y	FACW
2.			
3.			
4.			
5.			
6.			
	60 = Total Cover		
50% of total cover: 30	20% of total cover: 12		

Sapling Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Carex sp.*	10	Y	FACW
2. *Osmunda cinnamomea*	20	Y	FACW
3. *Rosa palustris*	15	Y	OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	45 = Total Cover		
50% of total cover: 22.5	20% of total cover: 9		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	15	x 1 = 15
FACW species	90	x 2 = 180
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	105 (A)	195 (B)

Prevalence Index = B/A = 1.86

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-10

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 5/2	80	7.5YR 5/8	20	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ☑ No ☐

Remarks:
UPL-10 = 10YR 5/4
Beech, red oak, white oak

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/27/19
Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-11
Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2
Subregion (LRR or MLRA): LRR P Lat: 35.141241 Long: -88.969734 Datum: NAD83
Soil Map Unit Name: Smithdale Loam/Providence Silty Clay Loam NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes [ ] No [x] (If no, explain in Remarks.)
Are Vegetation [ ], Soil [ ], or Hydrology [ ] significantly disturbed? Are "Normal Circumstances" present? Yes [x] No [ ]
Are Vegetation [ ], Soil [ ], or Hydrology [ ] naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes [x] No [ ]	**Is the Sampled Area within a Wetland?**	**Yes** [x] **No** [ ]
Hydric Soil Present?	Yes [x] No [ ]		
Wetland Hydrology Present?	Yes [x] No [ ]		

Remarks:
Size: 0.83 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [x] Surface Water (A1)
- [x] High Water Table (A2)
- [x] Saturation (A3)
- [x] Water Marks (B1)
- [x] Sediment Deposits (B2)
- [x] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [x] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [x] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] True Aquatic Plants (B14)
- [ ] Hydrogen Sulfide Odor (C1)
- [x] Oxidized Rhizospheres on Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [x] Sparsely Vegetated Concave Surface (B8)
- [x] Drainage Patterns (B10)
- [x] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [x] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Stunted or Stressed Plants (D1)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] Microtopographic Relief (D4)
- [ ] FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes x	No ___	Depth (inches): 0-6"
Water Table Present?	Yes x	No ___	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes [x] **No** [ ]

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: WTL-11

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	40	Y	FACW
2. *Nyssa sylvatica*	30	Y	FAC
3.			
4.			
5.			
6.			
	70	= Total Cover	
50% of total cover: 35	20% of total cover: 14		

Sapling Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	
50% of total cover:	20% of total cover:		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Carex sp.*	20	Y	FACW
2. *Osmunda cinnamomea*	20	Y	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	40	= Total Cover	
50% of total cover: 20	20% of total cover: 8		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Smilax glauca*	5	Y	FAC
2.			
3.			
4.			
5.			
	5	= Total Cover	
50% of total cover: 2.5	20% of total cover: 1		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	80	x 2 =	160
FAC species	35	x 3 =	105
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	115 (A)		265 (B)

Prevalence Index = B/A = 2.30

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: WTL-11

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 6/2	80	7.5YR 5/8	20	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] 2 cm Muck (A10) **(LRR N)**
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7)
- [ ] Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- [ ] Thin Dark Surface (S9) **(MLRA 147, 148)**
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- [ ] Umbric Surface (F13) **(MLRA 136, 122)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 148)**
- [ ] Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- [ ] 2 cm Muck (A10) **(MLRA 147)**
- [ ] Coast Prairie Redox (A16) **(MLRA 147, 148)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ✓ **No** ___

Remarks:
UPL-11 = 7.5YR 4/3
Tulip poplar, red maple

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/27/19

Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-12

Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR P Lat: 35.138728 Long: -88.961716 Datum: NAD83

Soil Map Unit Name: Luka Silt Loam NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	**Is the Sampled Area within a Wetland?** **Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐	
Wetland Hydrology Present?	Yes ☑ No ☐	

Remarks:

Size: 1.26 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☑ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☑ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes x	No ___	Depth (inches): 0-6"
Water Table Present?	Yes x	No ___	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: WTL-12

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Sapling Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size:)			
1. *Carex sp.*	20	Y	FACW
2. *Juncus effusus*	20	Y	FACW
3. *Ranunculus sp.*	40	Y	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80 = Total Cover		
50% of total cover: 40	20% of total cover: 16		

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	80	x 2 = 160
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	80 (A)	160 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: WTL-12

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 5/2	80	7.5YR 4/6	20	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] 2 cm Muck (A10) **(LRR N)**
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7)
- [ ] Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- [ ] Thin Dark Surface (S9) **(MLRA 147, 148)**
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- [ ] Umbric Surface (F13) **(MLRA 136, 122)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 148)**
- [ ] Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- [ ] 2 cm Muck (A10) **(MLRA 147)**
- [ ] Coast Prairie Redox (A16) **(MLRA 147, 148)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____

Depth (inches): ____

Hydric Soil Present? Yes [x] No [ ]

Remarks:
UPL-12 = 2.5Y 5/3 layered with 7.5YR 4/6
bermuda grass, broomsedge

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/27/19

Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-13

Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR P Lat: 35.138869 Long: -88.964482 Datum: NAD83

Soil Map Unit Name: Luka Silt Loam NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	Is the Sampled Area within a Wetland?	Yes ☑ No ☐
Hydric Soil Present?	Yes ☑ No ☐		
Wetland Hydrology Present?	Yes ☑ No ☐		

Remarks:

Size: 0.34 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☑ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☑ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes x	No ___	Depth (inches): 0-3"
Water Table Present?	Yes x	No ___	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes ☑ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: WTL-13

Tree Stratum (Plot size: ______)

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: ______ 20% of total cover: ______

Sapling Stratum (Plot size: ______)

Sapling Stratum	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: ______ 20% of total cover: ______

Shrub Stratum (Plot size: ______)

Shrub Stratum	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: ______ 20% of total cover: ______

Herb Stratum (Plot size: ______)

Herb Stratum	Absolute % Cover	Dominant Species?	Indicator Status
1. *Carex sp.*	20	Y	FACW
2. *Juncus effusus*	20	Y	FACW
3. *Ranunculus sp.*	30	Y	FACW
4. *Ludwigia peploides*	10		OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80 = Total Cover		

50% of total cover: 40 20% of total cover: 16

Woody Vine Stratum (Plot size: ______)

Woody Vine Stratum	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: ______ 20% of total cover: ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	70	x 2 = 140
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	70 (A)	140 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-13

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 5/2	80	7.5YR 4/6	20	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:
UPL-13 = 2.5Y 5/3 with faint 7.5YR 4/6 mottles
bermuda grass, broomsedge, clover

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/27/19

Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-14

Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR P Lat: 35.141854 Long: -88.968015 Datum: NAD83

Soil Map Unit Name: Luka Silt Loam NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	**Is the Sampled Area within a Wetland?** **Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐	
Wetland Hydrology Present?	Yes ☑ No ☐	

Remarks:

Size: 0.08 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☑ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☑ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes x	No ___	Depth (inches): 0-3"
Water Table Present?	Yes x	No ___	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: WTL-14

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: ______ 20% of total cover: ______

Sapling Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: ______ 20% of total cover: ______

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: ______ 20% of total cover: ______

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Indicator Status
1. *Carex sp.*	30	Y	FACW
2. *Juncus effusus*	30	Y	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	60 = Total Cover		

50% of total cover: 30 20% of total cover: 12

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: ______ 20% of total cover: ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	60	x 2 = 120
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	60 (A)	120 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-14

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 6/2	80	7.5YR 4/6	10	C	M		silty clay loam
			7.5YR 5/8	10	C	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:
UPL-14 = 2.5Y 5/3 with faint 7.5YR 4/6 mottles
bermuda grass, broomsedge, clover

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/27/19
Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-15
Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): Concave Slope (%): 0-2
Subregion (LRR or MLRA): LRR P Lat: 35.141632 Long: -88.970584 Datum: NAD83
Soil Map Unit Name: Smithdale Loam NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	**Is the Sampled Area within a Wetland?** **Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐	
Wetland Hydrology Present?	Yes ☑ No ☐	

Remarks:
Size: 0.31 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___
Water Table Present?	Yes x	No ___	Depth (inches): 0-6
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: WTL-15

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	
50% of total cover: ______	20% of total cover: ______		

Sapling Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	
50% of total cover: ______	20% of total cover: ______		

Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	
50% of total cover: ______	20% of total cover: ______		

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Carex sp.*	20	Y	FACW
2. *Juncus effusus*	25	Y	FACW
3. *Panicum dichotomiflorum*	35	Y	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80	= Total Cover	
50% of total cover: 40	20% of total cover: 16		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
50% of total cover: ______	20% of total cover: ______		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	80	x 2 = 160
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	80 (A)	160 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: WTL-15

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 6/2	80	7.5YR 4/6	20	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:
UPL-15 = 7.5YR 4/4 with no redox
fescue, broomsedge, clover

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/28/19

Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-16

Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR P Lat: 35.141064 Long: -88.97719 Datum: NAD83

Soil Map Unit Name: Enville Silt Loam NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	**Is the Sampled Area within a Wetland?**	**Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐		
Wetland Hydrology Present?	Yes ☑ No ☐		

Remarks:

Size: 1.22 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☑ Water Marks (B1)
- ☑ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☑ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☑ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes x	No ___	Depth (inches): 0-4
Water Table Present?	Yes x	No ___	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: WTL-16

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Liquidambar styraciflua*	40	Y	FAC
2. *Acer rubrum*	30	Y	FACW
3.			
4.			
5.			
6.			
	70 = Total Cover		
50% of total cover: 35	20% of total cover: 14		

Sapling Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Ilex opaca*	10	Y	FAC
2.			
3.			
4.			
5.			
6.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Carex sp.*	15	Y	FACW
2. *Juncus effusus*	10	Y	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	25 = Total Cover		
50% of total cover: 12.5	20% of total cover: 5		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	55	x 2 = 110
FAC species	50	x 3 = 150
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	105 (A)	260 (B)

Prevalence Index = B/A = 2.48

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-16

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 6/1	80	5YR 4/6	20	C	M		sandy clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:
UPL-16 = 7.5YR 5/4 with no redox - sandy loam
Christmas fern, green briar, sweetgum, red maple, cedar

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/28/19
Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-17
Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2
Subregion (LRR or MLRA): LRR P Lat: 35.14158 Long: -88.975604 Datum: NAD83
Soil Map Unit Name: Smithdale Loam NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	Is the Sampled Area within a Wetland? Yes ☑ No ☐
Hydric Soil Present?	Yes ☑ No ☐	
Wetland Hydrology Present?	Yes ☑ No ☐	

Remarks:
Size: 0.30 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☑ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☑ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		x	
Water Table Present?		x	
Saturation Present? (includes capillary fringe)	x		6

Wetland Hydrology Present? Yes ☑ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: WTL-17

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Indicator Status
1. *Liquidambar styraciflua*	40	Y	FAC
2. *Acer rubrum*	30	Y	FACW
3.			
4.			
5.			
6.			
	70 = Total Cover		

50% of total cover: 35 20% of total cover: 14

Sapling Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	___ = Total Cover		

50% of total cover: ____ 20% of total cover: ____

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	___ = Total Cover		

50% of total cover: ____ 20% of total cover: ____

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Indicator Status
1. *Carex sp.*	15	Y	FACW
2. *Juncus effusus*	10	Y	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	25 = Total Cover		

50% of total cover: 12.5 20% of total cover: 5

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	___ = Total Cover		

50% of total cover: ____ 20% of total cover: ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	55	x 2 = 110
FAC species	40	x 3 = 120
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	95 (A)	230 (B)

Prevalence Index = B/A = 2.42

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-17

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 6/2	80	7.5YR 4/6	20	C	M		sandy clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:
UPL-17 = 7.5YR 4/6 with no redox
Tulip poplar, red oak, sweetgum, green briar, Christmas fern

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/28/19
Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-18
Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): Concave Slope (%): 0-2
Subregion (LRR or MLRA): LRR P Lat: 35.136952 Long: -88.980914 Datum: NAD83
Soil Map Unit Name: Smithdale Loam NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	**Is the Sampled Area within a Wetland?**	**Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐		
Wetland Hydrology Present?	Yes ☑ No ☐		

Remarks:
Size: 0.21 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☑ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☑ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___
Water Table Present?	Yes x	No ___	Depth (inches): 0-6
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: WTL-18

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Liquidambar styraciflua*	30	Y	FAC
2. *Acer rubrum*	20	Y	FACW
3. *Platanus occidentalis*	30	Y	FACW
4.			
5.			
6.			
	80 = Total Cover		
50% of total cover: 40	20% of total cover: 16		

Sapling Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	50	x 2 = 100
FAC species	30	x 3 = 90
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	80 (A)	190 (B)

Prevalence Index = B/A = 2.38

Hydrophytic Vegetation Indicators:

- [x] 1 - Rapid Test for Hydrophytic Vegetation
- [x] 2 - Dominance Test is >50%
- [x] 3 - Prevalence Index is ≤3.0[1]
- [ ] 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes [✓] No [ ]

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-18

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 6/2	80	7.5YR 4/6	20	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:
UPL-18 = 7.5YR 4/4 with no redox
Sycamore, winged elm

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/28/19
Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-19
Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): Concave Slope (%): 0-2
Subregion (LRR or MLRA): LRR P Lat: 35.139203 Long: -88.980293 Datum: NAD83
Soil Map Unit Name: Smithdale Loam NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes [ ] No [x] (If no, explain in Remarks.)
Are Vegetation [ ], Soil [ ], or Hydrology [ ] significantly disturbed? Are "Normal Circumstances" present? Yes [x] No [ ]
Are Vegetation [ ], Soil [ ], or Hydrology [ ] naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes [x]	No [ ]	Is the Sampled Area within a Wetland? **Yes [x] No [ ]**
Hydric Soil Present?	Yes [x]	No [ ]	
Wetland Hydrology Present?	Yes [x]	No [ ]	

Remarks:
Size: 2.27 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [ ] Surface Water (A1)
- [x] High Water Table (A2)
- [x] Saturation (A3)
- [x] Water Marks (B1)
- [x] Sediment Deposits (B2)
- [x] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [x] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [x] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] True Aquatic Plants (B14)
- [ ] Hydrogen Sulfide Odor (C1)
- [x] Oxidized Rhizospheres on Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [x] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [x] Crayfish Burrows (C8)
- [x] Saturation Visible on Aerial Imagery (C9)
- [ ] Stunted or Stressed Plants (D1)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] Microtopographic Relief (D4)
- [ ] FAC-Neutral Test (D5)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		x	
Water Table Present?	x		0-6
Saturation Present? (includes capillary fringe)	x		0

Wetland Hydrology Present? Yes [x] No [ ]

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: WTL-19

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Liquidambar styraciflua*	30	Y	FAC
2. *Acer rubrum*	30	Y	FACW
3. *Platanus occidentalis*	20	Y	FACW
4.			
5.			
6.			
	80 = Total Cover		
50% of total cover: 40	20% of total cover: 16		
Sapling Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size:)			
1. *Osmunda cinnamomea*	15	Y	FACW
2. *Carex sp.*	20	Y	FACW
3. *Juncus effusus*	15	Y	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	50 = Total Cover		
50% of total cover: 25	20% of total cover: 10		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	100	x 2 = 200
FAC species	30	x 3 = 90
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	130 (A)	290 (B)

Prevalence Index = B/A = 2.23

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-19

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 5/2	80	7.5YR 4/6	20	C	M		sandy clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

Hydric Soil Present? Yes ☑ No ☐

Remarks:
UPL-19 = 7.5YR 4/4 with no redox
poplar, sweetgum

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/28/19

Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-20

Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR P Lat: 35.139445 Long: -88.978266 Datum: NAD83

Soil Map Unit Name: Smithdale Loam/Enville Silt Loam NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑	No ☐
Hydric Soil Present?	Yes ☑	No ☐
Wetland Hydrology Present?	Yes ☑	No ☐

Is the Sampled Area within a Wetland? **Yes** ☑ **No** ☐

Remarks:

Size: 3.14 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☑ Water Marks (B1)
- ☑ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		x	
Water Table Present?	x		0-6
Saturation Present? (includes capillary fringe)	x		0

Wetland Hydrology Present? **Yes** ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: WTL-20

Tree Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			

50% of total cover: 20% of total cover:

Sapling Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Indicator Status
1. *Alnus serrulata*	20	Y	FACW
2. *Salix nigra*	20	Y	OBL
3. *Acer rubrum*	15	Y	FACW
4.			
5.			
6.			
= Total Cover	55		

50% of total cover: 27.5 20% of total cover: 11

Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			

50% of total cover: 20% of total cover:

Herb Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Indicator Status
1. *Osmunda cinnamomea*	15	Y	FACW
2. *Carex sp.*	20	Y	FACW
3. *Juncus effusus*	15	Y	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	50		

50% of total cover: 25 20% of total cover: 10

Woody Vine Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
= Total Cover			

50% of total cover: 20% of total cover:

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:
OBL species	20	x 1 = 20
FACW species	85	x 2 = 170
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	105 (A)	190 (B)

Prevalence Index = B/A = 1.81

Hydrophytic Vegetation Indicators:

- [x] 1 - Rapid Test for Hydrophytic Vegetation
- [x] 2 - Dominance Test is >50%
- [x] 3 - Prevalence Index is ≤3.0[1]
- [ ] 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-20

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 5/2	80	7.5YR 4/6	20	C	M		sandy clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:
UPL-20 = 5YR 4/6 with no redox
fescue, broomsedge

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank   City/County: Middleton/Hardeman   Sampling Date: 2/28/19
Applicant/Owner: University of Tennessee Institue of Agriculture   State: TN   Sampling Point: WTL-21
Investigator(s): G. Babbit/C. Hertwig   Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): Slope   Local relief (concave, convex, none): Concave   Slope (%): 0-2
Subregion (LRR or MLRA): LRR P   Lat: 35.131894   Long: -88.977072   Datum: NAD83
Soil Map Unit Name: Smithdale Loam   NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes [ ] No [x] (If no, explain in Remarks.)
Are Vegetation [ ], Soil [ ], or Hydrology [ ] significantly disturbed?   Are "Normal Circumstances" present? Yes [x] No [ ]
Are Vegetation [ ], Soil [ ], or Hydrology [ ] naturally problematic?   (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes [x] No [ ]	**Is the Sampled Area within a Wetland?** **Yes** [x] **No** [ ]
Hydric Soil Present?	Yes [x] No [ ]	
Wetland Hydrology Present?	Yes [x] No [ ]	

Remarks:
Size: 0.26 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [ ] Surface Water (A1)
- [x] High Water Table (A2)
- [x] Saturation (A3)
- [x] Water Marks (B1)
- [x] Sediment Deposits (B2)
- [x] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [x] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [x] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] True Aquatic Plants (B14)
- [ ] Hydrogen Sulfide Odor (C1)
- [x] Oxidized Rhizospheres on Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [x] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [x] Crayfish Burrows (C8)
- [x] Saturation Visible on Aerial Imagery (C9)
- [ ] Stunted or Stressed Plants (D1)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] Microtopographic Relief (D4)
- [ ] FAC-Neutral Test (D5)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		x	
Water Table Present?	x		0-6
Saturation Present? (includes capillary fringe)	x		0

Wetland Hydrology Present? **Yes** [x] **No** [ ]

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: WTL-21

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	40	Y	FACW
2. *Liquidambar styraciflua*	30	Y	FAC
3.			
4.			
5.			
6.			
	70 = Total Cover		
50% of total cover: 35	20% of total cover: 14		
Sapling Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size:)			
1. *Carex sp.*	20	Y	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	20 = Total Cover		
50% of total cover: 10	20% of total cover: 4		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	60	x 2 =	120
FAC species	30	x 3 =	90
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	90 (A)		210 (B)

Prevalence Index = B/A = 2.33

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-21

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 5/2	80	7.5YR 4/6	20	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] 2 cm Muck (A10) **(LRR N)**
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7)
- [ ] Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- [ ] Thin Dark Surface (S9) **(MLRA 147, 148)**
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- [ ] Umbric Surface (F13) **(MLRA 136, 122)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 148)**
- [ ] Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- [ ] 2 cm Muck (A10) **(MLRA 147)**
- [ ] Coast Prairie Redox (A16) **(MLRA 147, 148)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ✓ **No** ___

Remarks:
UPL-21 = 2.5Y 6/4 with no redox
white oak, flowering dogwood, hickory

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/28/19

Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-22

Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR P Lat: 35.138919 Long: -88.954336 Datum: NAD83

Soil Map Unit Name: Chenneby Silt Loam NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	**Is the Sampled Area within a Wetland?**	**Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐		
Wetland Hydrology Present?	Yes ☑ No ☐		

Remarks:

Size: 0.94 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☑ Water Marks (B1)
- ☑ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☑ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___
Water Table Present?	Yes ___	No x	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0-6

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: WTL-22

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	40	Y	FACW
2. *Betula nigra*	40	Y	FACW
3.			
4.			
5.			
6.			
	80 = Total Cover		
50% of total cover: 40	20% of total cover: 16		
Sapling Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
6.			
	____ = Total Cover		
50% of total cover: ____	20% of total cover: ____		
Shrub Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
6.			
	____ = Total Cover		
50% of total cover: ____	20% of total cover: ____		
Herb Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	____ = Total Cover		
50% of total cover: ____	20% of total cover: ____		
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
50% of total cover: ____	20% of total cover: ____		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	80	x 2 = 160
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	80 (A)	160 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-22

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 5/2	80	7.5YR 4/6	20	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:
UPL-22 = 2.5Y 6/4 with no redox
poplar, cedar, willow oak, elm

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/28/19

Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-23

Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR P Lat: 35.138843 Long: -88.953421 Datum: NAD83

Soil Map Unit Name: Chenneby Silt Loam/Luverne and Smithdale Soils NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	**Is the Sampled Area within a Wetland?**	**Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐		
Wetland Hydrology Present?	Yes ☑ No ☐		

Remarks:

Size: 3.45 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☑ Water Marks (B1)
- ☑ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☑ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes x No ___ Depth (inches): 0-4

Water Table Present? Yes x No ___ Depth (inches): 0

Saturation Present? (includes capillary fringe) Yes x No ___ Depth (inches): 0

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: WTL-23

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	40	Y	FACW
2. *Betula nigra*	40	Y	FACW
3.			
4.			
5.			
6.			
	80 = Total Cover		
50% of total cover: 40	20% of total cover: 16		

Sapling Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	80	x 2 = 160
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	80 (A)	160 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WTL-23

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 5/2	80	7.5YR 4/6	20	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:
UPL-23 = 2.5Y 6/4 with no redox
poplar, cedar, willow oak, elm

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lone Oaks Farm - Cub Creek Mitigation Bank City/County: Middleton/Hardeman Sampling Date: 2/28/19
Applicant/Owner: University of Tennessee Institue of Agriculture State: TN Sampling Point: WTL-24
Investigator(s): G. Babbit/C. Hertwig Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): Concave Slope (%): 0-2
Subregion (LRR or MLRA): LRR P Lat: 35.139624 Long: -88.952523 Datum: NAD83
Soil Map Unit Name: Chenneby Silt Loam NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	**Is the Sampled Area within a Wetland?**	**Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐		
Wetland Hydrology Present?	Yes ☑ No ☐		

Remarks:
Size: 0.38 acres

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☑ Water Marks (B1)
- ☑ Sediment Deposits (B2)
- ☑ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☑ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes x	No ___	Depth (inches): 0-2
Water Table Present?	Yes x	No ___	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The site has received an unusually high amount of rainfall over the previous 2-3 months.

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: WTL-24

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	30	Y	FACW
2. *Betula nigra*	20	Y	FACW
3.			
4.			
5.			
6.			
	50 = Total Cover		
50% of total cover: 25	20% of total cover: 10		

Sapling Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer negundo*	20	Y	FACW
2.			
3.			
4.			
5.			
6.			
	20 = Total Cover		
50% of total cover: 10	20% of total cover: 4		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	70	x 2 = 140
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	70 (A)	140 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: WTL-24

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12"	2.5Y 5/2	80	7.5YR 4/6	20	C	M		silty clay loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:
UPL-24 = 2.5Y 6/4 with no redox
poplar, cedar, willow oak, elm

APPENDIX C: SOIL SURVEY REPORT

United States Department of Agriculture

NRCS

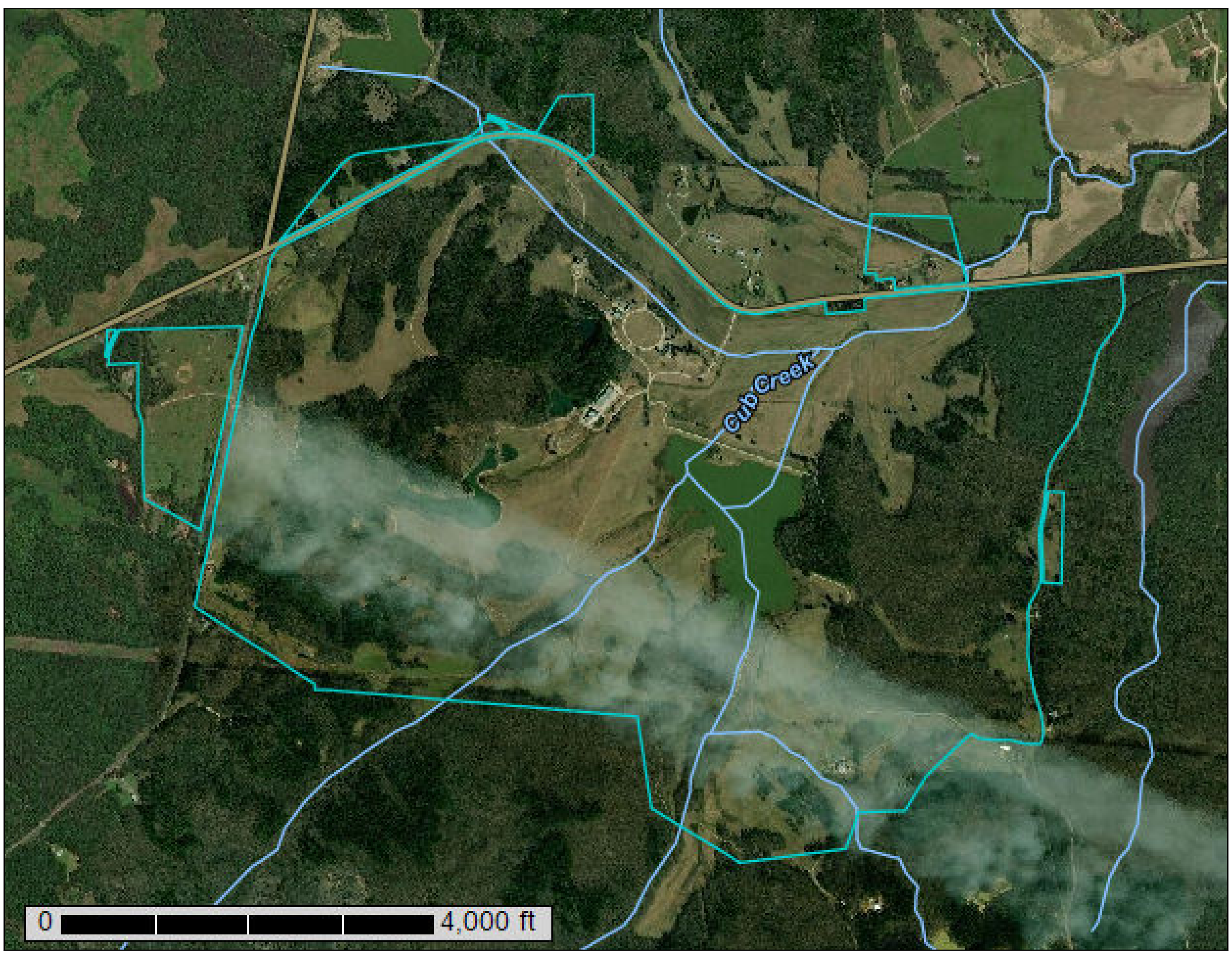
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Hardeman County, Tennessee

Lone Oaks Farm Soil Report



May 2, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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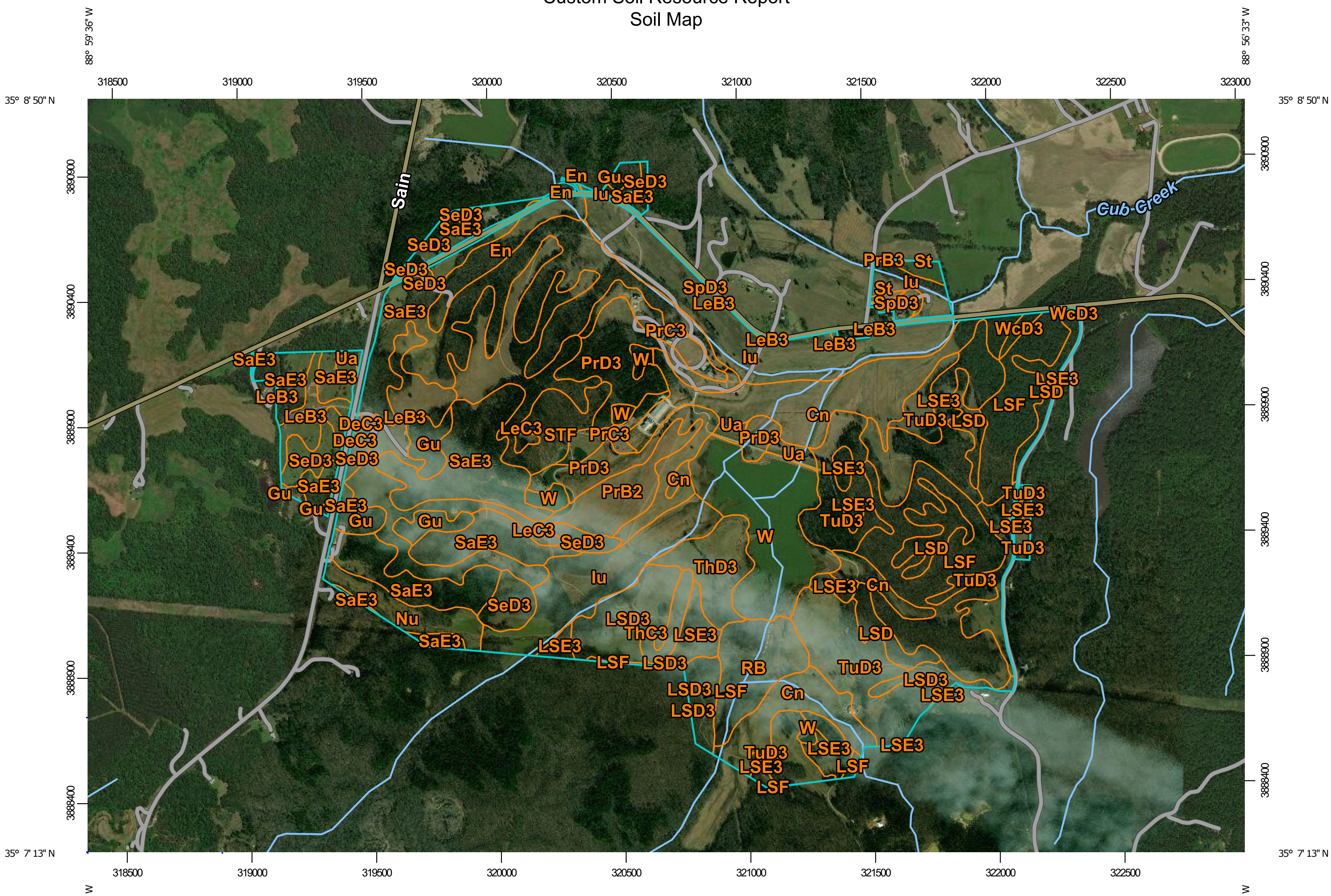
Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map



Map Scale: 1:21,200 if printed on A landscape (11" x 8.5") sheet.

N

0 300 600 1200 1800 Meters

0 1000 2000 4000 6000 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Hardeman County, Tennessee
Survey Area Data: Version 16, Sep 16, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 12, 2015—Aug 24, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Cn	Chenneby silt loam, 0 to 2 percent slopes, occasionally flooded	91.2	7.6%
DeC3	Deanberg clay loam, 5 to 8 percent slopes, severely eroded	2.1	0.2%
En	Enville silt loam, 0 to 2 percent slopes, occasionally flooded	16.8	1.4%
Gu	Gullied land-Hapudults complex, very steep	20.2	1.7%
Iu	Iuka silt loam, occasionally flooded	115.1	9.6%
LeB3	Lexington silty clay loam, 2 to 5 percent slopes, severely eroded	31.5	2.6%
LeC3	Lexington silty clay loam, 5 to 8 percent slopes, severely eroded	69.5	5.8%
LSD	Luverne and Smithdale sandy loams, 8 to 12 percent slopes	34.4	2.9%
LSD3	Luverne and Smithdale soils, 8 to 12 percent slopes, severely eroded	33.0	2.8%
LSE3	Luverne and Smithdale soils, 12 to 25 percent slopes, severely eroded	65.9	5.5%
LSF	Luverne and Smithdale sandy loams, 25 to 45 percent slopes	104.3	8.7%
Nu	Nugent loamy sand, occasionally flooded	17.0	1.4%
PrB2	Providence silt loam, 2 to 5 percent slopes, moderately eroded, north	21.7	1.8%
PrB3	Providence silty clay loam, 2 to 5 percent slopes, severely eroded	0.2	0.0%
PrC3	Providence silty clay loam, 5 to 8 percent slopes, severely eroded	20.8	1.7%
PrD3	Providence silty clay loam, 8 to 12 percent slopes, severely eroded	61.7	5.1%
RB	Rosebloom and Bibb soils, frequently flooded	28.1	2.3%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
SaE3	Smithdale loam, 12 to 25 percent slopes, severely eroded	207.8	17.3%
SeD3	Smithdale and lexington soils, 8 to 12 percent slopes, severely eroded	27.0	2.3%
SpD3	Smithdale-Providence complex, 5 to 12 percent slopes, severely eroded	2.2	0.2%
St	Steens loam	3.5	0.3%
STF	Smithdale and Toinette soils, 20 to 45 percent slopes	17.7	1.5%
ThC3	Tippah silt loam, 5 to 8 percent slopes, severely eroded	6.8	0.6%
ThD3	Tippah silt loam, 8 to 12 percent slopes, severely eroded	21.3	1.8%
TuD3	Tippah-Luverne complex, 5 to 12 percent slopes, severely eroded	104.7	8.7%
Ua	Udarents, loamy	6.3	0.5%
W	Water	64.8	5.4%
WcD3	Wilcox silty clay, 8 to 12 percent slopes, severely eroded	2.5	0.2%
Totals for Area of Interest		**1,198.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Hardeman County, Tennessee

Cn—Chenneby silt loam, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 2w6fh
Elevation: 310 to 470 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 59 to 72 degrees F
Frost-free period: 200 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Chenneby and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chenneby

Setting

Landform: Flood-plain steps
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium

Typical profile

A - 0 to 7 inches: silt loam
Bw - 7 to 22 inches: silty clay loam
Bg - 22 to 50 inches: silty clay loam
Cg - 50 to 62 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 12 to 29 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Hydric soil rating: No

Minor Components

Cascilla

Percent of map unit: 7 percent

Landform: Flood-plain steps
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Rosebloom

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

DeC3—Deanberg clay loam, 5 to 8 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: bzrc
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Deanburg and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Deanburg

Setting

Landform: Hillslopes
Landform position (three-dimensional): Interfluve
Parent material: Loamy over sandy alluvium

Typical profile

H1 - 0 to 4 inches: clay loam
H2 - 4 to 40 inches: clay loam
H3 - 40 to 60 inches: sand

Properties and qualities

Slope: 5 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

En—Enville silt loam, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 2vxx8
Elevation: 350 to 650 feet
Mean annual precipitation: 47 to 58 inches
Mean annual air temperature: 46 to 68 degrees F
Frost-free period: 196 to 224 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Enville and similar soils: 93 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Enville

Setting

Landform: Flood-plain steps
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium over sandy alluvium

Typical profile

A - 0 to 5 inches: silt loam
C - 5 to 13 inches: silt loam
Cg1 - 13 to 45 inches: stratified sand to loamy sand to sandy loam
2Cg2 - 45 to 79 inches: stratified sand to loamy sand to sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Hydric soil rating: No

Minor Components

Bibb

Percent of map unit: 7 percent
Landform: Flood-plain steps
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Gu—Gullied land-Hapudults complex, very steep

Map Unit Setting

National map unit symbol: bzrg
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Gullied land: 70 percent
Hapludults and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hapludults

Properties and qualities

Slope: 25 to 45 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydric soil rating: No

Iu—Iuka silt loam, occasionally flooded

Map Unit Setting

National map unit symbol: bzrh
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Iuka and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Iuka

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf
Parent material: Loamy alluvium

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 34 inches: sandy loam
H3 - 34 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

LeB3—Lexington silty clay loam, 2 to 5 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: bzrm
Elevation: 300 to 650 feet

Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Lexington and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lexington

Setting

Landform: Interfluves
Landform position (three-dimensional): Interfluve
Parent material: Loess over loamy marine deposits

Typical profile

H1 - 0 to 5 inches: silty clay loam
H2 - 5 to 37 inches: silty clay loam
H3 - 37 to 46 inches: loam
H4 - 46 to 60 inches: sandy loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

LeC3—Lexington silty clay loam, 5 to 8 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: bzrp
Elevation: 300 to 650 feet
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Lexington and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lexington

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Loess over loamy marine deposits

Typical profile

H1 - 0 to 5 inches: silty clay loam
H2 - 5 to 14 inches: silty clay loam
H3 - 14 to 37 inches: silt loam
H4 - 37 to 60 inches: sandy loam

Properties and qualities

Slope: 5 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

LSD—Luverne and Smithdale sandy loams, 8 to 12 percent slopes

Map Unit Setting

National map unit symbol: bzrw
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Luverne and similar soils: 60 percent
Smithdale and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Luverne

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Stratified clayey and/or loamy marine deposits

Typical profile

H1 - 0 to 9 inches: sandy loam
H2 - 9 to 29 inches: sandy clay
H3 - 29 to 36 inches: sandy clay loam
H4 - 36 to 60 inches: stratified loamy sand to sandy clay loam

Properties and qualities

Slope: 8 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Smithdale

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 14 inches: sandy loam
H2 - 14 to 51 inches: sandy clay loam
H3 - 51 to 60 inches: sandy loam

Properties and qualities

Slope: 8 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

LSD3—Luverne and Smithdale soils, 8 to 12 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: bzrx
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Luverne and similar soils: 60 percent
Smithdale and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Luverne

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Stratified clayey and/or loamy marine deposits

Typical profile

H1 - 0 to 4 inches: clay loam
H2 - 4 to 18 inches: clay
H3 - 18 to 30 inches: sandy clay loam
H4 - 30 to 60 inches: stratified loamy sand to sandy clay loam

Properties and qualities

Slope: 8 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Smithdale

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope

Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 4 inches: loam
H2 - 4 to 32 inches: sandy clay loam
H3 - 32 to 60 inches: sandy loam

Properties and qualities

Slope: 8 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Hydric soil rating: No

LSE3—Luverne and Smithdale soils, 12 to 25 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: bzry
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Luverne and similar soils: 65 percent
Smithdale and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Luverne

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Stratified clayey and/or loamy marine deposits

Typical profile

H1 - 0 to 4 inches: clay loam
H2 - 4 to 18 inches: clay
H3 - 18 to 30 inches: sandy clay loam
H4 - 30 to 60 inches: stratified loamy sand to sandy clay loam

Properties and qualities

Slope: 12 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Smithdale

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 4 inches: loam
H2 - 4 to 32 inches: sandy clay loam
H3 - 32 to 60 inches: sandy loam

Properties and qualities

Slope: 12 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Hydric soil rating: No

LSF—Luverne and Smithdale sandy loams, 25 to 45 percent slopes

Map Unit Setting

National map unit symbol: bzrz
Mean annual precipitation: 48 to 62 inches

Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Luverne and similar soils: 60 percent
Smithdale and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Luverne

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Stratified clayey and/or loamy marine deposits

Typical profile

H1 - 0 to 9 inches: sandy loam
H2 - 9 to 29 inches: sandy clay
H3 - 29 to 36 inches: sandy clay loam
H4 - 36 to 60 inches: stratified loamy sand to sandy clay loam

Properties and qualities

Slope: 20 to 45 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Smithdale

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 7 inches: sandy loam
H2 - 7 to 40 inches: sandy clay loam
H3 - 40 to 60 inches: sandy loam

Properties and qualities

Slope: 20 to 45 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Hydric soil rating: No

Nu—Nugent loamy sand, occasionally flooded

Map Unit Setting

National map unit symbol: bzs0
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Nugent and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nugent

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf
Parent material: Sandy alluvium

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 60 inches: stratified loamy sand to fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 36 to 48 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Hydric soil rating: No

PrB2—Providence silt loam, 2 to 5 percent slopes, moderately eroded, north

Map Unit Setting

National map unit symbol: 2vxxl
Elevation: 350 to 650 feet
Mean annual precipitation: 47 to 58 inches
Mean annual air temperature: 46 to 68 degrees F
Frost-free period: 196 to 250 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Providence and similar soils: 94 percent
Minor components: 6 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Providence

Setting

Landform: Terraces, divides
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Interfluve, tread
Down-slope shape: Concave, linear
Across-slope shape: Linear
Parent material: Loess over loamy marine deposits

Typical profile

Ap - 0 to 6 inches: silt loam
Bt - 6 to 18 inches: silt loam
Btx - 18 to 32 inches: silty clay loam
2Btx - 32 to 62 inches: loam
2Bt - 62 to 79 inches: sandy clay loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 14 to 21 inches to fragipan
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 to 16 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D

Hydric soil rating: No

Minor Components

Lexington

Percent of map unit: 6 percent
Landform: Divides
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

PrB3—Providence silty clay loam, 2 to 5 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: bzs3
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Providence and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Providence

Setting

Landform: Interfluves
Landform position (three-dimensional): Interfluve
Parent material: Loess over loamy marine deposits

Typical profile

H1 - 0 to 5 inches: silty clay loam
H2 - 5 to 18 inches: silty clay loam
H3 - 18 to 45 inches: silt loam
H4 - 45 to 60 inches: loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: About 18 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 26 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Hydric soil rating: No

PrC3—Providence silty clay loam, 5 to 8 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: bzs5
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Providence and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Providence

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Loess over loamy marine deposits

Typical profile

H1 - 0 to 5 inches: silty clay loam
H2 - 5 to 18 inches: silty clay loam
H3 - 18 to 45 inches: silt loam
H4 - 45 to 60 inches: loam

Properties and qualities

Slope: 5 to 8 percent
Depth to restrictive feature: About 18 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 26 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C/D
Hydric soil rating: No

PrD3—Providence silty clay loam, 8 to 12 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: bzs7
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Providence and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Providence

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Loess over loamy marine deposits

Typical profile

H1 - 0 to 5 inches: silty clay loam
H2 - 5 to 18 inches: silty clay loam
H3 - 18 to 45 inches: silt loam
H4 - 45 to 60 inches: loam

Properties and qualities

Slope: 8 to 12 percent
Depth to restrictive feature: About 18 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 14 to 22 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C/D
Hydric soil rating: No

RB—Rosebloom and Bibb soils, frequently flooded

Map Unit Setting

National map unit symbol: bzs8
Elevation: 50 to 450 feet
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Rosebloom and similar soils: 60 percent
Bibb and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rosebloom

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf
Parent material: Silty alluvium

Typical profile

H1 - 0 to 7 inches: silty clay loam
H2 - 7 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Description of Bibb

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf
Parent material: Stratified loamy and/or sandy alluvium

Typical profile

H1 - 0 to 4 inches: silt loam

H2 - 4 to 60 inches: stratified loamy sand to silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

SaE3—Smithdale loam, 12 to 25 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 2vxwx
Elevation: 160 to 660 feet
Mean annual precipitation: 48 to 67 inches
Mean annual air temperature: 51 to 68 degrees F
Frost-free period: 230 to 290 days
Farmland classification: Not prime farmland

Map Unit Composition

Smithdale and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Smithdale

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy fluviomarine deposits derived from sedimentary rock

Typical profile

A - 0 to 3 inches: loam
E - 3 to 13 inches: fine sandy loam
Bt1 - 13 to 53 inches: sandy clay loam
Bt2 - 53 to 59 inches: sandy loam

Properties and qualities

Slope: 12 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.13 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Luverne

Percent of map unit: 6 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Lexington

Percent of map unit: 4 percent
Landform: Loess hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

SeD3—Smithdale and lexington soils, 8 to 12 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: bzsd
Elevation: 300 to 650 feet
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Smithdale and similar soils: 60 percent
Lexington and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Smithdale

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 4 inches: loam
H2 - 4 to 32 inches: sandy clay loam
H3 - 32 to 60 inches: sandy loam

Properties and qualities

Slope: 8 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Lexington

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Loess over loamy marine deposits

Typical profile

H1 - 0 to 5 inches: silty clay loam
H2 - 5 to 14 inches: silty clay loam
H3 - 14 to 37 inches: silt loam
H4 - 37 to 60 inches: sandy loam

Properties and qualities

Slope: 8 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Hydric soil rating: No

SpD3—Smithdale-Providence complex, 5 to 12 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: bzsh
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Smithdale and similar soils: 55 percent
Providence and similar soils: 45 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Smithdale

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Loamy marine deposits

Typical profile

H1 - 0 to 4 inches: loam
H2 - 4 to 32 inches: sandy clay loam
H3 - 32 to 60 inches: sandy loam

Properties and qualities

Slope: 5 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Providence

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Loess over loamy marine deposits

Typical profile

H1 - 0 to 5 inches: silty clay loam
H2 - 5 to 21 inches: silty clay loam
H3 - 21 to 45 inches: silt loam
H4 - 45 to 60 inches: loam

Properties and qualities

Slope: 5 to 12 percent
Depth to restrictive feature: About 21 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 14 to 22 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C/D
Hydric soil rating: No

St—Steens loam

Map Unit Setting

National map unit symbol: bzsj
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Steens and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Steens

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Parent material: Loamy alluvium

Typical profile

H1 - 0 to 7 inches: loam
H2 - 7 to 60 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Hydric soil rating: No

STF—Smithdale and Toinette soils, 20 to 45 percent slopes

Map Unit Setting

National map unit symbol: 2vxy1
Elevation: 100 to 640 feet
Mean annual precipitation: 52 to 69 inches
Mean annual air temperature: 57 to 70 degrees F
Frost-free period: 215 to 270 days
Farmland classification: Not prime farmland

Map Unit Composition

Smithdale and similar soils: 55 percent
Toinette and similar soils: 35 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Smithdale

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy fluviomarine deposits derived from sedimentary rock

Typical profile

A - 0 to 4 inches: sandy loam
E - 4 to 11 inches: sandy loam
Bt1 - 11 to 38 inches: sandy clay loam
Bt2 - 38 to 52 inches: sandy loam

Bt3 - 52 to 80 inches: sandy loam

Properties and qualities

Slope: 20 to 45 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Toinette

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy marine deposits

Typical profile

A - 0 to 3 inches: loamy sand
E - 3 to 22 inches: loamy sand
Bt - 22 to 46 inches: sandy clay loam
BC - 46 to 79 inches: loamy sand

Properties and qualities

Slope: 20 to 45 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Lexington

Percent of map unit: 6 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Providence

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

ThC3—Tippah silt loam, 5 to 8 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: bzsm
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Tippah and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tippah

Setting

Landform: Hillslopes
Landform position (three-dimensional): Crest
Parent material: Loess over clayey marine deposits

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 28 inches: silty clay loam
H3 - 28 to 60 inches: silty clay

Properties and qualities

Slope: 5 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

ThD3—Tippah silt loam, 8 to 12 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: bzsp
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Tippah and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tippah

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Loess over clayey marine deposits

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 28 inches: silty clay loam
H3 - 28 to 60 inches: silty clay

Properties and qualities

Slope: 8 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C

Hydric soil rating: No

TuD3—Tippah-Luverne complex, 5 to 12 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: bzsq
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Luverne and similar soils: 50 percent
Tippah and similar soils: 50 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Luverne

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Stratified clayey and/or loamy marine deposits

Typical profile

H1 - 0 to 4 inches: clay loam
H2 - 4 to 18 inches: clay
H3 - 18 to 30 inches: sandy clay loam
H4 - 30 to 60 inches: stratified loamy sand to sandy clay loam

Properties and qualities

Slope: 5 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Tippah

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Loess over clayey marine deposits

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 28 inches: silty clay loam
H3 - 28 to 60 inches: silty clay

Properties and qualities

Slope: 5 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Hydric soil rating: No

Ua—Udarents, loamy

Map Unit Setting

National map unit symbol: bzsr
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Arents and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arents

Setting

Landform position (three-dimensional): Side slope

Properties and qualities

Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

W—Water

Map Unit Setting

National map unit symbol: bzsv
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

WcD3—Wilcox silty clay, 8 to 12 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: bzsy
Mean annual precipitation: 48 to 62 inches
Mean annual air temperature: 48 to 71 degrees F
Frost-free period: 197 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Wilcox and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wilcox

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Parent material: Clayey residuum weathered from claystone

Typical profile

H1 - 0 to 5 inches: silty clay
H2 - 5 to 16 inches: silty clay
H3 - 16 to 47 inches: clay
Cr - 47 to 60 inches: bedrock

Properties and qualities

Slope: 8 to 12 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Moderate (about 8.3 inches)

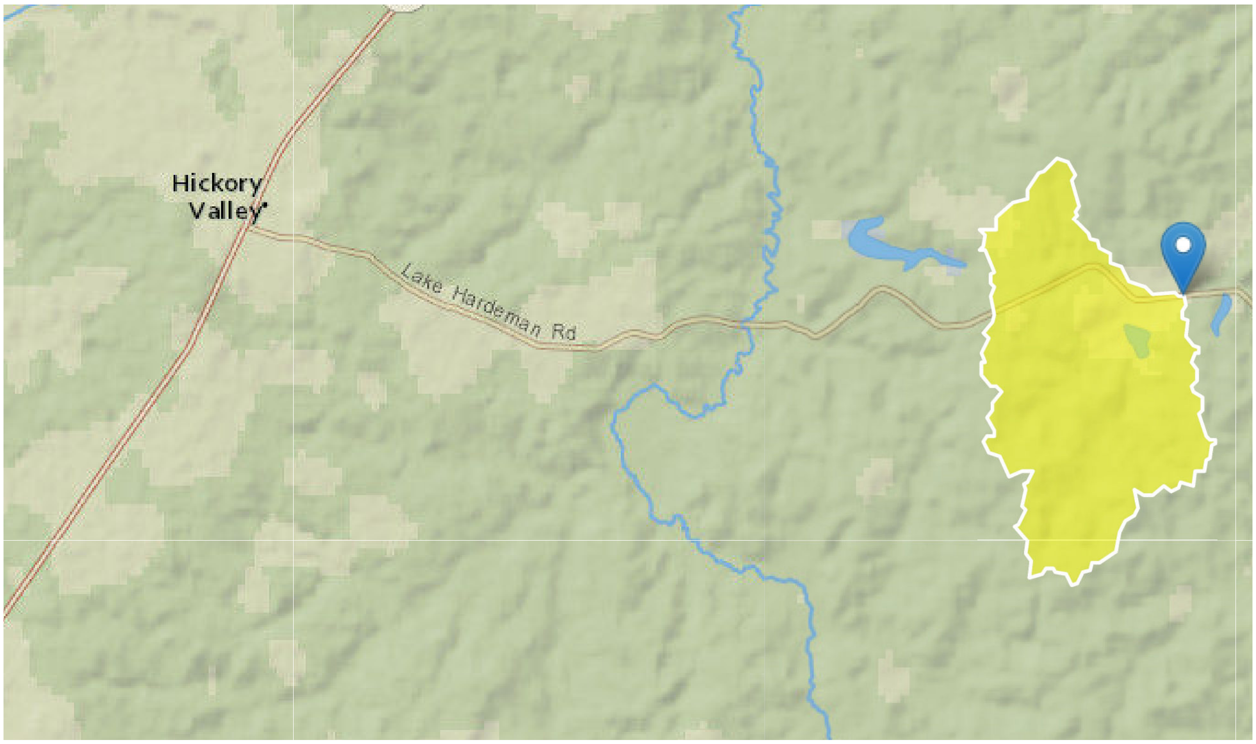
Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Hydric soil rating: No

APPENDIX D: USGS FLOW STATISTICS AND FEMA FIRM PANEL 265

StreamStats Report

Region ID: TN
Workspace ID: TN20190502194450011000
Clicked Point (Latitude, Longitude): 35.13918, -88.95543
Time: 2019-05-02 14:46:29 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	6.61	square miles
RECESS	Number of days required for streamflow to recede one order of magnitude when hydrograph is plotted on logarithmic scale	350	days per log cycle
CLIMFAC2YR	Two-year climate factor from Lichy and Karlinger (1990)	2.423	dimensionless
PERMGTE2IN	Percent of area underlain by soils with permeability greater than or equal to 2 inches per hour	67.85	percent
SOILPERM	Average Soil Permeability	2.036	inches per hour

Parameter Code	Parameter Description	Value	Unit
CONTDA	Area that contributes flow to a point on a stream	6.61	square miles

Annual Flow Statistics Parameters [Low Flow West Region 2009 5159]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	6.61	square miles	2	2405
RECESS	Recession Index	350	days per log cycle	32	350
CLIMFAC2YR	Tennessee Climate Factor 2 Year	2.423	dimensionless	2.307	2.455
PERMGTE2IN	Percent permeability gte 2 in per hr	67.85	percent	2	98

Annual Flow Statistics Flow Report [Low Flow West Region 2009 5159]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
Mean Annual Flow	9.8	ft^3/s	13.1

Annual Flow Statistics Citations

Law, G.S., Tasker, G.D., and Ladd, D.E.,2009, Streamflow-characteristic estimation methods for unregulated streams of Tennessee: U.S. Geological Survey Scientific Investigations Report 2009–5159, 212 p., 1 pl. (http://pubs.usgs.gov/sir/2009/5159/)

Flow-Duration Statistics Parameters [Low Flow West Region 2009 5159]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	6.61	square miles	2	2405
RECESS	Recession Index	350	days per log cycle	32	350
PERMGTE2IN	Percent permeability gte 2 in per hr	67.85	percent	2	98

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
CLIMFAC2YR	Tennessee Climate Factor 2 Year	2.423	dimensionless	2.307	2.455
SOILPERM	Average Soil Permeability	2.036	inches per hour	0.97	2.44

Flow-Duration Statistics Flow Report [Low Flow West Region 2009 5159]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
99.5 Percent Duration	0.76	ft^3/s	122
99 Percent Duration	0.872	ft^3/s	105
98 Percent Duration	0.982	ft^3/s	96.4
95 Percent Duration	1.21	ft^3/s	90.5
90 Percent Duration	1.43	ft^3/s	85.8
80 Percent Duration	1.82	ft^3/s	79.6
70 Percent Duration	2.32	ft^3/s	75
60 Percent Duration	3.23	ft^3/s	69.2
50 Percent Duration	3.79	ft^3/s	57
40 Percent Duration	5.21	ft^3/s	46.9
30 Percent Duration	8.19	ft^3/s	36.6
20 Percent Duration	12	ft^3/s	27.4
10 Percent Duration	20.4	ft^3/s	17.7

Flow-Duration Statistics Citations

Law, G.S., Tasker, G.D., and Ladd, D.E.,2009, Streamflow-characteristic estimation methods for unregulated streams of Tennessee: U.S. Geological Survey Scientific Investigations Report 2009–5159, 212 p., 1 pl. (http://pubs.usgs.gov/sir/2009/5159/)

Seasonal Flow Statistics Parameters [Low Flow West Region 2009 5159]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	6.61	square miles	2	2405

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
RECESS	Recession Index	350	days per log cycle	32	350
PERMGTE2IN	Percent permeability gte 2 in per hr	67.85	percent	2	98

Seasonal Flow Statistics Flow Report [Low Flow West Region 2009 5159]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
Summer Mean Flow	3.8	ft^3/s	38.3

Seasonal Flow Statistics Citations

Law, G.S., Tasker, G.D., and Ladd, D.E.,2009, Streamflow-characteristic estimation methods for unregulated streams of Tennessee: U.S. Geological Survey Scientific Investigations Report 2009–5159, 212 p., 1 pl. (http://pubs.usgs.gov/sir/2009/5159/)

Low-Flow Statistics Parameters [Low Flow West Region 2009 5159]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	6.61	square miles	2	2405
RECESS	Recession Index	350	days per log cycle	32	350
PERMGTE2IN	Percent permeability gte 2 in per hr	67.85	percent	2	98

Low-Flow Statistics Flow Report [Low Flow West Region 2009 5159]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
7 Day 10 Year Low Flow	0.826	ft^3/s	123
30 Day 5 Year Low Flow	1.15	ft^3/s	93.5

Low-Flow Statistics Citations

Law, G.S., Tasker, G.D., and Ladd, D.E.,2009, Streamflow-characteristic estimation methods for unregulated streams of Tennessee: U.S. Geological Survey Scientific Investigations Report 2009–5159, 212 p., 1 pl. (http://pubs.usgs.gov/sir/2009/5159/)

Peak-Flow Statistics Parameters [DAOnly Area 4]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
CONTDA	Contributing Drainage Area	6.61	square miles	0.76	2308

Peak-Flow Statistics Flow Report [DAOnly Area 4]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	PIu	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	1180	ft^3/s	630	2210	38.7	38.7	1.8
5 Year Peak Flood	1730	ft^3/s	944	3170	37.2	37.2	2.4
10 Year Peak Flood	2090	ft^3/s	1130	3880	38	38	3.1
25 Year Peak Flood	2550	ft^3/s	1330	4870	40.1	40.1	3.8
50 Year Peak Flood	2880	ft^3/s	1460	5690	42.2	42.2	4.2
100 Year Peak Flood	3200	ft^3/s	1560	6560	44.7	44.7	4.4
500 Year Peak Flood	3960	ft^3/s	1760	8910	51.1	51.1	4.7

Peak-Flow Statistics Citations

Law, G.S., and Tasker G.D.,2003, Flood-Frequency Prediction Methods for Unregulated Streams of Tennessee, 2000: U.S. Geological Survey Water-Resources Investigations Report 03-4176, 79p. (http://pubs.usgs.gov/wri/wri034176/)

Application Version: 4.3.0

NOTES TO USERS

o is for use in administering the National Flood Insurance Program. It does ssarily identify all areas subject to flooding, particularly from local drainage of small size. The **community map repository** should be consulted for updated or additional flood hazard information.

n more detailed information in areas where **Base Flood Elevations** (BFEs) **oodways** have been determined, users are encouraged to consult the Flood and Floodway Data and/or Summary of Stillwater Elevations tables d within the Flood Insurance Study (FIS) report that accompanies this FIRM. ould be aware that BFEs shown on the FIRM represent rounded whole-foot s. These BFEs are intended for flood insurance rating purposes only and ot be used as the sole source of flood elevation information. Accordingly, vation data presented in the FIS report should be utilized in conjunction with for purposes of construction and/or floodplain management.

Base Flood Elevations (BFEs) shown on this map apply only landward of h American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should e that coastal flood elevations are also provided in the Summary of Stillwater as table in the Flood Insurance Study report for this jurisdiction. Elevations the Summary of Stillwater Elevations table should be used for construction oodplain management purposes when they are higher than the elevations n this FIRM.

ies of the **floodways** were computed at cross sections and interpolated cross sections. The floodways were based on hydraulic considerations with requirements of the National Flood Insurance Program. Floodway widths r pertinent floodway data are provided in the Flood Insurance Study report risdiction.

areas not in Special Flood Hazard Areas may be protected by **flood control es.** Refer to Section 2.4 "Flood Protection Measures" of the Flood e Study report for information on flood control structures for this jurisdiction.

jection used in the preparation of this map was Universal Transverse (UTM) zone 16. The **horizontal datum** was NAD83, GRS1980 spheroid. ces in datum, spheroid, projection or UTM zones used in the production of or adjacent jurisdictions may result in slight positional differences in map across jurisdiction boundaries. These differences do not affect the accuracy RM.

evations on this map are referenced to the North American Vertical Datum of hese flood elevations must be compared to structure and ground elevations ed to the same **vertical datum**. For information regarding conversion the National Geodetic Vertical Datum of 1929 and the North American Datum of 1988, visit the National Geodetic Survey website at w.ngs.noaa.gov/ or contact the National Geodetic Survey at the following

Reference System Division
Geodetic Survey, NOAA
pring Metro Center
st-West Highway
pring, Maryland 20910
3-3191

n current elevation, description, and/or location information for **bench marks** n this map, please contact the Information Services Branch of the National c Survey at **(301) 713-3242** or visit its website at http://www.ngs.noaa.gov/.

ap information shown on this FIRM was provided in digital format by the Tennessee. This information was photogrammetrically compiled at scales of and 1"=400' from aerial photography.

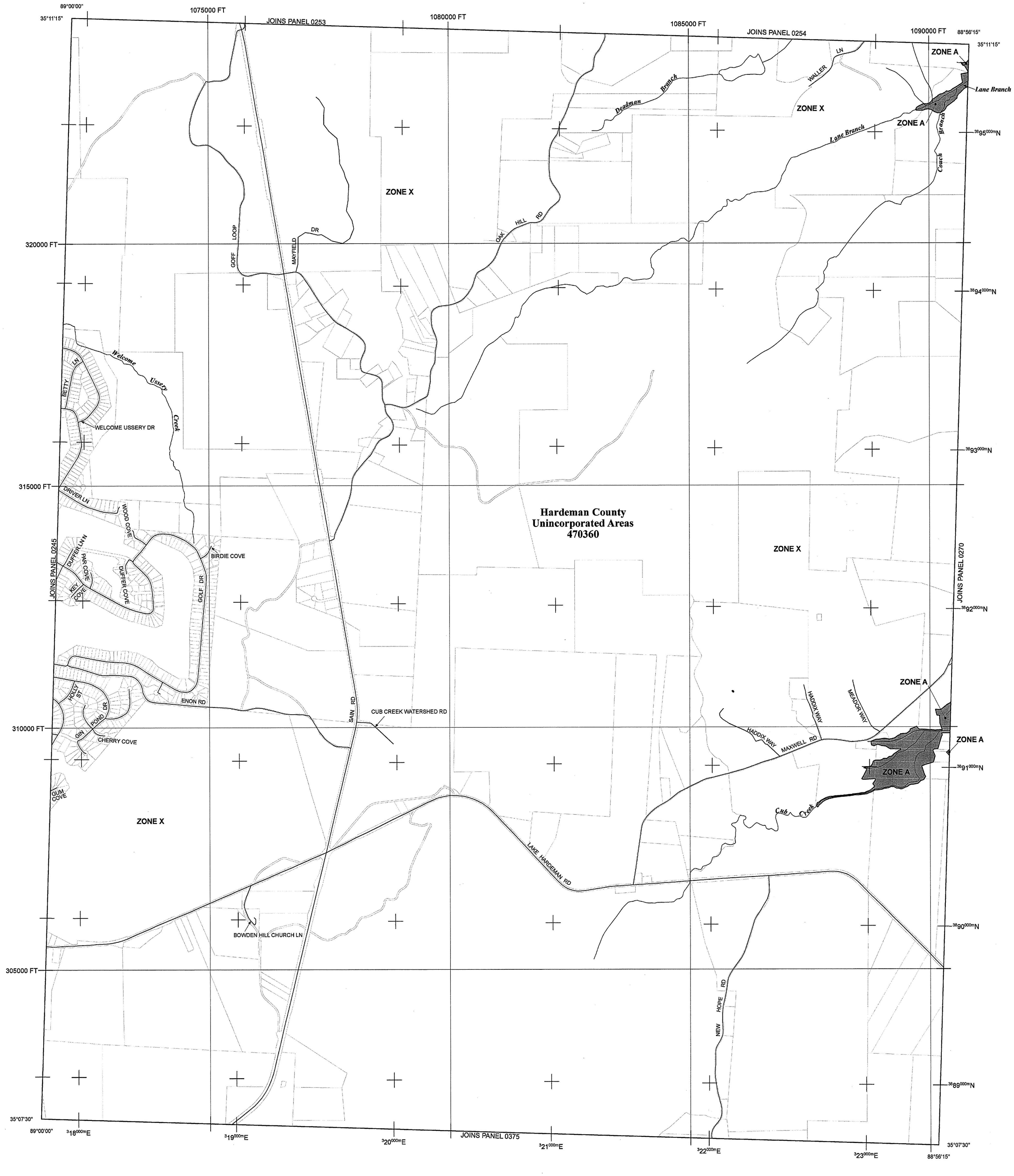
p reflects more detailed and up-to-date **stream channel configurations** se shown on the previous FIRM for this jurisdiction. The floodplains and ys that were transferred from the previous FIRM may have been adjusted to to these new stream channel configurations. As a result, the Flood Profiles odway Data tables *in the Flood Insurance Study report (which contains tive hydraulic data)* may reflect stream channel distances that differ from shown on this map.

te limits shown on this map are based on the best data available at the time cation. Because changes due to annexations or de-annexations may have after this map was published, map users should contact appropriate ity officials to verify current corporate limit locations.

efer to the separately printed **Map Index** for an overview map of the county the layout of map panels; community map repository addresses; and a f Communities table containing National Flood Insurance Program dates for mmunity as well as a listing of the panels on which each community is

the **FEMA Map Service Center** at 1-800-358-9616 for information on e products associated with this FIRM. Available products may include sly issued Letters of Map Change, *a Flood Insurance Study report,* and/or ersions of this map. The FEMA Map Service Center may also be reached by -800-358-9620 and its website at http://www.msc.fema.gov/.

ave **questions about this map** or questions concerning the National Flood ce Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or FEMA website at http://www.fema.gov/.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJE INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard in A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface eleva 1% annual chance flood.

ZONE A	No Base Flood Elevation determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); aver determined. For areas of alluvial fan flooding, velocities also determine
ZONE AR	Area of special flood hazard formerly protected from the 1% annual c event by a flood control system that was subsequently decertified. indicates that the former flood control system is being restored protection from the 1% annual chance of greater flood event.
ZONE A99	Areas to be protected from 1% annual chance flood event by a Fe protection system under construction; no Base Flood Elevations determi
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be encroachment so that the 1% annual chance flood can be carried without substantial flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood w depths of less than 1 foot or with drainage areas less than 1 squar areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Are

Floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of di Flood Elevations, flood depths or flood velocities.

~~ 513 ~~~	Base Flood Elevation line and value; elevation in feet
(EL 987)	Base Flood Elevation value where uniform within zon in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

(A)——(A)	Cross section line
(23)- - - -(23)	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North Datum of 1983 (NAD 83), Western Hemisphere
$^{42}75^{000m}$E	1000-meter Universal Transverse Mercator grid ticks,
6000000 FT	5000-foot grid values: Tennessee State Plane coordi (FIPSZONE = 4100), Lambert projection
DX5510 ×	Bench mark (see explanation in Notes to Users se FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP

SEPTEMBER 28, 2007

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Com History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance a the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 500 1,000 1,500 2,000 FEET
300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0265C

FIRM

FLOOD INSURANCE RATE

HARDEMAN COUN

TENNESSEE

AND INCORPORATED AI

PANEL 265 OF 500

(SEE MAP INDEX FOR FIRM PANEL

CONTAINS:

COMMUNITY	NUMBER	PAN
HARDEMAN COUNTY	470360	026

Notice to User: The **Map Number** shown below sho when placing map orders; the **Community Number** should be used on insurance applications for community.

U.S. DEPARTMENT OF HOMELAND SECURITY

MAP NU
47069C

EFFECTIVE
SEPTEMBER 2

Federal Emergency Managemen

APPENDIX E: USFWS IPAC REPORT

IPaC Information for Planning and Consultation **U.S. Fish & Wildlife Service**

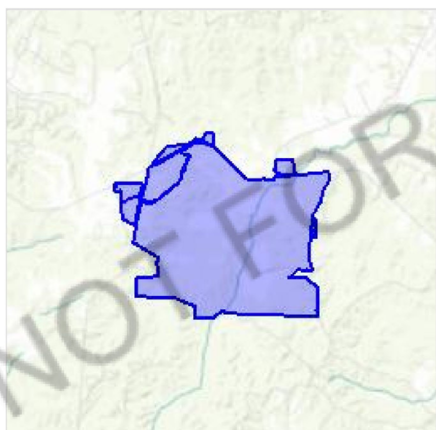
IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Hardeman County, Tennessee



Local office

Tennessee Ecological Services Field Office

(931) 528-6481
(931) 528-7075

446 Neal Street
Cookeville, TN 38501-4027

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species

[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Indiana Bat Myotis sodalis There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat Myotis septentrionalis No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045	Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act

[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
American Kestrel Falco sparverius paulus This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Apr 1 to Aug 31
Kentucky Warbler Oporornis formosus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 20
Red-headed Woodpecker Melanerpes erythrocephalus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Wood Thrush Hylocichla mustelina This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

■ probability of presence ■ breeding season | survey effort – no data

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures and/or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the E-bird Explore Data Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER FORESTED/SHRUB WETLAND

- PFO1A

FRESHWATER POND

- PUBHh

LAKE

- L2UBHh

RIVERINE

- R4SBC
- R2UB3H
- R5UBH
- R2UBHx

A full description for each wetland code can be found at the National Wetlands Inventory website

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

APPENDIX F: LAND USE RESTRICTIONS

TEMPLATE FOR STATE LAND

This instrument prepared by:
Tennessee Department of Environment and Conservation
Division of Water Resources
Attn: ________________________
312 Rosa L. Parks Ave., 10th Floor
Nashville, Tennessee 37243

STATE OF TENNESSEE
COUNTY OF ______________

NOTICE OF LAND USE RESTRICTIONS
(“*[Add Property Name]*”)

Notice is hereby given that, pursuant to their respective authorities found at Tennessee Code Annotated (“T.C.A.”) § 68-212-225 and 33 Code of Federal Regulations (“C.F.R.”) § 332.7(a), the Commissioner of the Tennessee Department of Environment and Conservation (“TDEC”) and the ____________ District Engineer of the United States Corps of Engineers (“USACE”) determined that land use restrictions are appropriate for the protection of streams and wetlands, or for other environmental conservation purposes, at the below-described property. Pursuant to T.C.A. § 68-212-225(d) the register of deeds shall record this Notice of Land Use Restrictions (“Notice”) and index it in the grantor index under the name of the owner of the property.

WITNESSETH:

WHEREAS, to its actual knowledge, State of Tennessee (“Owner”) is the sole owner in fee simple of approximately ______ acres of real property described in a deed of record with the ________ County, Tennessee Register of Deeds, Book ______, Page _____ *[or Instrument Number]* (“Property”), and as more particularly described in the legal description attached as **Exhibit A** and incorporated herein by reference;

WHEREAS, the Property is shown on a survey drawn by _________ dated ___________, attached hereto as **Exhibit B** and incorporated herein by reference;

WHEREAS, the Property possesses natural resources with significant aquatic, ecological and habitat values (“Conservation Values”). These natural resources are of aesthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people. These values include Waters of the United States, as defined in 40 C.F.R § 122.2 and 33 C.F.R. Part 328, and Waters of the State, as defined in T.C.A. § 69-3-101, *et seq*., including streams, wetlands and the adjacent uplands, and other native vegetation and wildlife. These natural resources are of great importance to USACE, TDEC and Owner;

WHEREAS, the Property has been approved by USACE for use as compensatory mitigation pursuant to and as defined in 33 C.F.R. Part 332;

WHEREAS, the Property is managed by the *[Insert Department Name and Abbreviation]* on behalf of the Owner; however the *[Insert Department Name and Abbreviation]* is constructing and managing the approved mitigation project on behalf of the Owner;

WHEREAS, the Property is identified as being occupied by, or as being potential habitat for species of native plants and wildlife, which Owner desires to establish, preserve, protect, restore, and enhance;

WHEREAS, on or about _______________, the Commissioner of TDEC issued Aquatic Resource Alteration Permit Number _____________ ("ARAP") to ______________, incorporated herein by reference;

WHEREAS, on or about _______________, the __________ District Engineer of the USACE issued Department of the Army Permit Number _______________ ("DA Permit") pursuant to Section 404 of the Clean Water Act to _____________, incorporated herein by reference;

WHEREAS, the ARAP and DA Permit, and any modifications thereto, authorize certain activities which could affect wetlands or other surface waters in or of the State of Tennessee;

WHEREAS, the ARAP and DA Permit and approval of the Property for use as mitigation requires that certain uses of the Property be restricted; and,

WHEREAS, the purpose of this Notice is to ensure that the Property will be retained forever in an open space condition and to prevent any use of the Property that will impair or interfere with the Conservation Values. Owner intends that this Notice (i) will assure that the Property will be used for such activities that are consistent with the purpose of this Notice, and (ii) shall be implemented consistent with the ARAP and DA Permit.

NOW, THEREFORE, in consideration of the foregoing, Owner hereby declares that the Property shall be held, sold, and conveyed subject to the following land use restrictions. Said land use restrictions shall run with the land and shall be binding on all parties having any right, title, or interest in the Property or any part thereof, their heirs, successors, successors-in-title, and assigns, and shall inure to the benefit of each owner thereof and to TDEC and USACE and the respective successors and assigns of such parties:

Land Use Restrictions: Any activity on or use of the Property inconsistent with the purpose of this Notice is prohibited. Without limiting the generality of the foregoing, the following activities and uses are expressly prohibited in, on, over, or under the Property.

1) **Destruction or Alteration.** There shall be no destruction or alteration of the Property described in this Notice other than those alterations authorized by TDEC under the ARAP and by USACE under the DA Permit.

2) **Livestock.** Livestock shall not be permitted to graze, inhabit, or otherwise enter the Property.

3) **Uses**. There shall be no commercial or industrial activity undertaken or allowed; nor shall any right of passage across or upon the Property be allowed or granted if that right of passage is used in conjunction with commercial or industrial activity.

4) **Vegetation**. There shall be no removal, destruction, cutting, or spraying with biocides or other agrichemicals of any vegetation, nor any disturbance or change in the natural habitat in any manner, excepting activities (*e.g.*, invasive species eradication and access road upkeep) that are essential to the maintenance of the Property as a protected natural area. There shall be no planting or introduction of any vegetation, except as described in the ARAP or DA Permit.

5) **Topography**. Except as permitted under the ARAP or DA Permit, there shall be no filling, excavating, dredging, mining, drilling, removal of topsoil, sand, gravel, rock, minerals or other materials, any dumping of ashes, garbage, or of any other material not required for the Property's maintenance as a protected natural area, nor granting or authorizing surface entry to the Property for any of these purposes, and no changing of the topography of the land in any manner, excepting activities (*e.g.*, wetland restoration, restorative streambank grading) that are essential for the management of the Property as a protected natural area.

6) **Building**. There shall be no construction or placing of buildings, mobile homes, advertising signs, billboards, or other structures, or additions or improvements to existing structures, excepting notice signs as required by the ARAP or DA Permit.

7) **Roads**. Except as permitted under the ARAP or DA Permit, there shall be no building of new roads or any other rights of way, nor widening of existing roads or rights of way, excepting access routes and trails required for the management of the Property as a natural area.

8) **Waters**. Except as permitted under the ARAP or DA Permit, there shall be no draining, ditching, diking, dredging, channelizing, damming, pumping, impounding, water withdrawals, or underground injection wells; no changing the grade or elevation, impairing or diverting the flow or circulation of waters, or reducing the reach of waters; and no other discharge or activity requiring

a permit under applicable clean water or water pollution control laws and regulations, as amended.

9) **Resources**. There shall be no transfer, encumbrance, sale, lease, or other conveyance of the mineral, air or water rights for the Property and any portion thereof separate from the surface rights, changing the place or purpose of use of the water rights, abandoning or allowing the abandonment of, by action or inaction, any water or water rights, ditch or ditch rights, spring rights, reservoir or storage rights, wells, ground water rights, or other rights in and to the use of water historically used on or otherwise appurtenant to the Property, including, but not limited to, (i) riparian water rights, (ii) appropriative water rights, (iii) rights to waters secured under contract with any irrigation or water district, to the extent such waters are customarily applied to the Property, and (iv) any water from wells that exist or may be constructed in the future on the Property.

10) **Vehicles**. There shall be no operation of dune buggies, motorcycles, or any recreational all-terrain vehicles, or any other types of motorized vehicles, excepting work vehicles (*e.g.*, tractors, backhoes, work trucks) required to maintain the Property as a protected natural area.

11) **Non-Native/Exotic Species.** There shall be no introduction of non-native or exotic species to the Property.

12) **Subdivision**. There shall be no legal or de facto division, subdivision, partitioning, or any other division of the Property.

13) **General.** There shall be no use of the Property which may adversely affect the purpose of this Notice or that violates or fails to comply with relevant federal, state, or local laws, regulations, or policies applicable to Owner, the Property, or the use or activity in question.

Other Provisions:

14) **Entrance and Inspection.** USACE and TDEC shall have the right to enter and inspect the Property and may enforce this Notice by means of a civil action.

15) **Enforcement.** Owner grants USACE and TDEC, as third party beneficiaries hereof, a discretionary right to enforce these land use restrictions in a judicial action against any person or other entity violating or attempting to violate these land use restrictions; provided, however, that no violation of these land use restrictions shall result in forfeiture or reversion of title. In any enforcement action, an enforcing agency shall be entitled to complete restoration for any violation, as well as any other remedy available under law or equity, such as injunctive relief and administrative, civil or

criminal penalties. No omission or delay in acting by USACE or TDEC shall bar subsequent enforcement rights or constitute a waiver of any enforcement right. These enforcement rights are in addition to, and shall not limit, enforcement rights available under other provisions of law or equity, or under any applicable permit or certification. Nothing herein shall limit the right of USACE and TDEC to modify, suspend, or revoke the DA Permit or ARAP, respectively. Nothing herein shall be construed to authorize USACE or TDEC to institute proceedings against the Owner for changes to the Property due to acts of God, natural disasters, or unauthorized acts of third parties outside the control of Owner so long as the compensatory mitigation has been completed and determined by the USACE and TDEC to be successful in accordance with the ARAP and DA Permit.

16) **Costs of Ownership**. Owner retains all responsibilities and will bear all costs and liabilities of any kind related to the ownership, operation, upkeep, and maintenance of the Property, including the maintenance of adequate liability insurance coverage. Owner remains solely responsible for obtaining any applicable governmental permits and approvals required for any activity or use permitted by this Notice. Owner agrees that neither USACE nor TDEC have any duty or responsibility for the operation, upkeep or maintenance of the Property, the monitoring of hazardous conditions on it, or the protection of Owner, the public, or any third parties from risks related to conditions on the Property.

17) **Filing**. Owner will record or cause this Notice to be recorded in the official land records of the Register of Deeds of ________ County, Tennessee, as soon as practicable after execution of this instrument, and will provide USACE and TDEC a copy of the recorded instrument within thirty (30) days of recordation.

18) **Term**. This Notice shall run with and bind the Property in perpetuity unless/until this Notice shall be made less stringent or canceled as set forth under the paragraph entitled “Amendment and Termination.”

19) **Amendment and Termination.** This Notice may only be waived, amended, modified, or terminated for cause by and upon the agreement of both the Commissioner of TDEC and ___________ District Engineer of USACE. No amendment to this Notice shall be effective until such amendment or instrument terminating this Notice is recorded in the Register of Deeds Office for _____________ County, Tennessee. Additional compensatory mitigation may be required for impacts resulting from the amendment.

20) **Modifications**. *[Insert Department Abbreviation(s)]* must provide sixty (60) days notice to TDEC and USACE prior to any action being taken that serves to void, modify, amend, or terminate this Notice.

21) **Severability.** Invalidation of any of these covenants or restrictions by judgment or court order shall in no way affect any other provisions, which shall remain in full force and effect.

22) **Title**. If any enforceable easement, right, interest, or lease on or to the Property, whether or not listed on **Exhibit C** (prepared after a review of the land file held by the Department of General Services, and that held by *[Insert Department Abbreviation(s)]*, and a title search prepared by ____ dated ____), is exercised in such a manner that conflicts with or voids the uses of the Property set out in this Notice, then the *[Insert Department Abbreviation(s)]* will be responsible for providing alternative compensatory mitigation in such amounts and of such resource type and function as USACE and TDEC or any enforcer of this Notice reasonably determines in accordance with the ARAP and DA Permit.

23) **Transfer and Assignment.** Owner shall include the following notice on all deeds, mortgages, plats, or any other legal instrument used to convey any interest in the Property:

> NOTICE: This Property is subject to a Notice of Land Use Restriction dated [*insert date of Declaration*], recorded in the [*insert County name*] Register of Deeds Office on [*insert date recorded*] in Deed Book [*insert number*], Page [*insert number*] *[or Instrument Number,]* and enforceable by the Tennessee Department of Environment and Conservation and U.S. Army Corps of Engineers.

Owner shall provide USACE and TDEC with written notice of any transfer sixty (60) days prior to such transfer. The notice shall include the name, address, and telephone number of the prospective transferee, a copy of the proposed deed or other documentation evidencing the conveyance, and a survey map that shows the boundaries of the Property being transferred. The new transferee will provide USACE and TDEC a letter acknowledging the terms and conditions of this Notice. Failure to comply with this paragraph does not impair the validity or enforceability of this Notice.

24) **Other Permits**. Any permit application, or request for certification or modification, which may affect the Property, made to any governmental entity with authority over Waters of the United States or Waters of the State, must expressly reference and include a copy, with the recording stamp, of the terms of this Notice.

25) **Jurisdictional Waters**. The Property will remain protected even though it may later be determined, through case law decisions or otherwise, not to have jurisdictional Waters of the United States.

26) **General Disclaimer**. USACE, including its employees, agents, and assigns disclaim and will not be held responsible for Owner's negligent acts or omissions or Owner's breach of any representation, warranty, covenant, or agreements contained in this Notice, or violations of any federal, state, or local laws, including all environmental laws including, without limitation, those that give rise to liabilities, claims, demands, losses, expenses, damages, fines, fees, penalties, suits, proceedings, actions, costs of actions, or sanctions asserted by or on behalf of any person or governmental authority, and other liabilities (whether legal or equitable in nature and including court costs) to which Owner may be subject or incur relating to the Property.

27) **Notification.** Any notice, request for approval, or other communication required by these land use restrictions shall be sent by registered mail, pre-paid postage, to the following addresses (or such addresses as may be hereinafter specified by notice pursuant to this paragraph):

To Owner: State of Tennessee
Insert name and contact information for agency primarily responsible for managing the property

With copy to:
Insert name and contact information for agency responsible for managing the mitigation project

To USACE: U.S. Army Corps of Engineers
Attn: Regulatory Division Chief

For Nashville District:
3701 Bell Road
Nashville, Tennessee 37214

For Memphis District:
167 North Main, Room B-202
Memphis, Tennessee 38103-1894

To TDEC: TDEC, Division of Water Resources
Attn: Natural Resources Unit
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243

IN WITNESS WHEREOF, *[Insert Department Name(s)]* on behalf of the State of Tennessee has caused this Notice of Land Use Restriction to be executed by its duly authorized representative(s) on this the ______ day of _______________, 20__.

[Insert Agency Name Primarily Responsible for Managing the Property]

By: ___________________________

Name: _________________________

STATE OF TENNESSEE
COUNTY OF _______________

Personally appeared before me, the undersigned Notary Public having authority within the aforesaid State, _______________ *[Insert Name]*, with whom I am personally acquainted (or proved to me on the basis of satisfactory evidence), and who acknowledged that he/she executed the within instrument for the purposes therein contained, and who further acknowledged that he/she is the ____________ *[Insert Title]* of the _______________ *[Insert Department Name]*.

WITNESS my hand, at office, this _______day of _________________, 20___.

____
Notary Public

My Commission Expires: _______________

[Insert Agency Name Responsible for the Mitigation Project]

By: ___________________________

Name: _________________________

STATE OF TENNESSEE
COUNTY OF ______________

Personally appeared before me, the undersigned Notary Public having authority within the aforesaid State, ______________ *[Insert Name]*, with whom I am personally acquainted (or proved to me on the basis of satisfactory evidence), and who acknowledged that he/she executed the within instrument for the purposes therein contained, and who further acknowledged that he/she is the ___________ *[Insert Title]* of the ______________ *[Insert Department Name]*.

WITNESS my hand, at office, this _______day of ________________, 20___.

____
Notary Public

My Commission Expires: ______________

Acknowledged By:

Tennessee Department of General Services

By: _________________________

Name: _______________________

Title: Commissioner

Exhibits should be on separate pages attached to this document.

EXHIBIT A – LEGAL DESCRIPTION

EXHIBIT B – SURVEY OF PROPERTY

EXHIBIT C – TITLE ENCUMBRANCES

APPENDIX G: PHASE I CULTURAL RESOURCE ASSESSMENT REPORT

PHASE I ARCHAEOLOGICAL SURVEY FOR THE PROPOSED LONE OAKS FARM SHOOTING RANGE, HARDEMAN COUNTY, TENNESSEE

By Howard J. Haygood and Howard J. Cyr

Prepared for:
Tony Hopson, Director
University of Tennessee
Capital Projects
Knoxville, Tennessee 37996

Lead Agency:
Tennessee Division of Archaeology
State Permit No. 000882

Michael G. Angst, Archaeologist-in-General Charge
Howard J. Cyr, MS, Archaeologist-in-Direct-Charge

Archaeological Research Laboratory
University of Tennessee
Department of Anthropology
Room 237, Middlebrook Building
Knoxville, Tennessee 37996-0060
Phone: (865) 946-1882
Fax: (865) 946-1883

September 2016

MANAGEMENT SUMMARY

From August 8 to August 12, 2016 the University of Tennessee's (UT) Archaeological Research Laboratory (ARL) carried out a Phase I archaeological investigation for the proposed shooting range at the Lone Oaks Farm in Hardeman County, Tennessee. Lone Oaks Farm is administered by the UT Extension, a unit of the University of Tennessee Institute of Agriculture (UTIA). The area of potential effect (APE) encompasses 33.3 hectares (82.3 acres) within the 485.6 hectares (1200 acres) farm. The goal of the Phase I archaeological survey was to identify all archaeological properties within the APE and provide recommendations with regard to National Register of Historic Places (NRHP) eligibility.

Prior to the initial fieldwork, an investigation of historic maps and Tennessee archaeological site files was carried out to identify potential historic structures and previously recorded archaeological sites within the APE. No previously recorded sites are located within the APE. An examination of the USGS Hebron quadrangle, surveyed in 1950 and printed in 1981, identified three structures depicted within the southwestern portion of the APE. These locations were examined via archaeological excavation and transect based pedestrian survey.

The field investigation employed two specific methodologies based on topographic characteristics. Areas exhibiting greater than 10 percent slope were visually inspected with archaeologists spaced at 30-m intervals. Areas exhibiting less than 10 percent slope were tested using shovel test pits (STPs) spaced at 30-m intervals. The location of each STP was digitally mapped prior to fieldwork using the fishnet function in ArcGIS 10.4. The data were then transferred to a Trimble Geo7X global positioning system (GPS) capable of sub-meter accuracy. Using the GPS, STP locations were then marked within the APE. STPs measured 30-cm in diameter and were excavated to sterile subsoil. All fill was screened through 0.25-in mesh screen. Detailed descriptions of the encountered soils were recorded on standardized ARL STP forms. When artifacts were encountered, additional STPs were placed at 15-m intervals to the north, south, east, and west of the positive STP. Artifacts recovered during the Phase I archaeological survey were collected, bagged, and returned to the ARL for further analysis.

STPs revealed a thin topsoil layer overlying undisturbed subsoil. No buried surfaces were detected in any of the shovel test probes. A total of 191 STPs were excavated during the Phase I survey, seven (7) of which contained historic archaeological material. Of the positive STPs, three (3) were within the initial 30-m grid and four (4) were 15-m radials. All artifacts found were late historic/early modern. Recovered artifacts include fencing wire, cut and wire nails, scraps of flat metal, bottle glass fragments, and whiteware ceramic fragments. All artifacts were recovered from the topsoil layer (i.e. within the upper 10-cm of the modern surface). While historic artifacts were recovered, no historic structures or features were identified during this survey.

Based on the results of the investigations, ARL recommends no further archaeological testing for the proposed Lone Oaks Farm shooting range installation and that the project should be allowed to proceed as planned.

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INTRODUCTION

At the request of Tony Hopson of the Department of Capital Projects at the University of Tennessee, the Archaeological Research Laboratory (ARL) at The University of Tennessee (UT) conducted a Phase I archaeological investigation for the proposed shooting range at the Lone Oaks Farm in Hardeman County, Tennessee (Figure 1). Since the project is on State of Tennessee property, ARL applied for and received a state permit for archaeological work. The work was conducted under Archaeological Permit No. 000882.

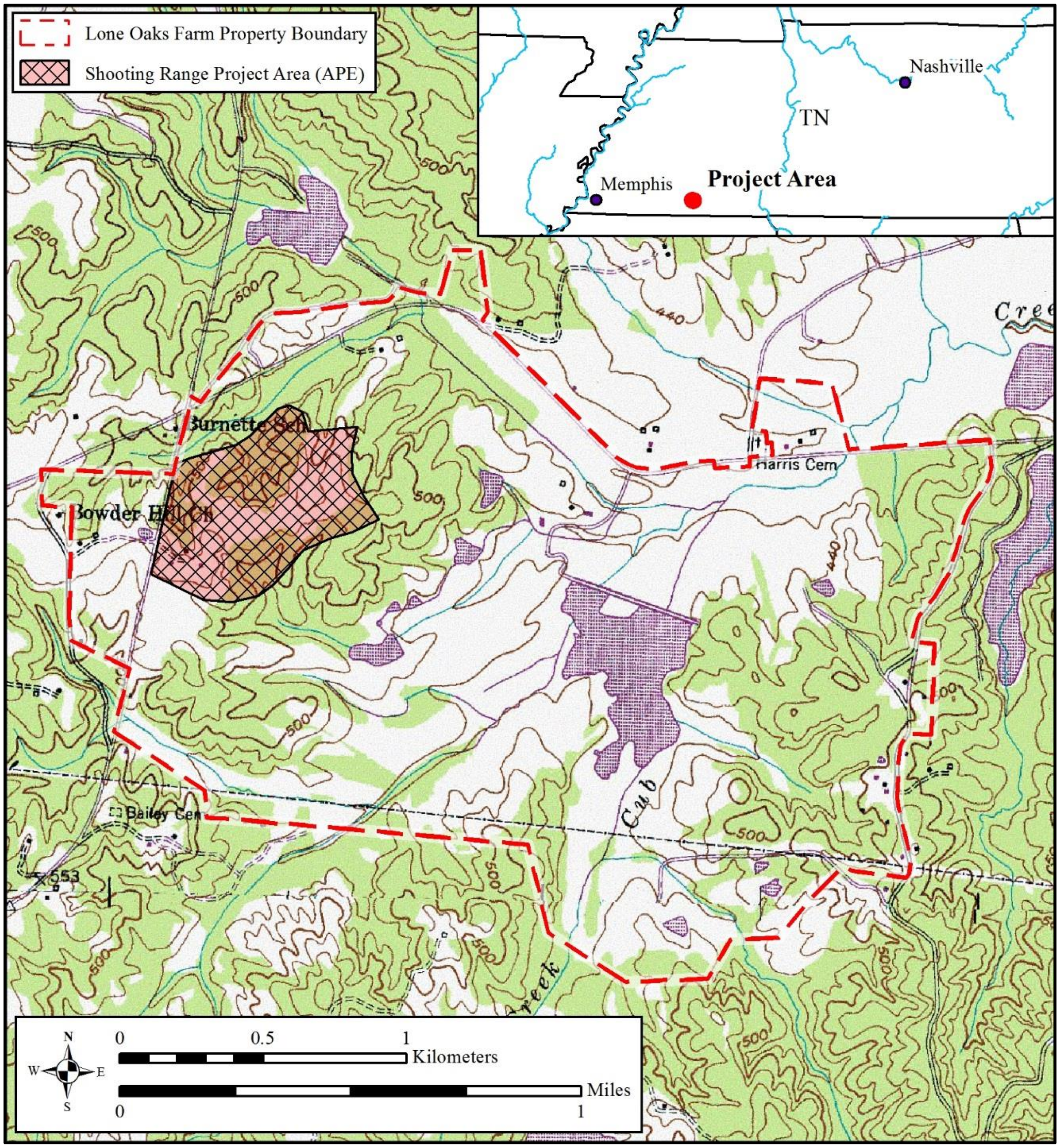

Figure 1. Lone Oaks Farm area of potential effect (APE) within the Lone Oaks property boundary (Base map: Hebron 7.5’ Quadrangle, USGS 1981).

The area of potential effect (APE) encompasses 33.3 hectares (82.3 acres) within the 485.6 hectares (1200 acres) farm. The project area occupies a small upland plateau and bordered by deeply dissected gullies. The western extent of the APE is delineated by Sain Road. The east and south margins largely follow modern gravel trails. The north edge of the project area is approximately 0.2-km south of Lake Hardeman Road.

The purpose of the Phase I archaeological survey was to identify all archaeological properties within the APE and provide recommendations with regard to National Register of Historic Places (NRHP) eligibility. The investigation fulfills the obligations outlined in the scope of work proposed by ARL as well as those outlined in Section 106 of the National Historic Preservation Act (16 U.S.C. 470f, 36 CFR part 800). Michael G. Angst served as Principal Investigator (Archaeologist-in-General-Charge) for the project; Howard J. Cyr served as Field Director (Archaeologist-in-Direct-Charge) and Geoarchaeologist; Charles Cianciolo, Lindsey Cochran, and Howard Haygood served as archaeological technicians.

ENVIRONMENTAL SETTING

Howard J. Cyr and Michael G. Angst

PHYSIOGRAPHY AND GEOLOGY

Lone Oaks Farm is located in the East Gulf Coastal Plain section of the Coastal Plain province. In general, the area is characterized by broad undulating upland plateaus, highly dissected upland slopes, and flat bottom lands. The underlying geology consists of irregularly bedded sand of the Claiborne formation locally interbedded with lenses and beds of gray to white clay and silty clay (Hardeman 1966).

The geomorphology of the immediate project area is characterized by a rolling upland plateau bordered to the north and south by deeply incised drainages (Figure 2). These drainages are broad, severely eroded, and heavily forested with side slopes ranging between 10 and 30 degrees.

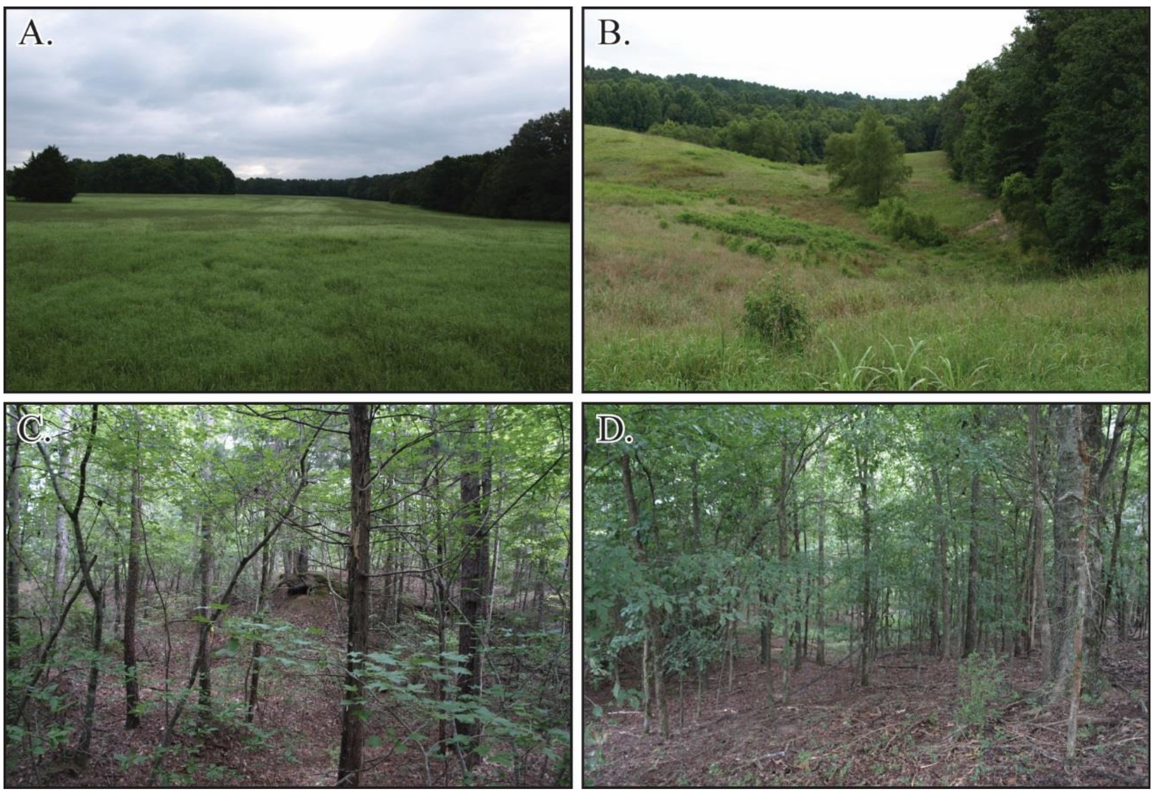

Figure 2. A. Rolling upland plateau at the center of the APE (view to the northwest); B. Deeply incised drainage located in the north-central portion of the APE (view to the north); C and D. Steep slopes and deep gullies characterizing the forested drainages (views to the north and the south).

SOILS

Modern soil characteristics within the project area closely reflect the local geomorphology and erosion patterns. The soil within the upland plateau is represented by the Lexington-Providence series. Located within well to moderately drained severely eroded upland ridgetops and side slopes, the Lexington-Providence series consists of a thin brown, mottled, silt loam surface horizon underlain by a strong brown silty clay loam subsoil (Thomas 1997). Soil within the deeply eroded gullies and drainages are represented by the Smithdale loam soil series. Occurring along steeply sloped hillsides with a high erosion potential and high runoff rate, soils within the Smithdale series consist of a very shallow and highly eroded surface horizon, characterized as a reddish brown, mottled, loam, underlain by a yellowish red, sandy clay loam (Thomas 1997).

The soil profiles exposed in the shovel test probes correspond well with the reported soil series. STPs from the upland survey area are within the reported extent of the Lexington-Providence soil series. These STP soil profiles consist of a very thin (2 to 5-cm thick), mottled brown, silt loam A horizon overlying an eroded yellowish brown, silty clay loam subsoil (B) horizon (Figure 3). The soil is heavily eroded with little remaining of the historic A horizon. The degree of soil erosion possibly resulted from historic and early modern cotton farming in the area.

Figure 3. Representative upland STP soil profiles characteristic of the Lexington-Providence soil series. Note the very thin surface horizon and well-weathered subsoil horizon.

Profile exposures within the gullied areas revealed a thin (2-cm thick), grayish brown, organic-rich, silty loam A horizon overlying eroded subsoil. Neither soil profiles from the upland plateau section nor the gullied areas contained buried surface soils. The eroded subsoil exposed in both areas represent well-weathered residuum.

FLORA

The study area falls near the border of the Carolinian and Austroriparian biotic provinces. The Carolinian province is characterized by a richly diversified hardwood forest. The climate is under cyclonic control year round and the temperature and humidity levels fluctuate frequently. Precipitation is adequate to support the hardwood forests with most falling in the fall and winter. The Austroriparian province covers much of the Southeast, is characterized by pine and hardwood forests, and contains numerous swamps and marshes. Mild winters and hot, humid summers typify the province and precipitation is moderately heavy. Climax vegetation is hardwood forest, but much of the uplands are covered by subclimax pine forest. Oaks, magnolias and hickories are the most important trees of the upland hardwood forests, while gums and cypresses dominate the swamps (Dice 1943:16-20).

Braun (2001) classifies the area as part of the Mississippi Embayment Section of the Western Mesophytic Forest Region. The difference is in name only, however. The native vegetation "displays a mosaic of unlike vegetation types, of prairie, oak-hickory forest, swamp forest and mixed mesophytic communities" (Braun 2001:157).

Oak-hickory forest occupied much of the rolling to moderately dissected uplands in the northern section of the biotic province. White oak (*Quercus alba*) is generally abundant and becomes dominant in ravines and between knolls. Southern red oak (*Q. falcata*) typically dominates on low hills. Several other species, including post (*Q. stellata*), blackjack (*Q. marilandica*), black (*Q. velutina*), and chinquapin (*Q. muehlenbergii*) oaks occur. Hickories (*Carya* spp.) are present throughout, but in variable amounts and species. Tuliptree (*Liriodendron tulipifera*) is frequent in white oak communities. To the south, yellow pine (*Pinus* spp.) mixes with the oaks, especially in strongly dissected and sandy areas, marking the transition into the Oak-Pine region. The understory of the oak-hickory forest includes young members of the canopy species, along with dogwood (*Cornus florida*), wild black cherry (*Prunus* sp.), winged elm (*Ulmus alata*), sour gum (*Nyssa sylvatica*), persimmon (*Diospyros virginiana*), mulberry (*Morus* spp.), white ash (*Fraxinus americana*), sassafras (*Sassafras albidum*), and sometimes holly (*Ilex* spp.). Shrubby species include Devil's walkingstick (*Aralia spinosa*), elderberry (*Sambucus canadensis*), American hazelnut (*Corylus americana*), upland swampprivet (*Forestiera ligustrina*), coralberry (*Symphoricarpos orbiculatus*), poison ivy (*Rhus radicans*) and Virginia creeper (*Parthenocissus quinquefolia*) (Braun 2001).

In Kentucky, northern Tennessee and portions of northern Mississippi, prairie areas or "barrens" were frequent, but are now mostly in cultivation. They were somewhat similar to the barrens on the Highland Rim (surrounding the Nashville Basin) (Braun 2001).

The broad alluvial valleys are occupied by swamp forests. Principal tree species include willow oaks (*Quercus phellos*), chestnut oaks (*Q. prinus*), pin oaks (*Q. palustris*), overcup oaks (*Q. lyrata*), water oaks (*Q. nigra*), downy poplars (*Populus heterophylla*), cottonwoods (*P. deltoides*), white elms (*Ulmus americana*), winged elms (*U. alata*), hackberries (*Celtis laevigata*), river birches (*Betula nigra*), pecans (*Carya illinoinensis*), sycamores (*Platanus occidentallis*), red maples (*Acer rubrum*), silver maples (*A. saccharinum*), boxelders (*A. negundo*), sweetgums (*Liquidambar styraciflua*), black willows (*Salix nigra*) and bald cypress (*Taxodium distichum*). These swamp forests are extensions of the forests of the Mississippi River alluvial plains and merge with them on the western edge of the section (Braun 2001).

FAUNA

Mammals of the Tennessee Coastal Plain include opossums (*Didelphis virginiana*), shrews (*Sorex longirostris*, *Cryptotis parva*, *Blarina carolinensis*), and eastern moles (*Scalopus aquaticus*). Numerous bat species occur, including little brown bats (*Myotis lucifugus*), southeastern bats (*M. austroriparius*), gray bats (*M. grisescens*), Keen's bat (*M. keenii*), Indiana bats (*M. sodalis*), small-footed bats (*M. leibii*), eastern pipistrelles

(*Pipistrellus subflavus*), big brown bats (*Eptesicus fuscus*), red bats (*Lasiurus borealis*), hoary bats (*Lasiurus cinereus*), evening bats (*Nycticeius humeralis*), and Rafinesque's big-eared bats (*Plecotus rafinesqii*). Rodents include groundhogs (*Marmota monax*), eastern chipmunks (*Tamius striatus*), gray squirrels (*Sciurus carolinensis*), fox squirrels (*S. niger*), southern flying squirrels (*Glaucomys volans*), beaver (*Castor canadensis*), eastern woodrats (*Neotoma floridana*), cotton rats (*Sigmodon hispidus*), rice rats (*Oryzomys palustris*), eastern harvest mice (*Reithrodontomys humulis*), common deer mice (*Peromyscus maniculatus*), white-footed mice (*P. leucopus*), cotton mice (*P. gossypinus*), golden mice (*Ochrotomys nuttalli*), prairie voles (*Microtus ochrogaster*), woodland voles (*Microtus pinetorum*), muskrats (*Ondatra zibethicus*), and meadow jumping mice (*Zapus hudsonius*). Other mammals include eastern cottontail (*Sylvilagus floridanus*), swamp rabbit (*S. aquaticus*), black bear (*Ursus americanus*), raccoon (*Procyon lotor*), minks (*Mustela vison*), long-tailed weasels (*Mustela frenata*), striped skunks (*Mephitis mephitis*), eastern spotted skunks (*Spilogale putorious*), river otters (*Lutra canadensis*), red foxes (*Vulpes vulpes*), gray foxes (*Urocyon cinereoargenteus*), red wolves (*Canis rufus*), cougar (*Felis concolor*), bobcats (*Lynx rufus*), white-tailed deer (*Odocoileus virginianus*), elk (*Cervus canadensis*), and bison (*Bison bison*) (Brown 1997; Kellogg 1939).

Coyotes (*Canis latrans*) are commonly thought to be native to the U.S. Southwest, not entering the region until the early twentieth century (Brown 1997:165-166; Kellogg 1939:267). The adaptive nature of coyotes makes it much more likely that they were native to the Southeast, but extirpated very early in the Historic period. Some researchers feel that coyotes are native to the entire Nearctic region (Tokar 2001), and are probably now simply reclaiming old territory. Wild boar (*Sus scrofa*) may have been introduced as early as the 1500s with Spanish explorers. European or Russian wild boars were introduced to North Carolina, Tennessee and Georgia in 1912 (Brown 1997:181).

Water birds of the Coastal Plain included pied-billed grebe (*Podilymbus podiceps*), double-crested cormorant (*Phalacrocorax auritus*), herons (*Ixobrychus exilis*, *Ardea herodias*, *A. alba*, *Egretta caerulea*, *Butorides virescens*, *Nycticorax* spp.), Canada goose (*Branta canadensis*), ducks (*Aix sponsa*, *Anas* spp.), hooded merganser (*Lophodytes cucullatus*), American coot (*Fulica americana*), and others (Nicholson 1997; Roedel and Kennedy 2005).

Carrion eaters and birds of prey included vultures (*Coragyps atratus* and *Cathartes aura*), osprey (*Pandion haliaetus*), bald eagles (*Haliaeetus leucocephalus*), hawks (*Accipiter* spp. and *Buteo* spp.), falcons (*Falco* spp.), and owls (*Otus asio*, *Megascops asio*, *Bubo virginianus* and *Strix varia*). Game birds would have included at least ruffed grouse (*Bonasa umbellus*), wild turkey (*Meleagris gallapavo*), and northern bobwhite (*Colinus virginianus*). Additional birds included rails (*Rallus* spp.), American woodcock (*Scolopax minor*), mourning dove (*Zenaida macroura*), woodpeckers (*Melanerpes* spp. and *Dryocopus pileatus*), purple martin (*Progne subis*), blue jay (*Cyanocitta cristata*), common raven (*Corvus corax*), yellow-billed cuckoo (*Coccyzus americanus*), common nighthawk (*Chordeiles minor*), whip-poor-will (*Camprimulgus vociferus*), chickadees (*Poecile* spp.), tufted titmouse (*Baeolophus bicolor*), nuthatches (*Sitta* spp.), eastern bluebird (*Sialia sialis*), wood thrush (*Hylocichla mustelina*), American robin (*Turdus migratorius*), brown thrasher (*Toxostoma rufum*), vireos (*Vireo* spp.), warblers

(*Dencroica* spp., *Helmitheros* spp., *Seiurus* spp., *Opornis* spp., *Geothlypis* spp.), tanagers (*Piranga* spp.), northern cardinal (*Cardinalis cardinalis*), indigo bunting (*Passerina cyanea*), passenger pigeon (*Ectopistes migratorius*), and Carolina parakeet (*Conuropsis carolinensis*) (Nicholson 1997; Roedel and Kennedy 2005).

Other birds, such as killdeer (*Charadrius vociferus*), eastern kingbird (*Tyrannus tyrannus*), northern mockingbird (*Mimus polyglottos*), and some sparrows and finches were probably not as common prehistorically as they are today. These birds prefer open spaces and would have been limited to burned or cleared areas, such as prehistoric habitation sites or horticultural and agricultural plots (Nicholson 1997).

The Tennessee, Obion, and Mississippi rivers and their tributaries were rich with fish, including paddlefish (*Polyodon spathula*), sturgeon (*Acipenser fulvencens* and *Scaphirhynchus platorynchus*), varieties of gar (*Lepisosteus* sp.), grindel (*Amia calva*), herrings or shad (*Alosa* spp., *Pomolobus* spp., *Dorosoma* spp.), suckers (*Cycleptus elongates*, *Megastomatobus cyprinella, Ictiobus bubalus, Carpiodes* spp., *Erimyzon* spp., *Minytreme melanops, Moxostoma* spp., *Placopharynx carinatus, Lagochila lacera*), minnows (*Nocomis* spp., *Hybopsis* spp., *Erimystax* spp., *Extrarius aestivalis hyostomus, Rhinichthys* spp., *Semotilus atromaculatus, Hemitremia flammea, Clinostomus vandoisulus, Chrosomus erythrogaster, Opsopoedus emiliae, Notemigonus chrysoleucas, Notropis* spp., *Ericymba buccata, Phenacobius* spp., *Hybognathus nuchalis, Ceratichthys vigilax taurocephalus, Pimephales promelas, Hyborhynchus notatus, Campostoma anomalum*) catfish (*Ictalarus* spp., *Pilodictis olivaris, Ameiurus* spp., *Notorus flavus, Schilbeodes* spp.), western mud-minnow (*Umbra limi*), pickerel (*Esox* spp.), American fresh-water eel (*Anguilla bostoniensis*), topminnows (*Fudulus* spp.), mosquito fish (*Gambusia affinis*), pirate perch (*Aphredoderus sayanus*), white bass (*Lepibema chrysops*), yellow bass (*Morone interrupta*), black basses (subfamily Micropterinae), sunfish (subfamily Lepominae), pigmy sunfish (*Elassoma zonatum*), glassy minnow (*Medinia audens*), Brook silversides (*Labidesthes sicculus*), drum (*Aplodinotus grunniens*), and others (Kuhne 1939). Abundant freshwater mussels and freshwater and terrestrial gastropods have also been recorded (Bogan and Parmalee 1983; Parmalee and Bogan 1998).

Amphibians of the Coastal Plain include toads (*Bufo* spp.), treefrogs (*Hyla* spp., *Pseudacris* spp.), eastern narrowmouth toads (*Gastrophryne carolinensis*), eastern spadefoot toads (*Scaphiopus holbrookii*), true frogs (*Rana* spp.), mole salamanders (*Ambystoma* spp.), three-toed amphiuma (*Amphiuma tridactylum*), mudpuppies (*Necturus maculosus*), lungless salamanders (*Eurycea* spp., *Plethodon* spp.), eastern newts (*Notophthalmus viridescens*) and lesser sirens (*Siren intermedia*) (Duellman and Sweet 1999; Scott and Redmond 1996).

Reptiles of the Coastal Plain include turtles, lizards and snakes. Turtle genera and species include alligator snapping turtles (*Macrochelys temminckii*), eastern box turtles *(Terrapene carolina*), eastern mud turtles *(Kinosternon subrubrum*), eastern musk turtles (*Sternotherus odratus*), map turtles (*Graptemys* spp.), painted turtles (Chrysemys spp.), pond sliders (Trachemys scripta), river cooter (Pseudemys concinna), snapping turtles *(Chelydra serpentine*) and spiny softshells (Apalone spinifera). Lizards include green anoles (*Anolis carolinensis*), eastern fence lizards (*Sceloporus undulatus*), slender glass lizards (*Ophisaurus attenuatus*), six-lined racerunners (*Aspidoscelis sexlineatus*) and various skink species (*Plestiodon* spp., *Scincella lateralis*). Snakes include coachwhips (*Coluber flagellum*), common gartersnakes *(Thamnophis sirtalis)*, copperheads *(Agkistrodon contortrix)*, cottonmouths *(Agkistrodon piscivorus*), Dekay's brownsnake (Storeria dekayi), diamond-backed watersnake (Nerodia rhombifer), eastern hog-nosed snakes (Heterodon platirhinos), eastern ribbonsnakes (Thamnophis sauritus), eastern wormsnake (Carphophis amoenus), gray ratsnake *(Pantherophis spiloides*), Kirtlands snakes (Clonophis kirtlandii), milk and kingsnakes (Lampropeltis spp.), North American racers (Coluber constrictor), pinesnakes (Pituophis melanoleucus), red-bellied mudsnakes (Farancia abacura), red-bellied snakes (Storeria occipitomaculata), red cornsnakes (Pantherophis guttatus), ring-necked snakes (Diadophis punctatus), earthsnakes (Virginia spp.), rough greensnakes *(Opheodrys aestivus*), scarletsnakes (*Cemophora coccinea*), southeastern crowned snake (*Tantilla coronata*), timber rattlesnakes (*Crotalus horridus*) and watersnakes *(Nerodia* spp.) (Scott and Redmond 2008).

PREHISTORIC BACKGROUND

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Prehistoric occupation of the southeastern United States began with the migration of people into North America sometime during the final glacial episodes of the late Pleistocene; however, the specifics of this migration, including the exact dates and routes of travel, are a matter of ongoing research and debate. Archaeological and genetic evidence indicates that human occupation is likely to have occurred continuously for at least the last 12,000 years. Over this vast amount of time, major changes have taken place in settlement patterns, subsistence practices, technology, social organization, population density, and many other aspects of human behavior. The following discussion provides a general overview of human development in the region as documented in the archaeological record of western Tennessee and throughout the larger region of the American Southeast. Archaeological research on the Tennessee Gulf Coastal Plain has been somewhat limited. As a result, what is known or anticipated about the archaeology of the region is largely gathered from neighboring areas. Therefore, the following chronology borrows from the more intensively studied lower Tennessee River valley and its environs. The cultural chronology of the last 12,000 years of prehistoric human occupation has been organized into four major stages: Paleoindian, Archaic, Woodland, and Mississippian.

PALEOINDIAN STAGE (11,500 B.C.–8500 B.C.)

Throughout most of the eastern United States, evidence of Paleoindian occupation is generally identified by isolated, fluted point surface finds rather than intact cultural deposits. Paleoindian adaptation is characterized by small, highly mobile bands that moved across the landscape as preferred resources were depleted and new resources sought. Environmentally, the stage marks the end of the Late Glacial era, when sea levels were rising and the Gulf shoreline was transgressing towards its present position. Changing hydrologic regimes associated with the glacial retreat and increased precipitation at the end of the Pleistocene probably destroyed and deeply buried many of the Paleoindian sites along river valleys. Deeply buried sites on the Cumberland River, such as the Johnson-Hawkins site (40DV313) near Nashville and the Puckett site (40SW228) in north central Tennessee, tend to corroborate this suggestion. The Johnson-Hawkins site has yielded the earliest evidence of human occupation in Tennessee, a calibrated radiocarbon date of 11,700 +/- 980 BP from charcoal associated with Paleoindian artifacts (Broster and Norton 1996).

The most common diagnostic artifact of the Paleoindian period is the lanceolate-shaped, basally-ground projectile point such as the fluted and unfluted Clovis, Cumberland, and Redstone types (Anderson 1996). The Paleoindian tool kit also includes some bifacial and unifacial tools that have been found in association with Clovis projectile points (Williams 1957). Anderson's (1990, 1995a, 1995b) research on Paleoindian diagnostics in the Eastern Woodlands led him to subdivide this stage into three periods, designated Early (circa 10,500 to 8900 B.C.), Middle (circa 8900 B.C. to 8500 B.C.), and Late (circa

8500 B.C. to 8000 B.C.) (Anderson et al. 1996). This chronology is based primarily on changes in hafted biface morphology.

Archaeological evidence indicates that Early Paleoindians in the broader Southeast hunted some megafauna, including giant tortoise and mastodon, before these animals became extinct around 8800 B.C. (Anderson 1996:51). However, smaller game animals and plant foods were probably a more significant part of the Paleoindian diet (Chapman 1985a, 1985b; Hollenbach 2009; McNutt et al. 1975; Meltzer and Smith 1986; Walker et al. 2001; Walthall 1980). These include deer, wild turkeys, and waterfowl, as well as nuts, wild fruits, and seeds of weedy plants.

In the Gulf Coastal Plain of western Tennessee, Paleoindian occupations are characterized by isolated surface finds in the loess hills (Smith 1996). Surveys of drainages in the region have failed to locate additional evidence of Paleoindian occupation (Anderson et al. 1987) and the early portion of the prehistoric sequence is still poorly understood. Just to the east of the project area, the lower Tennessee River valley has one of the densest concentrations of Paleoindian artifacts in North America. According to the Paleoindian Database of the Americas (PIDBA), more Paleoindian artifacts have been recovered from the five counties along the lower Tennessee River in Tennessee (Benton, Humphreys, Houston, Henry and Stewart) than have been recorded in the remainder of the state (Anderson et al. 2010). These sites tend to be located on high terraces at the mouths of tributaries to the Tennessee River (Broster et al. 1996:1). While many of these sites are low density scatters or isolates, there are sites in the valley that appear to be repeatedly occupied. Broster and Norton (1996:291) note that eight sites in the Kentucky Lake region have produced over 100 Paleoindian artifacts. Analysis of collections from these sites suggests that many of them probably served as both quarry/workshops as well as base camps (Adair 1976; Ellerbusch 2004; Lewis and Kneberg 1958; McNutt and Graham 1967; McNutt et al. 2008; Norton and Broster 1992a, 2008). These sites tend to cluster within a number of river miles of the mouth of the Duck River as it empties into the Tennessee, and the abundance of high quality chert (Bradbury and Carr 2009) is undoubtedly an important draw. Jones et al. (2010) have classified a number of these sites as the Tennessee-Duck River Paleoindian Complex (TDRPC). Data from these related sites have been used to describe lithic resource use through the Paleoindian stage. Statistically significant patterns document a general decrease in raw material variability as well as an intensification of use of high-quality Dover chert from the Early to Late Paleoindian periods. Ongoing research (e.g., Ellerbusch 2004; Jones et al. 2010; McNutt et al. 2008), and in particular studies at the Carson-Conn-Short site (Broster and Norton 1996; Nami et al. 1996; Norton and Broster 2008; Stanford et al. 2006) in the Kentucky Lake region will add significant data on the Paleoindian period.

ARCHAIC STAGE (8500 B.C.–900 B.C.)

The Archaic stage is marked by a shift in material culture, undoubtedly associated with changes in the ecology of the region. As the glaciers moved northward with the end of the Pleistocene, the last of the North American megafauna reached extinction. Vegetation throughout the Midsouth shifted from patchy boreal forest/parkland environments to mesic oak-hickory forests and are believed to have been firmly established by about 8000

B.C. (Anderson and O'Steen 1992; Anderson et al. 1996). These environments would have provided a much more diverse resource base than that available in the previous 13,000 years. The result was a shift in available faunal and floral resources. Faunal remains from Stanfield-Worley bluff shelter and Russell Cave indicate white-tailed deer and turkey were the two major sources of meat. Squirrel remains were the most common species identified with raccoon and box turtle rounding out the list of the most commonly found animal remains (Chapman 1985a; Futato 1983; Parmalee 1962; Weigel et al. 1974). Hickory nuts and acorns were the most common plant remains from Stanfield-Worley and Dust Cave (Hollenbach 2009). The changes in available food resources were reflected by the shifts in material culture and settlement patterns. Technological changes are marked by the cessation of fluted point manufacture, and the development of numerous regional projectile point forms, as well as a variety of other specialized artifact types. A slightly more sedentary lifestyle is evidenced in the archaeological record by larger, more densely occupied sites. In general, the onset of the Archaic tradition is associated with the environmental changes that occurred at the terminal Pleistocene/early Holocene transition, and the corresponding shift in adaptive strategies employed by prehistoric populations.

The Archaic stage has been divided into three periods based largely on temporal changes in projectile point types: Early (circa 8500 B.C.–6000 B.C.), Middle (circa 6500 B.C.–3000 B.C.), and Late (circa 3000 B.C.–900 B.C.).

Early Archaic Period

The Early Archaic period (circa 8500 B.C.–6000 B.C.) coincides with the initiation of the Holocene epoch in the Southeast. Differing, sometimes imperceptibly, from Late Paleoindian period occupation trends, the seasonal dichotomy model has been promoted for much of the mid- and lower-Southeast. Anderson and Hanson (1988) elaborated on this model, suggesting that social organization included band- and macroband-level social systems. At the band level, groups of roughly 50 to 150 individuals would have been responsible for seasonal movements within a single drainage basin with some migration into portions of surrounding drainages. At selected seasonal intervals, gatherings of 500 to 1,500 people would have occurred, facilitating mating networks and economic and social interaction (Anderson 1996).

Early Archaic occupation in the lower Tennessee Valley continues to suggest a concentration of prehistoric peoples following the end of the Pleistocene. A pattern of occupation, similar to that suggested by Futato (1982) and Hubbert (1989) for the Paleoindian stage, is also suggested for the Early Archaic period. This pattern, based on seasonal habitation of upland and lowland areas, would have mirrored the seasonal availability of exploitable resources (Hollenbach 2009). These changes can be identified in the number of sites in both riverine and upland contexts and the density of artifacts. The continuity is also seen on sites in west Tennessee that have both substantial Paleoindian and Early Archaic occupations (e.g., Broster et al. 2006; McNutt et al. 2008; Norton and Broster 1992a, 1992b).

The chronological organization of data from Archaic complexes is the result of excavations of buried deposits in cave and rockshelter sites (DeJarnette et al. 1962; Driskell 1992, 1994, 1996; Griffin 1974; Sherwood et al. 2004), well-stratified open air sites predominantly situated in riverine environments (Cable 1996; Chapman 1977; Coe

1964; Davis 1990; Lewis and Lewis 1961), and surface collection from throughout the Southeast.

Evidence for the Early Archaic diet shows wide variability evidenced by the range of stone implements and faunal and ethnobotanical remains recovered from these sites. Grinding stones, butchering, and hide-working tools suggest a diversified subsistence pattern that included deer, bear, turkey, raccoon, squirrel, and opossum. Faunal remains from Dust Cave indicate a shift from a Late Paleoindian exploitation pattern heavy on the hunting of avifauna, including passenger pigeon and waterfowl, to a greater reliance on fish and terrestrial mammals during the Early Archaic (Walker 2000). Hickory nuts, acorns, and other nuts were increasingly exploited throughout the period as well (Chapman 1994:43–46; Yarnell and Black 1985). Hollenbach's (2009) examination of plant remains at four rockshelter sites in northwest Alabama showed relatively little change in the plant foods utilized between the Late Paleoindian and Early Archaic periods. Instead, she has highlighted the use of certain sites within different environments for specialized resource acquisition, including acorn, hickory nut, black walnut, hazel, and various fruits and seeds.

The material culture of the Early Archaic period is distinguished from the earlier Paleoindian by changes in PP/K forms. Beginning in about 10,000 BP, the PP/Ks became smaller, took on more triangular shapes as opposed to earlier lanceolate forms, and began to have notched bases. The diagnostic artifacts for the Early Archaic include Early Side Notched (Big Sandy), Thebes cluster, Kirk Corner Notched cluster, bifurcated and Kirk stemmed/serrated projectile points/knives (PP/Ks) (Driskell 1994, 1996; Justice 1987; Meeks 1994). Pitted cobbles, unifacial (thumbnail) scrapers, and drills are also frequently associated with Early Archaic components (Chapman 1994:38–41). Early Archaic components in western Tennessee are identified using the same hafted biface types found in adjacent regions.

It has been postulated that the population density in most areas of the Southeast increased from the Early Archaic Periods (e.g. Anderson 1989; McNutt and Weaver 1985).

Middle Archaic Period

The Middle Archaic period (circa 6500 B.C.–3000 B.C.) coincided with the Mid-Holocene, Hypsithermal or Altithermal Interval, a time of warmer temperatures and drier conditions in the mid-continent. The Hypsithermal (approximately 6000 B.C.–2000 B.C.) considerably altered the environment and likely influenced the settlement and procurement strategies of peoples living in the region. This environmental shift created challenges for prehistoric populations, with local inhabitants experiencing long droughts and corresponding changes in resource availability. It was during the Middle Archaic that foraging groups began to create massive shell middens along the middle and lower Tennessee River.

By 4000 B.C., major environmental changes had taken place across the Southeast. The effects of the Hypsithermal are noted from pollen data collected in St. Clair County, Alabama, Georgia, coastal Alabama, and the Tennessee valley. The oak-hickory, mixed hardwood, and mixed-oak hickory and southern pine forests were firmly developed across the area (Delcourt et al. 1983). Even with the changing environment, increased populations – evidenced by site density – suggest increased settlement pressures, resulting in greater social stress factors. Walthall (1980:57–58) suggested an increase in territorialism and provincial diversity as environments evolved into modern regional patterns.

Material culture can be distinguished from the Early Archaic by an increase in ground stone tools, and a more diverse stone tool kit (Coe 1964). Atlatl weights appeared for the first time and give conclusive evidence for the use of the atlatl or spear thrower (Lewis and Lewis 1961). Stone net sinkers have been found in the archaeological record and suggest new technologies for fishing (Chapman 1977; Davis 1990). Diagnostic bifaces found in western Tennessee include basally notched Eva and Calf Creek points and side notched Hickory Ridge and Cache River projectile points (Barrett and Karpynec 2006). Middle Archaic peoples continued to use acorns, black walnuts, and hickory nuts (Chapman 1977:125; Lewis and Lewis 1961:40–43), with some evidence that hickory nut use increased significantly at this time (Carmody 2009).

Extensive trade networks start to appear during the Middle Archaic. These large interaction spheres are highlighted by the similarity in ceremonialism over broad areas. Complex mortuary practices involving specialized grave goods such as the large, finely chipped Benton point and blade caches found with burials of the Benton Mortuary Complex, the presence of red ochre, and other “killed” artifacts, such as burned bifaces, found with human interments show similar belief systems integrated into the archaeological record of sites across the Midsouth (Deter-Wolf et al. 2004; Meeks 2000:36–38).

Benton occupations are well documented in the middle and lower Tennessee Valley and in western Tennessee (Futato 1983; Lewis and Lewis 1961; Mainfort 1994; Peterson 1973; Smith 1996). They occur toward the end of the Middle Archaic and continue into the early Late Archaic. Meeks (2000) placed the date of core Benton occupations between 4000 and 3000 B.C. Benton PP/Ks are associated with both shell midden (Lewis and Lewis 1961) and non-shell sites (Bentz 1996; Deter-Wolf et al. 2004).

Bentons were recovered from a non-shell bearing stratum (VII) at the Spring Creek site in Perry County, Tennessee. In addition to Benton PP/Ks, a limited array of stone tools (due to limited excavations) included knives and unifacial scrapers. A carbon date of 2645±210 is probably too late to be attributable to Benton occupations. A deeper stratum (Bank Stratum VI) noted in the cut bank consisted of a dense shell midden that may be associated with a Benton occupation. A radiocarbon date of 3055±260 B.C. was obtained from this stratum (Peterson 1973). This date falls at the tail end of Meeks’ (2000) core date range for Benton sites.

The Eva site, in Benton County, was excavated by Lewis and Lewis (1961) prior to the creation of Kentucky Lake and produced much of the baseline data for what is known about the Middle Archaic in the region. When it was occupied, a substantial shell and organic midden accumulated at the site on a floodplain rise adjacent to the Tennessee River. The chipped stone tool industry included Eva basally notched and stemmed PP/Ks; large, trianguloid knives and bifaces; adzes; large and small unifacial scrapers that occasionally have graver spurs; and large drills. Other stone artifacts include atlatl weights, gorgets, pendants, hammer and anvil stones, pestles, nutting stones, and honing stones. Due in large part to the quantity of shell in the midden, faunal preservation at Eva was excellent and a significant bone and antler tool industry was recovered. These tools include several types of awls, scrapers, projectile points, fish hooks, wrenches, beads and atlatl hooks. Nearly 200 human interments were also excavated. Typically fully flexed, just under one-third of the burials contained associated artifacts including ochre, PP/Ks, bone awls and needles, atlatls and ornaments such as turtle shell rattles and beads. Eighteen dog interments were also excavated (Lewis and Kneberg 1947, 1959; Lewis and Lewis 1961).

Late Archaic Period

The Late Archaic period (circa 3000 –900 B.C.) was a time of a rapid population increase as evidenced by larger and more numerous sites. Chapman (1985a:150) refers to Late Archaic sites as “widespread and frequent.” Sites interpreted as single-family occupations along the first river terraces are manifested by rock-filled firepits. Larger, multi-family sites, represented by a denser pattern of these firepits, suggest these sites were established on a relatively long-term basis (Chapman 1994:51–53).

By the beginning of the Late Archaic, modern climatic conditions were well established. The period is marked by a continued increase in population and evidence for social institutions, more stable settlement patterns, and increased trade interaction. Social institutions and ceremonialism are noted with the appearance of monumental architecture in portions of the Southeast and the inclusion of grave goods. Non-local artifacts at large sites hint at continued regional interaction and trade of material goods.

During this time, exploitation of environments continued to be specialized with shell middens along many of the major rivers and increasing harvest of white-tailed deer. Hickory nuts continued to dominate the plant remains of Late Archaic sites, but a gradual shift is noted throughout much of the Midsouth and Southeast. Large storage pits filled with nutshells, primarily hickory, are known from terminal Archaic sites in the Tennessee Valley and Highland Rim (Bentz 1996; Bowen 1979; Crites 1996; Futato 1983; Oakley 1975). However, plant remains from the Tennessee Valley, the Cumberland Plateau in eastern Kentucky, and the Coastal Plain indicate that by the Late Archaic some peoples had begun cultivating at least some seed crops, including sunflower, maygrass, chenopod, and gourd, namely cucurbits (Chapman et al. 1982; Chapman and Shea 1981; Chapman and Watson 1993; Gremillion 1996, 2004; Yarnell 1993; Yarnell and Black 1985).

In the middle and lower Tennessee Valley, several relatively large, stemmed, hafted biface types, including Ledbetter, Wade, and Little Bear Creek (Cambron and Hulse 1975; Futato 1983; Little et al. 1997), serve as hallmarks of the Late Archaic/Gulf Formational material culture.

In the upper Duck River valley, Ledbetter Phase (3000-1000 B.C.) sites consist of seasonal hunting and gathering camps, apparently occupied by single family units. Sites contained storage pits, hearths, shallow basins, occasional burials and postmolds. At the Bailey site in the lower Elk River drainage, Ledbetter Phase occupation appears to be year round. Structures (both winter and summer), storage pits, earth ovens and burials were all reported. Subsistence was based on gathering nuts and the exploitation of a wide variety of faunal resources. Burials were flexed and typically without accompanying artifacts. In addition to Ledbetter cluster PP/Ks, the lithic assemblage included bifaces, unifacial tools, ground stone tools and debitage. Modified bone and antler were also present (Bentz 1996:307-308, 314-315; Faulkner and McCollough 1973:420-421).

Peterson (1973) described the Perry Zone from excavations at the Spring Creek site in the lower Tennessee Valley. The Perry Zone shows similarities to the Ledbetter Phase, including the diagnostic PP/Ks. He intentionally refused to identify the type by name. Rather, Peterson (1973) referred to the dominant type as “Stemmed Archaic” PP/Ks, characterized as typically larger than Little Bear Creeks, roughly made, many being asymmetrical, with straight stems and broad blades. Justice (1978:150) later noted that Ledbetters, in addition to PP/Ks identified as Cotaco Creek, Mulberry Creek, and Little Bear Creek, were recovered from the Perry Zone. Other artifacts associated with the Perry occupation zone include knives, many being broad-bladed and small unifacial tools, including gravers and denticulates. No pottery was recovered from the Perry Zone. Finally, Peterson (1973) noted a possible relationship with Poverty Point culture based on similarities in micro-tool assemblages. Radiocarbon dates from the site bracket the Perry Zone between 2500 and 1400 B.C. (Peterson 1973:35-37, 44).

Data from Late Archaic sites in the Tennessee Gulf Coastal Plain, especially excavation data, are lacking. Peterson (1979a, 1979b; in Mainfort 1994:9) identified multiple Late Archaic sites on terraces in the Loosahatchie and Wolf river drainages, but additional research would be necessary to verify settlement patterning.

The Poverty Point culture (2,200 B.C. -ca. 700 B.C.) is represented during the Terminal Late Archaic period in western Tennessee. This culture can be identified based on several distinctive artifactual and architectural remains. Mounds and earthworks, clay cooking balls, lapidary objects, microblades, and exotic raw materials indicate Poverty Point contacts in the region. Fiber-tempered pottery is diagnostic of this period in the middle and western Tennessee Valley (Morse and Morse 1983). Some examples of this type have been found occasionally at Terminal Late Archaic sites in West Tennessee (Smith 1996) and examples have also been found at the French Lick Site in downtown Nashville (Walling et al. 2000). Poverty Point diagnostic hafted bifaces include Gary, McIntire, Mulberry Creek, and Etley forms (Justice 1987; Smith 1979).

By the end of the Archaic, the environment had again shifted. The Late Holocene environment had fluctuated throughout the Archaic and by the terminal Late Archaic had reached a warmer and wetter trend. With the end of the Hypsithermal, the ecosystem of the Midsouth came to include vegetation resembling modern forests, with an increase in coniferous pines resulting from an increased dominance of the tropical maritime air mass rising from the Gulf of Mexico and abundant year-round precipitation (Delcourt 1978). These significant changes affected cultural adaptation in the Southeast. By ca. 3000 BP, pottery manufacturing and incipient horticulture spread throughout the region, giving rise to the Woodland period. The Late Archaic period marks the end of the Archaic Stage and the preceramic occupation of the Southeast.

GULF FORMATIONAL STAGE (2500 B.C.–100 B.C.)

The Gulf Formational stage is geographically limited to the Atlantic Coastal Plain of South Carolina, Georgia, and Florida, and the Gulf Coastal Plain states of Alabama, Mississippi, west Tennessee, and Louisiana. The hallmark for the stage is the appearance of early fiber- and sand-tempered pottery, the earliest of which appears to be the fiber-tempered Stallings series from the Savannah River drainage (Sassaman 1993). Walthall and Jenkins (1976) argued that the appearance of fiber-tempered ceramics originated in the east and moved west over time. Rather than follow the trend of referring to the appearance of ceramics as marking Woodland (Griffin 1952; Hudson 1976), they proposed the term Gulf Formational to differentiate the early fiber-tempered vessels and subsequent sand-tempered wares of the Gulf Coast region from slightly later ceramic traditions from nearby areas (Jenkins et al. 1986; Walthall 1980).

Gulf Formational component sites tend to center around riverine and swampy environments. By the Late Gulf Formational, more permanent occupations are evidenced by the presence of large, often bell-shaped storage pits. These pits were also used for interments of both cremated and flexed burials. The trend towards use of these types of environments and the presence of large storage pits may correspond with the onset of the Subatlantic Period and colder, drier conditions (Jenkins et al. 1986; Walthall 1980).

The Gulf Formational stage is divided into the Early (circa 2500 B.C.–1200 B.C.), Middle (circa 1200 B.C.–500 B.C.), and Late (circa 500 B.C.–100 B.C.) periods. The Early Gulf Formational period occurs along the Atlantic coast and likely began with the Stallings Island pottery (Sassaman 1993; Walthall and Jenkins 1976).

Middle Gulf Formational Period

In the western middle Tennessee Valley, the earliest pottery is found in the Pickwick Basin during the Middle Gulf Formational period (circa 1200 B.C.–500 B.C.). Fiber-tempered Wheeler pottery appears first in the western portion of the basin and moves out towards the Wheeler and Guntersville basins.

The Wade Phase (1200-450 B.C.) occurs in the date range listed above for the Middle Gulf Formational period. Diagnostic chipped stone artifacts include Wade, Little Bear Creek, Motley, McIntire, Limestone and Cotaco Creek PP/Ks. In the upper Duck River drainage, Wade Phase sites are seasonally occupied hunting-and-gathering encampments. Additional stone tools consisted of digging implements, sandstone and steatite vessels, and gorgets. Bone tools are also documented. Subsistence is based on seasonal gathering of nuts, possibly herbaceous seeds and a wide variety of faunal resources. Small, apparently seasonal structures or windbreaks are reported at multiple sites. Burials were flexed, interred on their sides or occasionally in a seated position, located on the margins of occupation areas. Artifact inclusions in burials ranged from none/few to numerous, including non-local material (Bentz 1996:308-309; Herbert 1986; Keel 1978). Keel (1978:154) considered steatite vessels to be a true diagnostic of the Wade Phase. Although the Wade Phase was considered adamantly pre-ceramic (Keel 1978:153), fiber- and sand-tempered pinched sherds have been reported on late Wade sites (Bentz 1996:309; Kerr 1996:26).

Kerr (1996:669) only recovered one fiber-tempered sherd in his survey of the lower Tennessee valley. Peterson (1973), on the other hand, identified the Kirby Zone at the Spring Creek site based partly on the occurrence of plain, fiber-tempered pottery. Chipped stone artifacts from the Kirby Zone include Little Bear Creek and Motley PP/Ks, elongated and straight-sided bifaces, long knives and flake gravers. Other artifacts include one hematite hoe, a steatite gorget, and bone awls and pins. Additionally, a semi-subterranean structure was identified in the Kirby Zone. The investment of time and effort to build such a structure indicates a certain degree of permanency at the site. The fact that it was semi-subterranean also suggests a winter occupation. Additional support for seasonality, in the form of floral and faunal material, was not recovered. A non-descript hearth was identified just outside of the structure and may have been related. Charcoal from the house pit was dated at 1370±160 B.C. Based on this date and data above and below, the Kirby Zone is thought to date between 1400 B.C. and 800 B.C. (Peterson 1973).

Late Gulf Formational Period

The Late Gulf Formational period is differentiated based on the appearance of sand-tempered pottery. The Alexander Series is typically a middle Tennessee Valley ware, appearing only rarely in the lower valley, where it is considered an Early Woodland type (Kerr 1996:670).

WOODLAND STAGE (900 B.C.–A.D. 900)

Woodland occupations in west Tennessee and the lower Tennessee Valley, especially those at the beginning of the stage, are not very well understood. Most of what is written about it is based on excavation data outside the region, in particular the data generated in the upper Duck River valley. While the Works Progress Administration (WPA) work in the lower Tennessee Valley certainly encountered Woodland occupations, satisfactory excavation data and interpretation of that data are lacking. Discussing the end of the Late Archaic and beginning of the Early Woodland, Kerr summarized the data deficiency, stating:

> [I]t is clear that population persistence in the Western Valley from Archaic to Woodland cannot be interpreted as cultural persistence. The changes in the organization of prehistoric populations in the interim were considerable and the Kneberg interpretation [1952] effectively obscures the importance of these changes, rather than emphasizing them, much less explaining them. Just because there is a temporal succession of Woodland ceramic types on sites also occupied during the Archaic—and we know Western Valley Woodland best from these multi-component contexts—does not mean that there was a persistence of settlement organization or an absence of significant social evolution. Quite the contrary was the case although this cannot be adequately documented with extant Western Valley data but rather through comparison with neighboring areas [Kerr 1996:24].

Early Woodland Period

Like the Archaic, the Woodland period is divided into three sub-periods. Although use of pottery likely has its roots in the Late Archaic period in Tennessee, as elsewhere in the South (e.g. Sassaman 1993, 2006), the widespread manufacture and use of ceramics traditionally marks the beginning of the Woodland period. Tempering agents, surface treatments, and vessel forms serve as temporal indicators throughout the Woodland period (Bense 1994). The earliest ceramic tradition in the central Tennessee River valley is the Wheeler series fiber-tempered pottery. The Wheeler series appears to have originated with groups occupying the lower section of the Tennessee River valley, although examples of this type are found infrequently in western Tennessee. Low frequencies have been reported from surface collections and from the lower stratigraphic levels of one multicomponent site in Memphis (Childress and Wharey 1990; Mainfort 1985). Use of soapstone bowls for cooking purposes appears to have continued as well, at least through the first part of the Early Woodland period (Faulkner and Graham 1966:52; Truncer 2004; Ward and Davis 1999:141; Wells 2006; Wells et al. 2014).

Based on the results of his Kentucky Lake survey, Kerr (1996:271) proposed that Early Woodland (1000 B.C. to 300 B.C.), which overlaps Late Gulf Formational, settlement followed a pattern similar to what Kimball (1985) and Davis (1990) outlined for the Little Tennessee River drainage. Residential bases were generally larger, close to the river and had thick midden deposits. Middens contained limited ceramics, dense fire-cracked rock (FCR), lithics and features, indicating intensive but not permanent occupations. Smaller extractive camps were located on valley margins and uplands. The reduced number of sites recorded in the valley may be the result of a decrease in population or simply difficulty in accurately defining Early Woodland.

Peterson (1973) investigated one site that sheds some light on the early part of the Woodland. The Spring Branch Zone at the Spring Creek site was identified by a dense midden deposit containing snail and some mussel shell. Adena PP/Ks are common and diagnostic. Drills are also common and chipped stone knives are rather long, similar to those in the preceding Kirby Zone. Flake tools, including unifacial scrapers, gravers, denticulates and artifacts on retouched blades, are part of a well-documented micro-tool industry. Although no blade cores were recovered, utilized and retouched blades were. Faunal preservation was good in the midden and numerous bone tools were recovered, including one awl, three pins, an antler flaker and one partially sawed antler tine. One broken steatite cone and a broken, undrilled limestone gorget were the only pieces of ground stone recovered from the midden. Ceramics were all limestone tempered, with check stamping on the vast majority of the sherds. Fabric-impressed sherds, many smoothed over, and plain sherds were minor types. The Spring Branch Zone is thought to date between 800 and 200 B.C. (Peterson 1973).

The Fulmer site (40SY527) is located above an unnamed tributary to the Loosahatchie River on the western edge of the Loess Hills in southwest Tennessee. Excavations identified scattered remnants of midden and a well-defined activity area surrounding a central hearth. Other features and dateable carbon were rare. Ceramic vessels included bowls, jars and flared-rim bowls with fabric-impressed, slipped, punctated, and cord-impressed surface treatments. The entire artifact assemblage is consistent with the Early Woodland Tchula period, with an estimated occupation between ca. 400 – 100 B.C. (Weaver et al. 1999). Additional, fairly large (>2 ha) Tchula period sites are known from western Tennessee (Mainfort 1994; Rolingson and Mainfort 2002:23). Tchula pottery and sites occur in the lower Mississippi River basin, including parts of Mississippi, Louisiana, Arkansas, and west Tennessee (Kidder 2002:68-72; Rafferty 2002:205-207), but do not appear to reach the lower Tennessee Valley.

Middle Woodland Period

Larger villages and associated middens, as well as monumental architecture and localized artifact assemblages, point to an increase in sedentism throughout the Southeast. Middle Woodland (200 B.C. to A.D. 600) subsistence practices focused on hunting, fishing, and collecting shellfish, as well as gathering wild plant foods and harvesting cultivated crops. Animal resources include deer and other wild game, such as black bear, raccoon, opossum, beaver, turkey, frogs/toads, box and other aquatic turtles, non-poisonous snake, catfish, redhorse, suckers, drum, gastropods, and mussels (Bogan 1982:41; Cridlebaugh 1981; Schroedl 1978, 1990; Wetmore et al. 2000:142). Wild nuts and fruits, including the standard hickory, acorn, and walnut, as well as hazelnut, chestnut, grape, cherry/plum, hawthorn, honey locust, persimmon, maypop, sumac, blueberry, blackberry/raspberry, and hackberry occur. Horticulture had become firmly established, with small grains being a major diet component (Gremillion 2002; Yarnell and Black 1985). Horticultural practices are indicated by the recovery of chenopod, sunflower, sumpweed, little barley, maygrass, amaranth, knotweed, and smartweed (Chapman and Shea 1981; Cridlebaugh 1981; Schroedl 1990:68-71; Tickner 2007; Wetmore 2002:260, 265; Wetmore et al. 2000:141-142). Weedy seeds such as bedstraw, carpetweed, copperleaf, purslane, sedge, and members of the Aster, Grass, Legume, Rose, and Spurge families (Chapman and Shea 1981; Cridlebaugh 1981; Tickner 2007; Wetmore 2002:260; Wetmore et al. 2000:142) also point to the presence of disturbed ground (gardens) in the vicinity of Middle Woodland sites. Additional economic plants represented at Middle Woodland sites include bearsfoot, cattail, and pokeweed (Chapman and Shea 1981; Wetmore 2002:265).

Much of what is known about the Middle Woodland period in west Tennessee is due to research at Pinson Mounds. Pinson Mounds figuratively and literally dominate the archaeological landscape of western Tennessee. The complex covers in excess of 400 acres and stretches for approximately two miles above the Forked Deer River. At least 12 mounds occur at the site, including the second tallest mound in the United States (Mound 9 is 22 m [72 ft.] tall). Ceremonial habitation areas and a roughly circular enclosure are also present. Numerous burials included mica, galena, copper, copious amounts of *Marginella* beads, freshwater pearl necklaces, engraved rattles carved from human parietals, ground stone artifacts, chipped stone tools and micro-blades of exotic cherts. Pan-regional interaction is evident from the trade items brought from the upper Midwest, Atlantic Coastal region, and the Gulf Coast (Walthall 1980). Excavation at Pinson Mounds in Madison County has yielded pottery and stone tools of Ohio Hopewell origin, indicating Middle Woodland cultures in Tennessee were engaged in some interaction with the Hopewell culture centered on the Ohio River Valley. This site was likely part of a broader exchange system among Middle Woodland people that reached as far south as Crystal River, Florida. Cranial deformation, non-local burial goods, and monumental architecture highlight the intricate ceremonialism associated with the Middle Woodland. Nearly 40 dates show the main activity at Pinson occurring from the first through third century A.D. (Mainfort 1986; Mainfort and McNutt 2004; Rolingson and Mainfort 2002; Thunen 1998).

The introduction of sand-tempered, cord-marked ceramics is a standard temporal marker for the beginning of the Middle Woodland period on the Coastal Plain. Excavations at Pinson Mounds have yielded sand, sand and clay, and clay tempered ceramic sherds, all with nearly identical surface treatment (Mainfort 1986). Diagnostic Middle Woodland projectile points in western Tennessee consist of a tapered shoulder cluster, lanceolate expanding haft element cluster, and lanceolate spike cluster (Ensor 1981).

Autry and Hinshaw (1981:63) noted that numerous sites in the lower Tennessee Valley have Middle Woodland occupations. Unfortunately, most of those sites are not well documented, typically lacking controlled excavation data, analysis, and/or write up. They felt that Middle Woodland ceramics from the lower Tennessee Valley indicate wider relationships with groups in middle Tennessee and the middle Tennessee Valley. Kerr (1996:272-277) noted a significant increase in the number of Middle Woodland sites in the lower valley. He also identified at least a dozen different ceramic types, many of them common to the middle section of the valley. Numerous phases have been identified in middle Tennessee and the middle valley that may be relevant to the lower valley and west Tennessee.

Owl Hollow Phase (A.D. 300-A.D. 800) sites are highly organized, have dense middens, and are only located in broader river valleys. Smaller extractive camps have not been documented. Domestic structures are characterized by large, oval winter houses with double earth ovens paired with warm-season oval or square houses. Houses were occasionally built around a midden-free, plaza-like area. Maize occurs occasionally in food-processing pits, and deep storage pits have been documented. These factors indicate that horticulture on the broad floodplains had become an important part of the subsistence pattern. Burial patterns included cremation clusters as well as in-flesh interments. Ceramics continued to be limestone tempered, with simple stamping and, later, plain surface treatments. Shallow side-notched and spike-type PP/Ks are diagnostic, along with a distinctive chert micro-tool industry. After A.D. 600, the Owl Hollow Phase is not as well documented, but it may continue through A.D. 800 or later (Faulkner 2002:196-199).

Toward the end of the WPA work in the lower Tennessee Valley, excavations turned to sites with Woodland occupation for the sake of studying the Woodland, rather than excavating through those zones in order to focus on Archaic occupations. One of those sites was the Burton’s Landing site (40DR6) in the Busseltown unit of the Tennessee National Wildlife Refuge (TNWR). Excavation focused on several shell deposits that contained Middle Woodland artifacts, but no structures or pit features. Five separate strata were investigated. Long Branch Fabric Marked and Mulberry Creek plain sherds were recovered in lower strata while Flint River Cord Marked and Mulberry Creek cord marked sherds were recovered from the upper strata. Lithic materials included Little Bear Creek and Copena variants. Burton’s Landing, along with several other sites (Hog Creek, Burton’s Spring Site, 40DR1, 40DR11 and 40DR43), were used to define the Decatur Focus in the lower valley. The Decatur Focus appears to be entirely too broad today to be a useful classification, as it includes cultural material spanning at least from the Gulf Formational/Early Woodland through the Late Woodland periods (Autry and Hinshaw 1981:63-64; Lewis and Kneberg 1947).

Peterson (1973) also investigated a Middle Woodland occupation at the Spring Creek site in the lower valley. The mostly plowed-out Copena occupation included a hearth and small pit, which were the only features identified. Several Copena PP/Ks were recovered from the plowzone. Ceramics associated with the hearth were all limestone tempered, with plain, fabric impressed and check stamping being the dominant surface treatments. A single Cormorant Cord Impressed rim sherd was also recovered.

Kerr (1996:33-34) also noted Crab Orchard and Baumer foci in the lower Tennessee and Cumberland River valleys. Ceramics are the primary distinguishing characteristic between the two. Baumer ceramics are grog/limestone tempered, while Crab Orchard series tend to be grog/grit tempered. Both series are typically fabric marked with some cord marking. Crab Orchard ceramics are associated with Adena/Cypress Stemmed cluster PP/Ks, with Snyders cluster PP/Ks occurring later. Settlements are typically large with dense concentrations of midden and features.

Late Woodland Period

The Late Woodland Period (A.D. 900-1650) in middle Tennessee is not as well understood as other time periods. It is often viewed as a culturally less complex time, with smaller and more dispersed sites (Kerr 1996:35). Fewer, less intensively occupied sites have been identified, marking a significant shift from the previous Owl Hollow Phase. This period marks the decline and in some areas the disappearance of inter-regional trade and earthwork construction that marked the socio-cultural peak of the Middle Woodland period. Hunting and gathering, along with some horticulture, continues to be the main source of subsistence.

Autry and Hinshaw (1981:64-66) and Kerr (1996:278-282) noted that Late Woodland sites are rather numerous in the lower Tennessee Valley. They are also consistently part of much larger multi-component sites. Controlled excavations on Late Woodland sites/components are lacking and surface collections and shovel testing can only provide so much information. Diagnostic artifacts include Jacks Reef and small triangular (Hamilton, Madison) PP/Ks. A shift from larger projectile points to smaller triangular projectile points (Madison, Hamilton) which can be Late Woodland or Mississippian is thought to reflect the advent of the bow and arrow in Late Woodland times. Ceramics characterized by grog tempering appear widely in western Tennessee. Diagnostic types in the lower valley include Wheeler Check Stamped, McKelvey Plain, Coles Creek Incised, and a predominance of Mulberry Creek Cord Marked over Baytown Plain (Smith 1996). During the Late Woodland, population in the Mississippi River valley, like the Tennessee Valley, remained constant or even increased. An argument has been made, however, that the west Tennessee Coastal Plain was largely abandoned at that time (Mainfort 1994:16).

MISSISSIPPIAN STAGE (A.D. 900–A.D. 1600)

The Mississippian stage is marked by a distinct shift in political, social, and general cultural conditions in the Southeast. The foundation for Mississippian society is believed to have its source in the Mississippi Valley, but quickly spread east and incorporated local variations. Pottery with shell tempering appeared; small, triangular points (Hamilton and Madison types) were prevalent; and floodplain horticulture centered on maize agriculture, and eventually the triad of maize, beans, and squash was cultivated. Massive ceremonial centers, such as Cahokia and Moundville, were constructed. The Mississippian is divided into Early (roughly A.D. 900–A.D. 1300) and Late (roughly A.D. 1300–A.D. 1450) periods, each with more regional phases. As with much of the archaeological data from the region, most of the excavations of Mississippian sites in the lower Tennessee Valley were conducted by the WPA prior to reservoir inundation. Nearly all of these data, especially in Tennessee, remain unanalyzed and unpublished.

Early Mississippian Period

In the lower Tennessee Valley in Kentucky, the Early Mississippian phase is known as Jonathan Creek (A.D. 900-1300). The phase classification is based on excavations at the type site, a large fortified town with three large mounds and a central plaza in Marshall County, Kentucky (Webb 1952). Early structures ringed the plaza and mounds, and were more or less square with individual set posts. Later structures were constructed by setting posts in wall trenches. Nearly 90 structures were identified in the southern portion of the village. Eight separate palisade lines, not all necessarily dating to the Jonathan Creek Phase, encircled the village. The palisaded area ranged from five to eleven acres. Burials at Jonathan Creek were limited; some contained small open bowls or water bottles, and bone artifacts; one included a celt. At least some of the interments were in stone boxes. The economy was most likely based on maize agriculture, hunting and gathering. Diagnostic PP/Ks are small, triangular PP/Ks (Madison cluster). Pottery tends to be shell-tempered plain jars, bowls and pans. Specific types include Mississippian Plain, Bell Plain, Kimmswick Fabric Impressed and McKee Island Cord Marked. Although the Jonathan Creek site itself is a large, palisaded village, smaller sites such as individual farmsteads have been reported (Autry and Hinshaw 1981:67-68; Clay 1979; Kerr 1996:38; Lewis 1986:132-133; Webb 1952).

In the lower Tennessee Valley in Tennessee, multiple sites including Odle (40BN23), Patterson (40HS12), Hobbs (40HS44), Lick Creek (40BN30), Williams (40HY1), Thompson Village (40HY5), Gray Farm (40SW1) and Standing Rock (40SW2) were investigated by WPA crews but, again, published data are lacking and distinguishing between Early and Late Mississippian is difficult. Based on at least photographic data, Autry and Hinshaw (1981:68) attributed structures at Hobbs and Odle to the Jonathan Creek Phase, indicating at least Early Mississippian occupations at those sites.

A few Early Mississippian sites, many mound complexes, have been recorded in the west Tennessee Coastal Plain. The Kenton group (40OB4) is a cluster of several mounds marked by a paucity of artifacts (Mainfort 1994:17, 109-110). Mainfort (1992, 1994) has interpreted the site as one of a number of vacant ceremonial centers. More recently, Goddard (2011) has reported on the Early Mississippian occupation at the Ames site (40FY7). The site had been described as the “empty ceremonial center at 40FY7” (Peterson 1979a, in Goddard 2011:15), similar to Kenton and others. Systematic research, including surface collection, shovel testing, extensive geophysical work and test unit excavation, has identified multiple domestic structures, a palisade line and a series of large, midden-filled pits (Goddard 2011). Although surface collection failed to recover a significant artifact assemblage, it certainly appears that Ames was not as vacant as previously thought. Excavation at Kenton and similar sites should provide comparative data. A wall-trench house was also identified at Pinson that probably represents an isolated Early Mississippian farmstead. Surveys in the general area have identified other small sites that are probably comparable (Mainfort 1986).

Middle to Late Mississippian Periods

In the lower Tennessee Valley in Kentucky, the Late Mississippian period is known as the Tinsley Hill Phase (ca. A.D. 1300-1450). The settlement systems and economy of Tinsley Hill Phase are consistent with the previous Jonathan Creek Phase. The Tinsley Hill site was a small Mississippian center with an associated cemetery and a sub-structure mound. Pottery is shell tempered and contains much more decoration than Jonathan Creek assemblages. Both share the same types mentioned above, but Kimmswick Plain, Nashville Negative Painted, var. Nashville, Matthews Incised, vars. Matthews, Beckwith and Manly, O'Byam Incised, var. Stewart, and Tolu Interior Fabric Impressed were also recovered from the Tinsley Hill site (Clay 1979; Lewis 1986:145-147). Several excavated but unpublished sites on the Tennessee side of the lower valley probably are Tinsley Hill Phase. Structural data are available that supplement the Tinsley Hill data. Excavations at Thompson Village (40HY5), Gray (40SW1) and William (40HY1) all identified Late Mississippian occupations. Three structure types were identified: 1) square with posts set in trenches; 2) rectangular, about four to six meters on a side, with posts in trenches and rounded corners; and 3) square to rectangular with posts set in individual holes without wall trenches (Autry and Hinshaw 1981:68).

In addition to data on Late Mississippian structures, over 200 burials were excavated on the aforementioned and earlier Mississippian sites. Autry and Hinshaw (1981:75) suggested that accompaniments of exotic materials in burials indicate social stratification. Additionally, many of the burials were in stone boxes.

In a survey of the Kentucky Lake region, Kerr (1996) recorded 40 habitation sites with Mississippian occupations. Six earth and two stone mounds were recorded on seven of the Mississippian sites. The mounds are probably Mississippian, but survey data could not verify that, as several of the sites were multi-component. It was also difficult to distinguish Early vs. Late Mississippian components based on the ceramic assemblages. While surface collections of mostly plain, shell-tempered sherds are of limited utility beyond indicating they are Mississippian, some of the difficulty in establishing chronology comes from the lack of published excavation data, especially on the Tennessee side of the lower valley.

Similar to the Late Woodland, Late Mississippian sites tend to cluster along the Mississippi and Tennessee rivers. Sites in the interior, however, are generally absent (Mainfort 1994:18).

HISTORIC BACKGROUND

Valerie Altizer

Hardeman County lies within the West Tennessee Uplands ecoregion, a region that served as a hunting territory of the Chickasaw Indians at the time of European contact. The range of the Chickasaws, based in northern Mississippi and Alabama, included all of West Tennessee and a portion of Middle Tennessee (Satz 1998). Despite the acceleration of Chickasaw-European contact after 1763, the Chickasaw remained in control of the region throughout the 1700s. The American government in 1786 formally recognized Chickasaw land claims in Tennessee and began sending trade goods to the Lower Chickasaw Bluffs on the Mississippi River near present-day Memphis. In 1792, William Blount signed a treaty of peace with the Chickasaws, who provided a barrier between the Cumberland settlements and hostile tribes such as the Creeks. The United States subsequently established a trading house on the Lower Chickasaw Bluffs in 1802. Encouraged to buy on credit, the Chickasaw became increasingly dependent upon trade goods. Through treaties negotiated by Andrew Jackson in 1805, 1816, and 1818, economic coercion among other tactics was used to acquire nearly 20 million acres of land in Tennessee from the Chickasaws. With the Jackson Purchase Treaty of 1818, the Chickasaw relinquished control of all their lands in West Tennessee. Hardin and Shelby counties were created after the Jackson Purchase in 1818. Hardin County included the lands that would later be designated Hardeman County by the Tennessee General Assembly in 1823 after Thomas Jones Hardeman, a veteran of the War of 1812. Euro-American settlers began arriving quickly, with most migrating from Middle Tennessee, Virginia, South Carolina, North Carolina, and Kentucky. The county seat was established on the Hatchie River and named Hatchie Town. Due to its location on the river, the early town suffered from flooding and was relocated a mile to the south after about a year. In 1824, the county commissioners officially named the town Bolivar in honor of South American patriot Simon Bolivar, and the town was incorporated in 1847 (Davidson 2009).

Chickasaw tribal members continued to hunt in this area after the 1818 treaty, but when the Indian Removal Bill was passed in 1830, President Andrew Jackson met with tribal leaders and secured a provisional removal agreement. Removal of the Chickasaw to the west was carried out in 1837 (Satz 1998). A detachment of the Cherokee tribe, under the direction of John Bell, passed through Bolivar and Hardeman County in November of 1838 during the removal. The detachment crossed the Hatchie River by ferry near what was known as the "Stage Road to Purdy" and continued on the Bolivar-Somerville Road into Fayette County (Nance 2001:37).

The economy of Hardeman County has historically focused on the production of cotton and lumber (Davidson 2009). Hardeman County was quickly identified as a good location to grow cotton in the early 1800s. The plentiful, relatively cheap agricultural lands proved conducive to the rise of Southern plantations in the county; however, this economy was dependent upon the institution of slavery. The location of Bolivar on the Hatchie River, which feeds into the Mississippi, allowed it to serve as a port to ship the product. The production of cotton as a cash crop in Fayette and Hardeman Counties increased significantly from 1840 to 1860, and this region of West Tennessee in general experienced a period of prosperity for the landowners. A significant steamboat trade operated on the Hatchie River during the 1830s and 1840s, allowing goods manufactured in the north to be transported to the plantation homes built in the area (Davidson 2009). Census schedules reveal that this reliance upon slave labor resulted in a population of 7,108 enslaved African-Americans in 1850, or 41 percent of the total population (DeBow 1850; Barrett and Karpynec 2006).

With the arrival of the railroad in Hardeman County in 1854, the town of Grand Junction was established at the junction of the Memphis and Charleston and the Mississippi Central Railroads, previously known as Moore’s Crossroads. In 1856, the Mississippi Central Railroad extended a line to Bolivar. The operation of the railroad eventually led to the demise of the river port at Bolivar in the 1880s (Davidson 2009). The presence of the railroad lines also made Hardeman County a target for both Union and Confederate armies during the Civil War who wanted to control the rail lines. Major battles took place in the county, including the Battle of Davis Bridge near Pocahontas on the Hatchie River, which involved more than 20,000 soldiers. Other battles occurred near Middleburg and Bolivar, destroying much of those towns as Union and Confederate troops fought for control of the railroad (APTA 2001).

As the Union Army entered the heavily slaveholding region of West Tennessee, they encountered large numbers of hungry fugitive slaves, many of whom had been supplying forced labor for the Confederates. In August of 1862, Chaplain John Eaton was ordered by General Ulysses S. Grant to establish the first “Contraband Camp” for fugitive slaves at the town of Grand Junction, so named for the formerly enslaved African Americans who were considered contraband under the Confiscation Act. By March of 1863 the “contrabands” at Grand Junction numbered 1,713. The army put those able to work at fifty cents per day on abandoned farms, government-supervised plantations, and military projects (Lovett 2009).

Recovery after the devastation of the Civil War was difficult since Hardeman County’s economy had been based largely on slave labor. This led to labor shortages after the war, and most farmers turned to sharecropping and borrowing money from the government to cover costs until harvests could be sold. Cotton prices fell sharply due to overproduction, and farmers began to diversify, planting corn, wheat, rye, rice, and growing livestock. The presence of the railroad allowed the shipment of lumber out of the county, and the economy of Hardeman County continued to focus on the production of hardwood and the county became known as the “Hardwood Capital of Tennessee” (APTA 2001).

In 1890, the Western State Mental Hospital opened near Bolivar on the farm of Paul T. Jones. During the twentieth century, the hospital became a major employer for the county. The number of patients grew to over 2,000 by the 1960s, but the hospital was plagued from its inception by inadequate state funding and poor living conditions for the patients. In more recent decades, the “deinstitutionalization” of the mentally ill has resulted in a marked decrease in the patient population although the hospital is still in operation (Austin 2009).

The current project area is located about nine miles south of the town of Bolivar in an area that has remained rural and agricultural. A 1923 map shows a few community buildings just outside of the western boundary of the project area, including Bowden

Chapel, Russell School, and Burnetts Mill (Figure 4). The Bowden Hill Christian Methodist Episcopal Church (CME) is the only one of these structures still standing. This church was established by African Americans as the center of the Bowden Hill community. The first CME church congregation was formed by African Americans in Nashville shortly after the end of the Civil War in 1866. This church was founded as the Capers Memorial Colored Methodist Episcopal Church, and its leaders had a prominent role in the creation of the formal CME convention four years later in 1870. In that year, Capers Church members, along with about forty other black Methodists in West Tennessee, broke from the Methodist Episcopal Church, South and formed their own independent denomination that they felt was more reflective of issues central to the black community. These issues included advanced education, community involvement through outreach, and spiritual growth. This founding group became the Colored Methodist Episcopal Church in America (CME) on December 16, 1870 in Jackson, Tennessee. In 1954 the CME Church changed its name from the Colored Methodist Episcopal Church to the Christian Methodist Episcopal Church (Van West 2000). Bowden Hill Church is still an active congregation led by the Reverend Jellory Stokes.

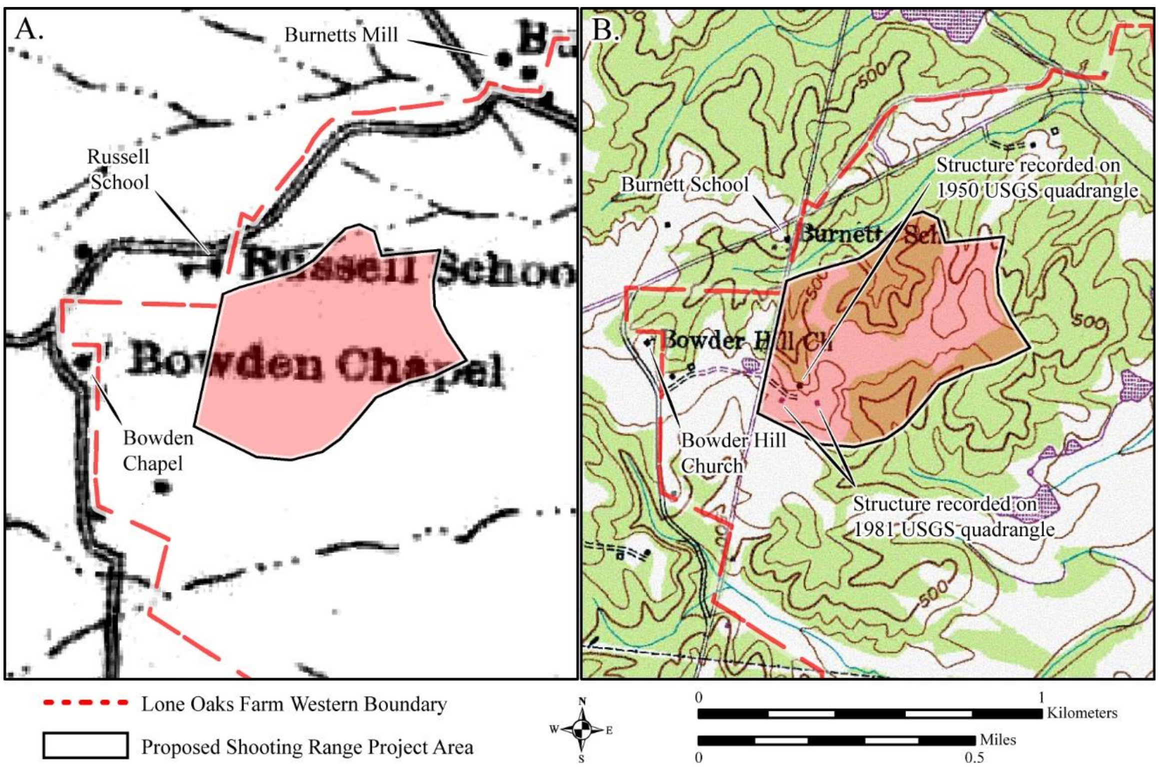

Figure 4. A. 1923 map of Hardeman County, TN (Tennessee Board of Natural Resources 1923) illustrating the location of Burnetts Mill, Russell School, and Bowden Chapel with reference to the western boundary of the Lone Oaks Farm and the proposed shooting range project area. B. 1981 reprint of the 1950 Hebron 7.5' quadrangle (USGS 1981) illustrating the location of the Burnett School (previously Russell School) and Bowder Hill Church (previously Bowden Chapel). Also illustrated is the location of a structure built after the publication of the 1923 Hardeman County map and two structures built after the 1951 publication of the Hebron 7.5' quadrangle.

In 1998, Memphis real estate developer Scott Ledbetter and his wife Kathy purchased the first of 32 parcels of land that would eventually make up the 1,200-acre Lone Oaks Farm, the location of the current project area. The properties were largely a blank slate when purchased, with no existing buildings or roads within the farm's boundaries (Zamudio 2015). This allowed the Ledbetters to hire a landscape architect to assist in planning the farm's layout, including roads, lakes, buildings, and agricultural facilities. All of the extant buildings and roads on the property were added by the Ledbetters, who eventually built eleven residences on the property, including houses, lodges, and cabins. Farm buildings including a barn, cattle handling facility, horse stable, event center and tool museum were also constructed. The University of Tennessee's Institute of Agriculture purchased 1,200 acres of the 2,000-acre property in 2015 to turn the farm into a regional 4-H camp and conference center for the children of West Tennessee to learn about agriculture and the environment (Ferree 2015). The current project area is comprised of an approximately 90-acre portion of Lone Oaks Farm that has been designated for a proposed shooting range by the UT Extension, a unit of the University of Tennessee's Institute of Agriculture.

Another University of Tennessee System Agricultural Research and Education Center was previously established in 1950 on the Ames Plantation, which encompasses 18,400 acres in Hardeman and Fayette Counties. This property is owned by the Trustees of the Hobart Ames Foundation, and it continues to serve as the location of intensive research efforts focusing on agriculture and natural resource management by the University of Tennessee. The plantation also contains over two hundred nineteenth-century historic sites including the manor house, an antebellum mansion constructed in 1847, along with a replica mid-nineteenth-century farmstead used as a cultural resource education facility. Each February the Ames Plantation also serves as the site of the National Championship Field Trials for all-age bird dogs, conducted annually at the Ames Plantation since 1915 (Evans 2009).

Hardeman County as a whole remains largely rural today with the majority of its economy centered on agricultural products like cotton, soybeans, wheat, livestock and corn in addition to the production of hardwood. After World War II, the county saw some growth in industry with the production of goods such as automotive parts, textiles, elevators, pyrotechnics, electrical switches, and clay products. Hardeman County is also the location of two of Tennessee's three private prisons, the Whiteville Correctional Facility and the Hardeman County Correctional Center which provide employment for county residents (Davidson 2009).

METHODOLOGY

Howard J. Haygood

BACKGROUND RESEARCH

Prior to the initiation of the field component of this project, an examination of Tennessee Archaeological site files and survey reports was conducted to assess the presence and characteristics of previously recorded archaeological sites within the project area as well as to develop a better understanding of the types of archaeological resources expected during the course of the field survey. In addition, historical documents and maps, aerial photos, and USGS quadrangles were examined for evidence of previously unrecorded historic resources within the project area.

No previously recorded prehistoric or historic archaeological sites are present within the Lone Oaks Farm property boundary. Very few historic records are available for the area. The 1923 Hardeman County map shows no structures or features within the APE (Figure 4). The most informative record is the USGS Hebron 7.5-minute quadrangle topographic map. Initially published in 1951 and based on 1946 and 1950 survey data, the map illustrates a single structure in the western portion of the project boundary (Figure 4). Present on the 1981 Hebron quadrangle re-print are two additional structures approximately 50-m south of the earlier structure. Between the single northern structure and the two southern structures is an east-west trending primitive road. These mapped structure locations were examined through both shovel testing and pedestrian survey.

FIELD METHODOLOGY

The field investigation employed two specific methodologies based on topographic characteristics. Areas exhibiting greater than 10 percent slope (i.e. the deeply incised gullies) were visually inspected with archaeologists spaced at 30-m intervals. A total of 39.5 acres were visually inspected during the Phase I survey (Figure 5).

Areas exhibiting less than 10 percent slope (i.e. the upland plateau) were tested using shovel test pits (STPs) spaced at 30-m intervals (Figure 5). A total of 42.8 acres were examined through shovel testing. The location of each STP was digitally mapped prior to fieldwork using the fishnet function in ArcGIS 10.4. The data were then transferred to a Trimble Geo7X global positioning system (GPS) capable of sub-meter accuracy. Using the GPS, STP locations were then marked across the APE and excavated.

STPs measured 30-cm square and were excavated to sterile subsoil. All soil and sediment removed from the STPs was screened through 6.4-mm (0.25-in) mesh hardware cloth. When artifacts were encountered, additional STPs were placed at 15-m intervals to the north, south, east, and west of the positive STP. Detailed descriptions of the encountered soils were recorded on standardized ARL shovel test forms. Artifacts recovered during the Phase I survey were collected, bagged, and returned to the ARL for further analysis.

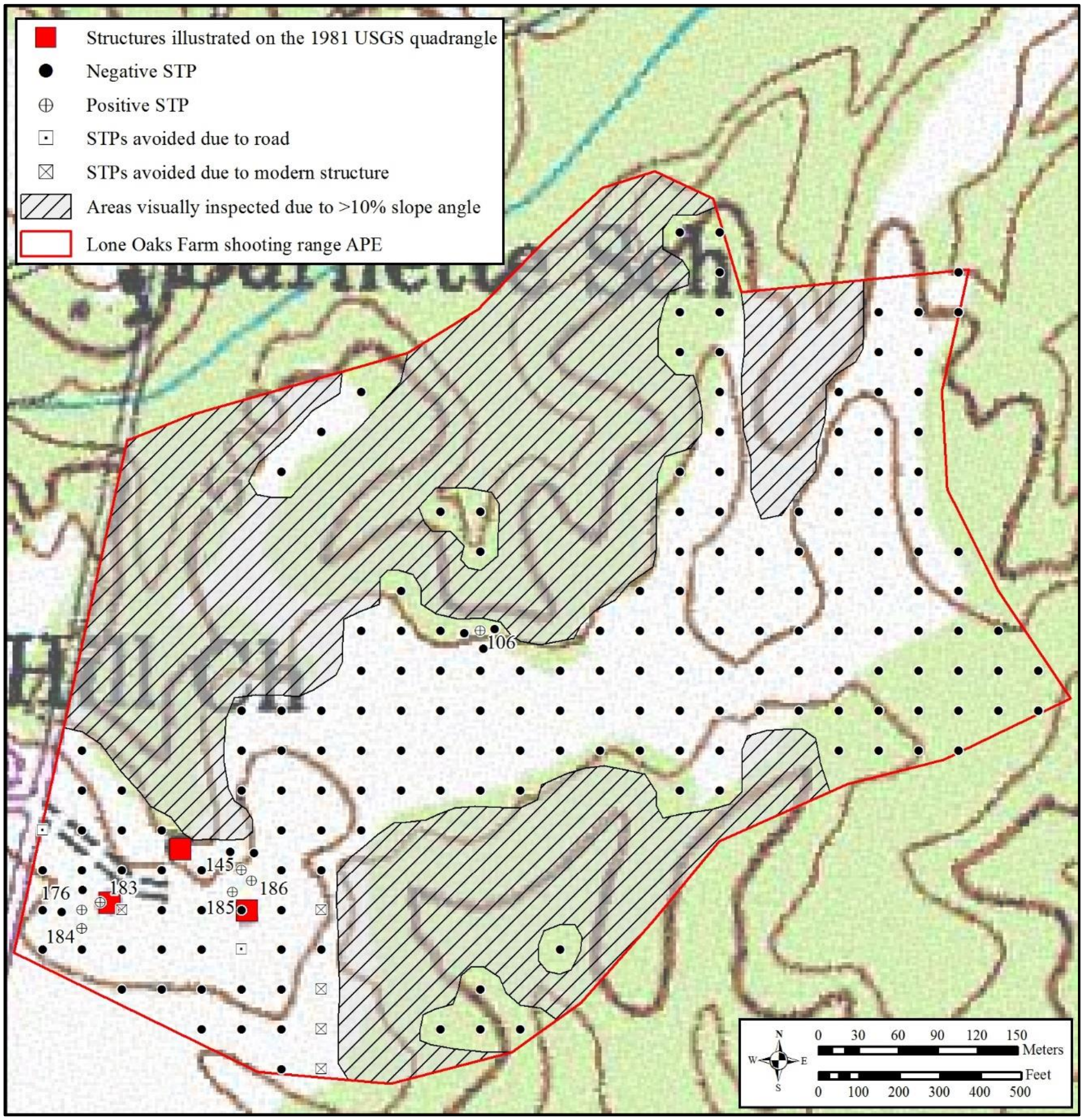

Figure 5. Areas within the APE visually inspected and shovel tested during the Phase I archaeological survey. Also illustrated are the positive and negative STP locations and the possible structure locations previously mapped on the 1981 Hebron 7.5' quadrangle.

LAB METHODOLOGY

Artifacts recovered were washed, dried, and put in labeled, curation-quality bags. They and all the paperwork associated with the project will be curated at the University of Tennessee, Knoxville.

RESULTS

No historic artifacts, features, or structures were identified during the visual inspection of the steeply sloped/gullied areas. No buried surface soil horizons were identified in either the gullied areas or in the STP profiles. As previously discussed, the soil profiles exposed in each STP revealed a thin topsoil layer (A horizon) overlying well-weathered subsoil. In places, a thin layer of the underlying subsoil was disturbed likely due to historic plowing.

A total of 191 STPs were excavated during the Phase I survey. Seven STP locations were avoided; two were located within the center of a modern road and five were located beneath modern structures. Figure 5 illustrates the location of positive and negative STPs. Table 1 lists the associated STP, recovery depth below surface (cmbs), classification, and material type of artifacts recovered.

Table 1. Artifacts Recovered from Positive Shovel Test Pits.

STP	Depth (cm bs)	Artifacts	Material
106	0-5	One purple-tinted, glass bottle base fragment	Glass
		One brick fragment	Brick
		Three re-fitted scalloped plate whiteware fragments	Ceramic
145	0-10	One wire nail ~10-cm long	Metal
		One segment of fencing wire ~13-cm long	Metal
176	5-12	One cut nail	Metal
183	5-17	Three small brick fragments	Brick
		One scrap of flat metal	Metal
		One wire nail ~5.5-cm long	Metal
		One possible cut nail ~8.5cm long	Metal
184	0-10	One cut nail ~7-cm long	Metal
		One clear glass bottle lip fragment	Glass
		One clear glass bottle base fragment	Glass
		One clear glass fragment	Glass
		One clear flat glass fragment 2.02mm thick	Glass
185	0-5	One faunal rib fragment (poss. pig)	Bone
186	0-16	One wire segment 6-cm long	Metal

Seven of the 191 STPs (3.7%) tested positive for cultural material. All artifacts were recovered from within 17-cm of the ground surface and date to the late historic/early modern period. Artifact assemblages consist of clear and purple-tinted glass fragments, fencing wire, brick fragments, cut and wire nails, and one faunal rib bone fragment. One positive STP (106, Figure 5) was isolated from the remainder of the positive STPs. Located near the edge of a northern facing slope adjacent to a gullied area, STP 106 consisted of three re-fitted scalloped plate-rim fragments, a single small brick fragment, and a single purple-tinted glass fragment and likely represents an isolated late historic trash dump.

Three of the positive STPs (STP 176, 183, and 184, Figure 5) were clustered near the location of the westernmost post-1951/pre-1981 structure illustrated on the 1981 Hebron 7.5’ topographic map. These artifacts likely represent refuse associated with that structure. Three positive STPs (STP 145, 185, and 186, Figure 5) were clustered within 25-m of the easternmost post-1951/pre-1981 structure illustrated on the 1981 Hebron 7.5’ topographic map. As with the westernmost cluster, these artifacts likely represent refuse associated with the eastern structure. No artifacts were found in the area of the post-1923/pre-1950 structure illustrated in Figure 4.

Figure 6 illustrates the field conditions of each historically mapped structure. Visual inspection and shovel testing near the structure locations illustrated on the 1951 and 1981 Hebron 7.5’ quadrangle topographic map found no evidence of historic structures or features. The westernmost post-1951/pre-1981 structure location is likely beneath the recently constructed Roadhouse (Figure 6C). Given the thin and eroded nature of the surface soil horizon and the shallowness of the subsoil horizon, the likelihood of buried cultural features or structural components within any of the mapped structure locations is extremely low.

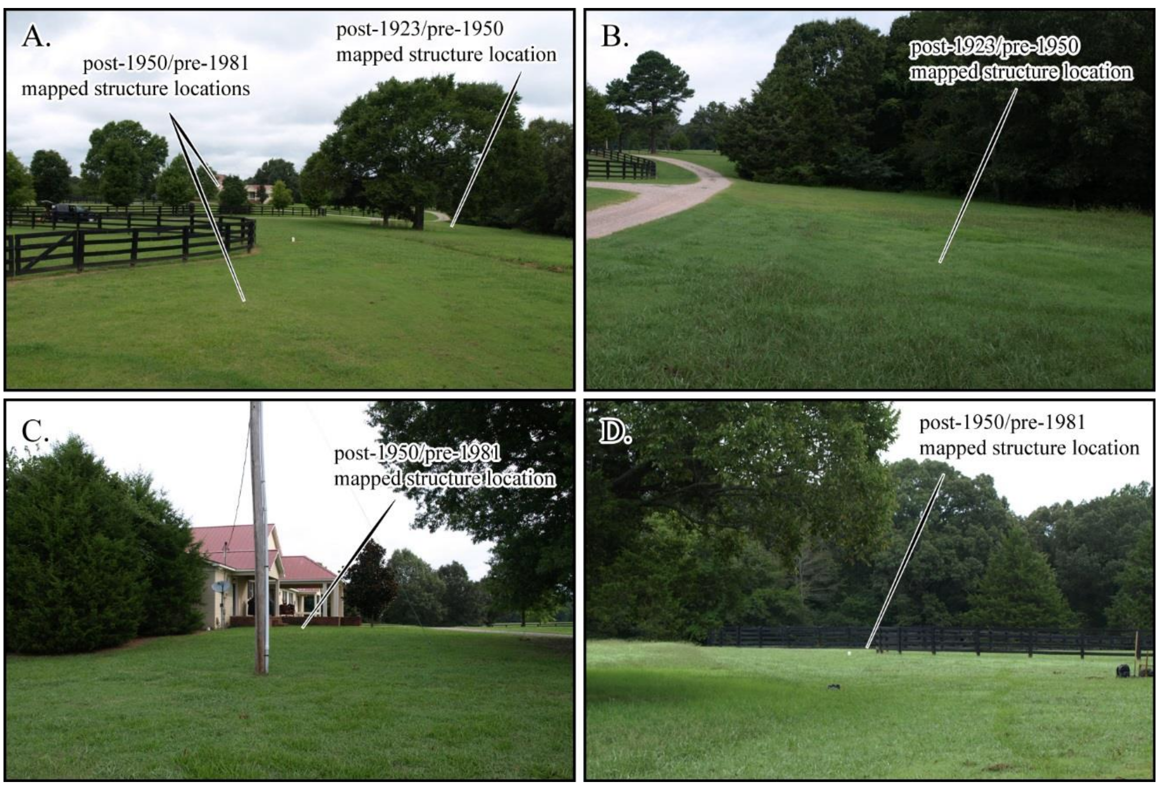

Figure 6. A. Overview of mapped structure locations illustrated on the 1981 Hebron 7.5’ topographic map (view to the west). B. Location of the post-1923/pre-1950 mapped structure (view to the northwest). C. Location of the western post-1950/pre-1981 structure (view to the north). D. Location of the eastern post-1950/pre-1981 structure (view to the east).

CONCLUSIONS AND RECOMMENDATIONS

From August 8 to August 12, 2016 the University of Tennessee's Archaeological Research Laboratory carried out a Phase I archaeological investigation for the proposed shooting range at the Lone Oaks Farm in Hardeman County, Tennessee. The project area encompasses 82.3 acres, 39.5 acres of which consisted of steeply sloped and gullied terrain and were visually inspected using archaeologists spaced at 30-m intervals. The remaining 42.8 acres were examined using 191 shovel test pits spaced at 30-m intervals.

Seven of the 191 STPs tested positive for cultural material. This included a distinct cluster of positive STPs near each of the two post-1951/pre-1981 structures illustrated on the 1981 Hebron 7.5' topographic map and a single isolated occurrence near the edge of a southern facing slope adjacent to a gullied area. All artifacts were recovered from within 17-cm of the ground surface and date to the late historic/early modern period.

No historic artifacts, features, or structures were identified during the visual inspection of the steeply sloped/gullied areas. Soil profiles exposed in each STP revealed a thin topsoil layer (A horizon) overlying well-weathered subsoil. No buried surface soil horizons were identified in either the gullied areas or in the STP profiles. Visual inspection and shovel testing near the structure locations illustrated on the 1951 and 1981 Hebron 7.5' quadrangle topographic map found no evidence of historic structures or features. Given the thin and eroded nature of the surface soil horizon and the shallowness of the subsoil horizon, the likelihood of buried cultural features or structural components within any of the mapped structure locations is extremely low.

Based on the results of the investigations, ARL recommends no further archaeological testing for the proposed Lone Oaks Farm shooting range installation and that the project should be allowed to proceed as planned. However, should any unanticipated artifacts, features or burials be encountered, the project must be halted and a qualified archaeologist should be contacted for an evaluation before work resumes.

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