WETLAND MITIGATION AND MONITORING PLAN
FOR
DEPARTMENT OF THE ARMY INDIVIDUAL SECTION 404 PERMIT
AND
INDIVIDUAL AQUATIC RESOURCE ALTERATION PERMIT
FOR THE PROPOSED
US 27/I-24 INTERCHANGE IMPROVEMENT
MARION COUNTY, TENNESSEE
TDOT PE No. 58007-1220-64
TDOT PIN 102236.00

COE FN. 2009-00128

Prepared by:

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and
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TDOT

18 June 2009

1.0 INTRODUCTION

1.1 Project Background

The Tennessee Department of Transportation (TDOT) plans to improve the SR-27/I-24 interchange at Kimball in Marion County, Tennessee by adding an exit ramp in the northeast quadrant of the interchange and improve vertical clearance for the I-24 bridge over SR-27. The existing interchange is located within the Guntersville Lake watershed [Hydrologic Unit Code 8 (HUC 8) 06030001] and will result in the placement of fill material in the Tennessee Valley Authority (TVA) flood control storage zone on Guntersville Reservoir.

The Guntersville Lake flood control storage zone is between elevations 593.0 and 616.7 ft. above sea level (asl) and the estimated fill within the flood control storage zone is 71,776 cubic yards (44.5 acre-ft). This volume is greater than the net loss of 1 acre-foot of flood control storage allowable by TVA. TDOT has proposed to mitigate the fill in the flood control storage zone by excavating material from the TVA property in the northeast quadrant of the interchange, adjacent to the proposed exit ramp. Excavating an average depth of approximately 3.0 ft over the 14.86 acre site will offset the calculated fill volumes. Excavated depths will be greater in certain portions of the site, especially along the northern and western boundaries, which currently have higher surface elevations. Areas that have been delineated as wetland will be excavated approximately 2 to 4 feet deeper (see elevations on Attachment A).

A total of five jurisdictional isolated or contiguous wetlands have been identified within the project limits. TDOT has coordinated the proposed alterations and impacts to these wetlands with the Tennessee Department of Environment and Conservation (TDEC) and the U.S. Army Corps of Engineers (USACE). TDOT proposes a combination of on-site alteration and off-site mitigation that will mitigate for the wetland impacts while also offsetting fill placed in the TVA flood control storage zone on Guntersville Reservoir.

1.2 General Site Description

The five on-site wetland areas are located in each quadrant of the US-27/I-24 interchange in Kimball, Marion County, Tennessee. A topographic overview of the site can be found on the U.S. Geological Survey (USGS) South Pittsburg 7.5-minute topographic map (100 SW), Tennessee quadrangle (Figure 1 and Figure 3).

Wetland 1 (WTL-1)

Wetland 1 (WTL-1) is located at US-27 STA No. ±413+20R to ± 416+70R and I-24 STA No. ±144+25 to ±160+00 (Figure 2) in the northeast quadrant of the project. General coordinates of WTL1 are 35°02'25.11" north latitude and -85°41'12.58" west longitude. Existing elevation of the WTL-1 area ranges from ±600 to ±608 feet above mean sea level (AMSL). The total acreage of WTL-1 is ±7.99 acres. Elevation within WTL-1 range from 600 ft above sea level (asl) for the lowest portions of the site, located near the existing culvert inlet under I-24, to 607 ft asl for the highest portions of the site, located at the northern and southern extremes of the wetland (Figure 2).

WTL-1 is a predominately emergent wetland that is dominated by rushes (*Juncus spp.*), *Typha*, and various species of sedge (*Carex spp.*). There are sections of the wetland that are progressing to a scrub/shrub wetland with species such as common buttonbush (*Cephalanthus occidentalis*) and black willow (*Salix nigra*). The wetland has been impounded as a result of a beaver constructed dam across the culvert inlet under I-24. This dam is approximately three feet tall and has backed water onto most areas mapped as Melvin Silty Clay Loam, making it difficult to determine normal water depth and drainage (Photographs 1 – 4).

According to the U.S. Department of Agriculture Soil Survey for Marion County, Tennessee, soils within the boundaries of WTL-1 are mapped as Melvin silty clay loam (Ma), Wolftever silt loam (undulating phase) (Wn), Taft sit loam (Ta), and Hollywood silty clay loam (Hh). Melvin soils occur in the lowest part of the bottom lands inland from the stream channels. These soils are subject to annual overflow, and most areas are flooded for relatively long period late in winter and early in spring. This soil has very slow internal drainage. The Wolftever soils are described as occurring on low stream and river terraces. They are moderately well drained and have moderately slow permeability. These soils are subject to annual flooding during periods of high rainfall in winter and early spring. The Taft soils are found on upland flats, stream terraces, and in depressions. They are described as being somewhat poorly drained with a frigpan in the subsoil. They also have slow runoff and permeability. Lastly, the Hollywood soils occur mainly on footslopes and on depressed upland areas. They are moderately well drained, have very slowly permeable soils that formed in clayey colluvial sediments over limestone. The US Army Corps of Engineers Hydric soils list describes only the Melvin soils as hydric in Marion County.

Wetland 2 (WTL-2)

Wetland 2 (WTL-2) is located at I-24 STA No ±124+00 to US-27 STA No ±401+20. General coordinates of WTL-2 are 35° 2' 20.331" north latitude and -85° 41' 30.116" west longitude. The total acreage for this wetland was not determined as the project is only affecting part of the boundary. It is a forested wetland with sections that are scrub/shrub due to powerline maintenance impacts. The dominant species are blackberry (*Rubus* spp.), water oak (*Quercus nigra*), willow oak (*Quercus phellos*), red maple (*Acer ruburm*), rushes (*Juncus* spp.), and various sedge species (*Carex* spp.). WTL-2 will have 0.15 acres of temporary impacts.

Wetland 3 (WTL-3)

Wetland 3 (WTL-3) is located at I-24 STA No ±820+00 to US-27 STA No. ±401+40. General coordinates of WTL-3 are 35° 2' 17.812" north latitude and -85° 41' 19.939". The total acreage for this wetland was not determined as the project is only affecting part of the boundary. It is a forested wetland that is dominated by red maple (*Acer rubrum*), boxelder (*Acer negundo*), water oak (*Quercus nigra* hyb.), and sycamore (*Plantus occidenalis*). WTL-3 will have 0.73 temporary impacts and 0.12 acres of permanent impacts.

Wetland 4 (WTL-4)

Wetland 4 (WTL-4) is located at I-24 STA No. ±125+00 to Ramp C STA No ±510+40. General coordinates of WTL-4 are 35° 2' 30.772" north latitude and -85° 41' 31.013" west longitude. The total acreage for this wetland was not determined as the project is only affecting the boundary along US-27 and the I-24 west bound on-ramp. There are no anticipated temporary or permanent impacts to this wetland.

Wetland 5 (WTL-5)

Wetland 5 (WTL-5) is located within the TDOT ROW of the I-24 west bound off ramp (Ramp B), STA No. ±362+00 to ±363+00. This is an altered wetland that is constantly mowed and is perched on top of fill from the ramp construction. General coordinates of WTL-5 are 35° 2' 28.012" north latitude and -85° 41' 27.62" west longitude. This wetland was determined to be non-jurisdictional by USACE. There are no anticipated temporary or permanent impacts to this wetland.

2.0 PROPOSED ALTERATION AND MITIGATION PLAN

The objective of this alteration and mitigation plan is to provide documentation in regard to the geomorphic alteration of wetland WTL-1 and mitigation for the permanent impacts to wetlands WTL-1, WTL-2 and WTL-3 within the SR-27/I-24 interchange.

Temporary impacts to existing wetlands will be minimized, to the maximum extent practicable, by removing the top six to 12 inches of topsoil and stockpiling it until construction is complete. Once construction activities are completed, the temporary impacted areas will be restored to pre-construction activities. This includes removing haul roads, restoring the site to the original (pre-construction) elevation and spreading the stockpiled topsoil back over the wetland site. It will then be seeded with a wetland seed mix and covered with straw.

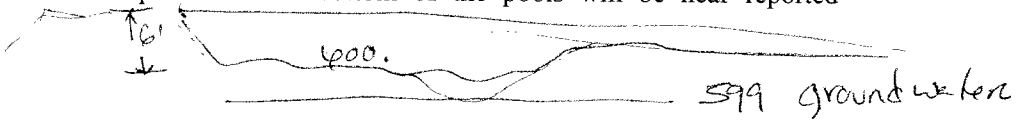
2.1 Proposed Alteration to Wetland WTL-1

Wetland WTL-1, a 8.03 acre wetland, will be impacted by construction of the offset basin and Exit Ramp A. Excavation of the offset basin will alter 4.06 acres of the wetland by lowering the average elevation of the wetland by approximately three feet; direct fill will impact 1.87 acres and 1.51 acres will be considered lost due to position/location – these are area that are either on the slopes of the offset basin or areas higher in elevation that the excavated basin bottom (See Appendix I).

2.1.1 Geomorphic Alteration

Existing elevations for WTL-1 range from 600 ft asl to 606 ft asl as you move from south to north across the site. The proposed offset basin will lower much of WTL-1 and adjoining upland areas to 600.00 ft asl. TDOT geotechnical exploration of the site, which was completed in February 2007, encountered water at elevations 598 to 599 ft asl, with limestone occurring between elevations 585 to 587 ft asl. In order to minimize the potential for ponding within the offset basin, TDOT Hydraulics recommended the bottom elevation of the basin be set at 600.00 ft asl, one to two feet above groundwater elevations as reported in the TDOT geotechnical report; this elevation also corresponds to existing elevations within the lowest portions of the wetland.

Prior to excavation, the upper one foot of topsoil will be stripped from the site and stockpiled. The site will then be excavated and the stockpiled topsoil replaced to finish grade at 600.00 ft asl elevation. The excavated material will then be disposed of offsite. Once final elevation has been reached and topsoil replaced, final grading of the basin will be conducted in such a manner as to result in an irregular surface, establishing pools and hummocks located randomly throughout the site. Pools will be excavated approximately 12 inches deep so that the bottom of the pools will be near reported groundwater elevation.



2.1.2 Hydrologic Alteration

No significant alteration to hydrologic inputs is anticipated, as all existing inflows will be maintained to the site. Excluding direct precipitation and groundwater, flow into the existing wetland is primarily storm water runoff carried to the site from two 36 inch culverts that drain the retail development center northeast of the site and a third culvert that carries storm water runoff from retail areas north of SR-27. These culverts all empty directly into the wetland or upland areas adjacent to the wetland and will be unaltered by the proposed construction.

During high water events, water from Battle Creek backs into the site via a 72 inch culvert under I-24; the bottom elevation for this pipe is 598.12 ft asl. An additional culvert will be placed under the new exit ramp to maintain a connection between the site and Battle Creek; this culvert will carry flow from

the offset basin to the remaining portion of wetland between proposed Ramp A and I-24, then flow out the existing 72 inch culvert under I-24 (Figure 1). The bottom elevation for the new culvert will be 600.00 ft asl. While this culvert inlet will be 1.88 ft higher than the culvert inlet under I-24, it will be flush with the bottom of the offset basin and ensure WTL-1 is not impounded. This elevation also closely corresponds to the elevation of the beaver constructed dam, the top of which was approximately 601.00 ft asl.

2.1.3 Planting

Plant selection was made according to existing vegetation, locally common species and anticipated hydrology of the site.

Plant composition will approximate existing site conditions and consist primarily of emergent species with clump planting of shrubs scattered throughout the site (Tables 1 & 2). Planting of emergent species will be completed in spring or early summer, with shrubs planted during the winter.

2.1.4 Control of invasive species

Currently Bradford pear (*Pyrus calleryana*) is found throughout the drier areas of WTL-1 as well as adjacent upland areas. Prior to construction, these trees will be cut and an herbicide applied to the stump to ensure no viable Bradford pear trees are included in the stockpiled topsoil. Following construction of the basin and redistribution of the stockpiled topsoil, the site will be monitored for presence of Bradford pears; all Bradford pears will be cut and the stump treated with herbicide.

Table 1. Special Wetland Seed Mix**

SPECIAL WETLAND SEED MIX: Item Number_____					
Cover Crop Seed Mix					
Scientific Name	Common Name	Seeding Rate		Quantity, by weight	Overall Quantity
		Pounds/Acre	Pounds/Unit*		
Triticum aestivum	Winter Wheat	42.0	0.964	60%	52.0%
Secale cereale	Cereal Rye	21.0	0.482	30%	26.0%
Elymus virginicus	Virginia Wild Rye	7.0	0.161	10%	08.6%
Cover Crop Totals		***70.0***	***1.607***	***100%***	
Grass/Sedge Seed Mix					
Scientific Name	Common Name	Seeding Rate		Quantity, by weight	
		Pounds/Acre	Pounds/Unit*		
Carex lupulina	Hop Sedge	3.0	0.069	27%	03.7%

Juncus effusus	Soft Rush	3.0	0.069	27%	03.7%
Scirpus validus	Softstem Bulrush	2.5	0.057	23%	03.0%
Scirpus cyperinus	Woolgrass	1.5	0.035	14%	01.8%
Glyceria striata	Fowl Managrass	1.0	0.023	09%	01.2%
Grass/Sedge Totals		***11.0***	***0.253***	***100%***	
GRAND TOTALS:		**81.0**	**1.837**		**100%**

* UNIT = 1,000 square feet

*** * A special pay item will be required for this mix**

Preparation of the seedbed and sowing of the seed mixture shall be as specified in the TDOT Standard Specifications manual.

The Special Wetland Seed Mix is to be used to stabilize the Offset Basin and all wetland areas with temporary impacts.

MULCHING:

All seeded areas are to be covered by straw mulch as specified in Section 801.07 of the TDOT Standard Specifications book.

Table 2. Shrub Species

Scientific Name	Common Name	Description	Item Number	Total
Hibiscus moscheutos	Swamp Rose Mallow	SDLNG BARE ROOT	802-13.17	250
Cephalanthus occidentalis	Buttonbush	SDLNG BARE ROOT	802-13.53	250

1.87
1.51
+ .12
3.50 AC

2.2 Compensatory Mitigation for Wetlands WTL-1 and WTL-3

To compensate for the unavoidable loss of jurisdictional wetlands and their associated functions and values, permanent impacts (total permanent impacts for all wetlands = ±3.5 acre) will be mitigated at a site in Sequatchie Valley, 8.4 miles northeast of the project location. At a 2:1 ratio this will require ±7 acres of mitigation. If successful, this site will generate a total of 18.2 acres of wetland mitigation, resulting in 11.2 acres of surplus mitigation at this site.

Wetland WTL-1 permanent impacts resulting from direct fill (1.87 acres) as well as wetland areas on the slopes and top of the basin (1.51 acres) will mitigated at the Sequatchie Valley site. Impacts resulting from direct fill of wetland WTL-3 (0.12 acres) will also be mitigated at the Sequatchie Valley site.

The proposed wetland mitigation area is being constructed and managed by Ken Morgan with MRW Environmental LLC. All details for the mitigation site are contained within the attached mitigation plan (Appendix II).

FIGURES

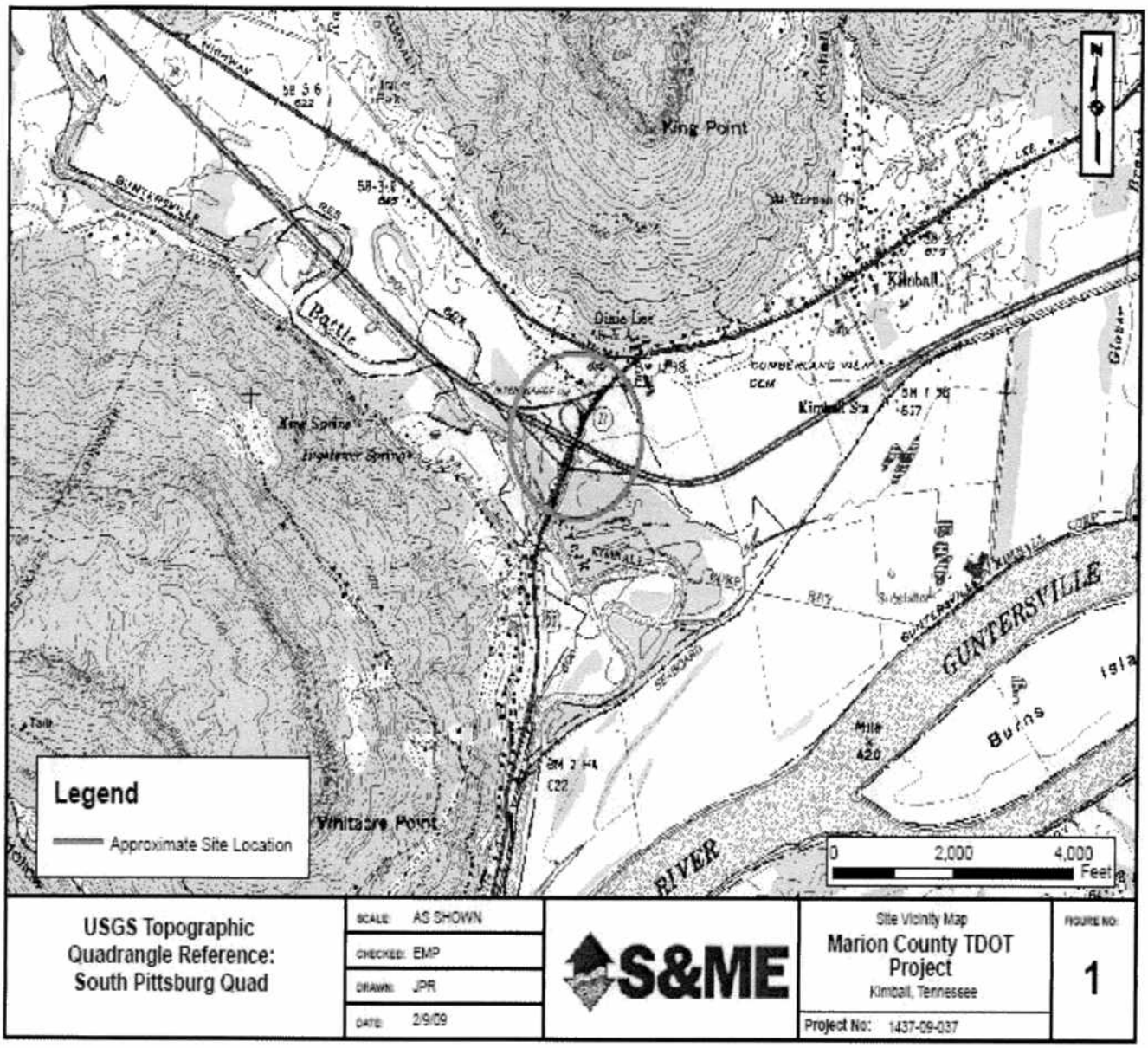


Figure 1: Project location.

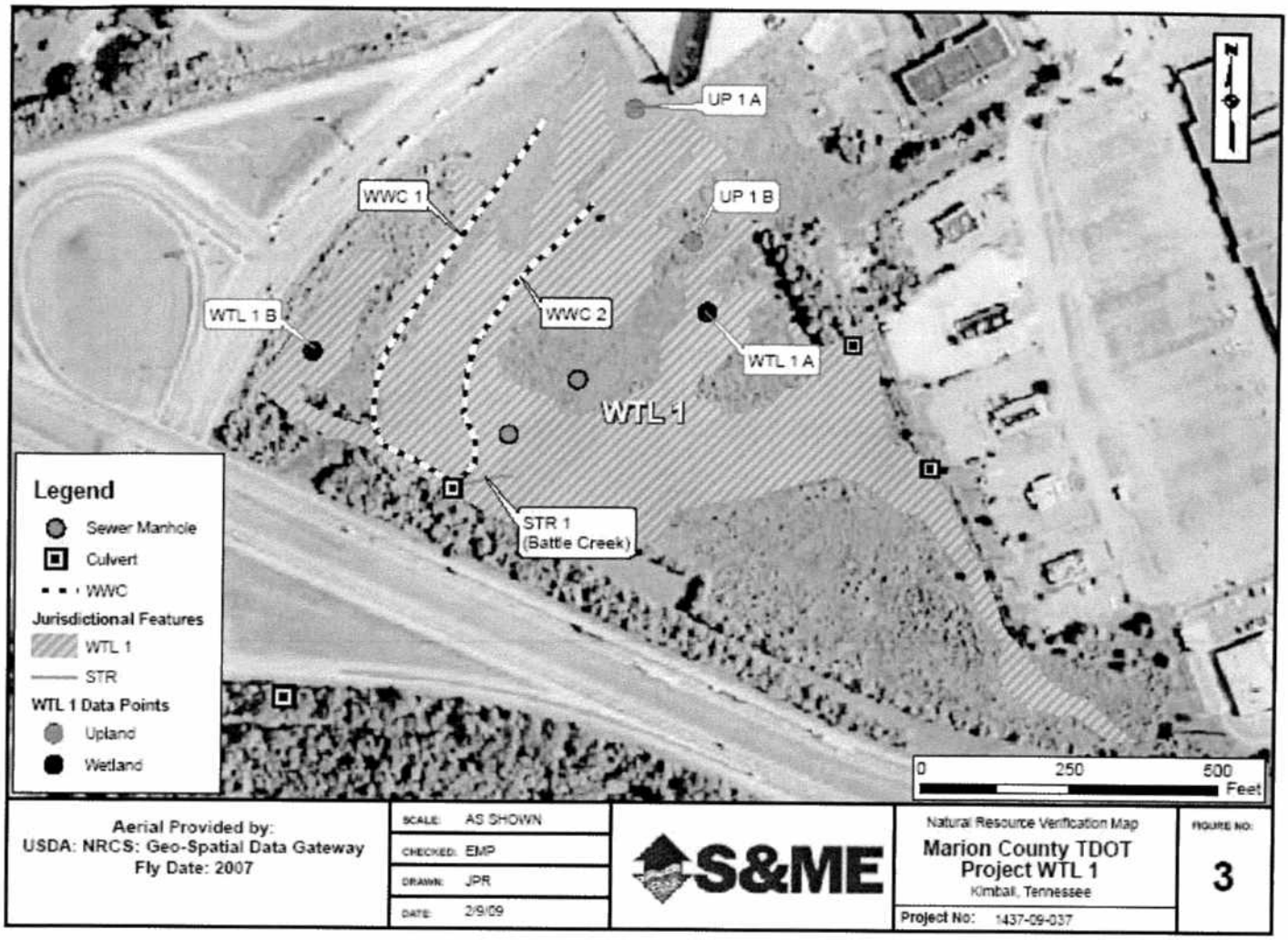


Figure 2: Wetland 1 (WTL-1) according to delineation confirmed by the US Army Corps of engineers.

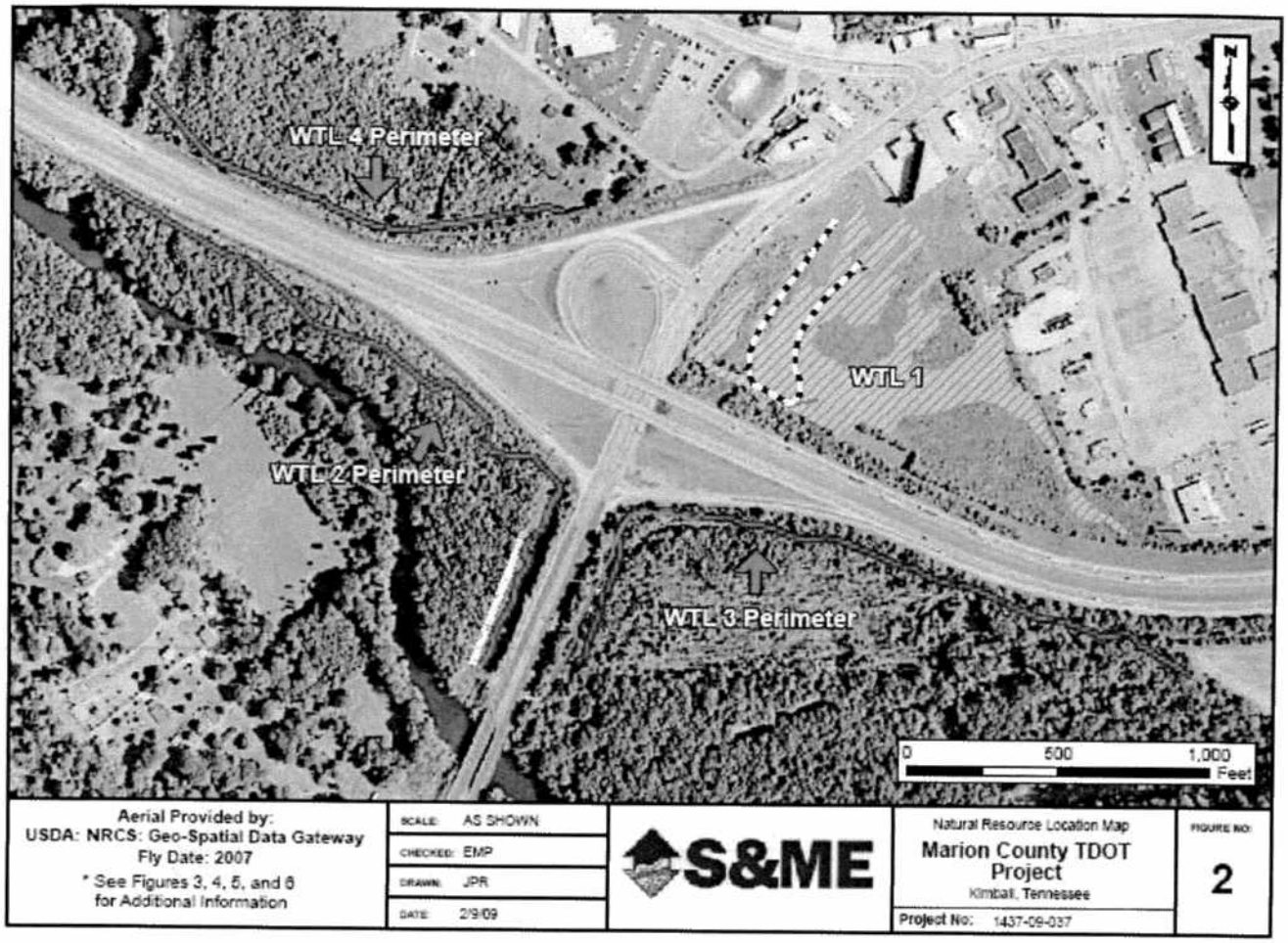
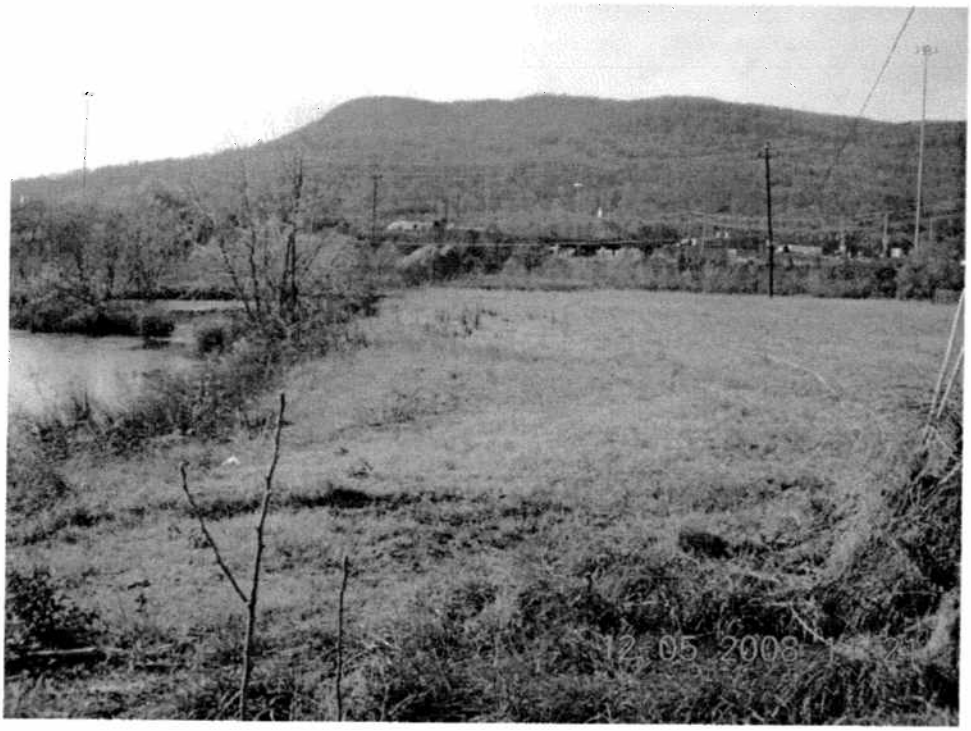


Figure 3: Wetland boundaries for all wetlands within the project area, according to delineation confirmed by the US Army Corps of engineers.

PHOTOGRAPHS

Photograph 1: WTL-1: Standing by the manhole looking toward I-24.



Photograph 2: Standing by the pond looking toward the interchange across WTL-1.

Photograph 3: Beaver dam within WTL-1.

Photograph 4: Standing at the culvert inlet where STR-1 enters and crosses under I-24, looking at beaver dam.

APPENDIX I

TENNESSEE D.O.T.
DESIGN DIVISION
FILE NO.

ENVIRONMENTAL MITIGATION PLAN:

TYPE	YEAR	PROJECT NO.	SHEET NO.
ROW	2007	NH-27(45)	31
CONST	2009	APD-NH-27(46)	260

CHANNEL RELOCATION SEQUENCE AND IMPLEMENTATION NOTES FOR RELOCATED STREAM CHANNELS (**IGNORE REFERENCES TO ITEMS NOT SPECIFIED**)

1. The new channel shall be excavated and stabilized during a low-water period. Rip-rap (only as shown on plans), seeding, and sod shall be installed immediately following channel completion. Trees shall be installed in the first planting season following channel excavation. Water shall be diverted into the new channel only after it is completely stabilized, and only during a low-water period. Stabilized means that all specified rock and erosion control blanket or flexible channel liner is in place, and seeding and sod are in place and established.

2. CHANNEL RELOCATION SEQUENCE
   a. Flag edge of the new channel top bank prior to clearing. Do not clear large trees in position to shade the new channel. Leave as many trees and shrubs as possible between toe of the new highway slope and the stream.
   b. Excavate the new channel "in the dry" by leaving areas of undisturbed earth (diversion berms) in place at both ends.
   c. Shape channel to specifications shown. Remove loose soils and debris.
   d. Place topsoil, erosion control blanket or flexible channel liner, seed, and sod as specified.
   e. Remove diversion berms, beginning with the most downstream, banks and bottom elevation of the old channel should transition smoothly into the new channel. The elevations of the new channel bottom at each end of the relocation sequence should match the elevations of the existing channel, and a steady percent slope should be maintained throughout the relocated channel centerline or as specified.
   f. Install trees according to standard specifications section 802.
3. Only rip-rap shown on plans should be used in the relocated channel reach. Any other proposed rip-rap should be coordinated with the Environmental Division through the TDOT Headquarters Construction Office.
4. Requests by any agency that would require the modification of channels, ditches, elevations, rip-rap or any other stream mitigation items associated with the channel relocations shall be referred to the TDOT Environmental Division via the Headquarters Construction Office for coordination with all involved agencies and TDOT divisions.

TREES, SHRUBS, AND SEEDLINGS

No substitutions of plant species or sizes shall be allowed without the written approval of TDOT Environmental Division. Concerning **stream mitigation**, trees shall be of the variety requested and first quality. Concerning **temporary wetland mitigation**, trees shall be of the variety requested, well branched, **bare root (roots must be kept moist at all times),** and first quality. No clones or cultivars will be accepted. Any found to be incorrect species, or improperly planted, at any time prior to termination of the contract shall be removed and replaced at the contractor's expense. Stakes and wires shall be removed immediately prior to contract termination, unless otherwise directed by the engineer.

The contractor should arrange several months ahead of time to obtain the correct tree species, as some may require some time to locate.

All plants shall be planted as per section 802.07 of TDOT standard specifications for the road and bridge construction.

Plants shall be watered as required through the period of establishment to ensure survival.

Standard Stream Mitigation (STR-2)

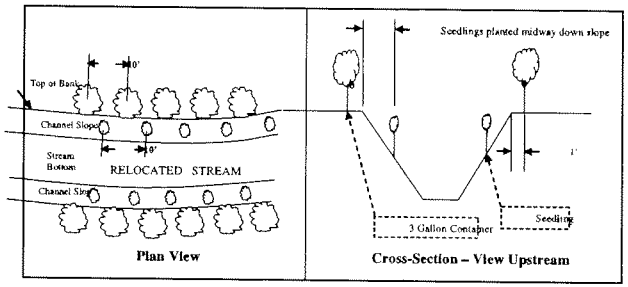
Apply these measures to all applicable streams listed in Form J. Duplicate the length, bottom channel width, elevations, side slopes, meander wavelength, and curvature of the existing channels to the extent possible. Each channel should transition smoothly from its beginning elevation to its tie-in elevation in the receiving stream, without profile drops or jumps. Locate the new channels in as flat an area as possible to avoid unusually high side slopes; this may require some additional right-of-way. Channel length placed in spring-boxes or culverts counts as part of the new channel length (but may require off-site compensatory mitigation that would not be required for an open channel). Channel side slopes should mimic existing channel side slopes, if possible, and be stabilized using appropriate BMPs – the use of rip-rap should be avoided if possible. If rip-rap is required, the rip-rap should be imbedded into the soil so that the top of the rip-rap is flush with the bottom and sides of the channel.

Plant two alternating rows of tree or shrub species on both sides of the new channels; the first row shall be bare root seedlings that are planted on the channel slope, centered on the midpoint of the slope. Along the top of bank, 3-gallon container-grown trees are to be planted within one foot of the top of bank, unless directed otherwise. For the side of the stream closest to the road, plant only the shrub species (Item numbers802-13.01 and 802-13.60.

Rip-rap, if required, should be limited to ends of culverts. All relocated channels and their accompanying mitigation features, including trees, are to be placed in right-of-way rather than easements; this may require acquisition of additional right-of-way. Use the following specifications for planted species:

Item #	Description	Unit
802-13.01	ALNUS SERRULATA (HAZEL ALDER 2-5FT CNTNR GRWN)	Each
802-11.13	CRATAEGUS PHAENOPYRUM (WSHNGTN HAWTHORN 2-5FT CNTNR GRWN)	Each
802-11.12	CORNUS FLORIDA (FLOWERING DOGWOOD 2-5FT CNTNR GRWN)	Each
802-12.40	SALIX NIGRA (BLACK WILLOW SEEDLNG B.R.)	Each
802-13.60	SAMBUCUS CANADENSIS (ELDERBERRY SDLNG BARE ROOT)	Each

Figure 1. SPACING FOR PLANTING ALONG RELOCATED STREAM.



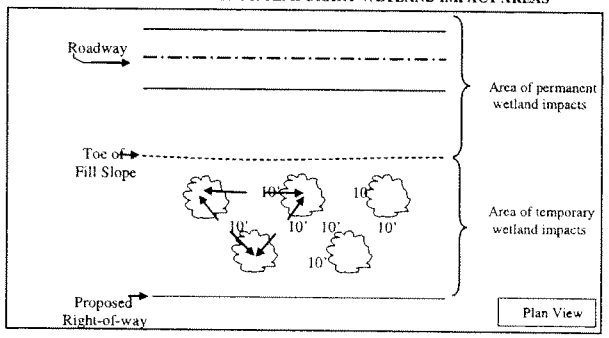
Standard On-site Mitigation for Temporary Wetland Impact Areas

Apply these measures to all applicable temporary wetland impact areas listed in Form J. For temporary wetland impact areas, remove the top six to 12 inches of topsoil and stockpile it until construction is complete. Once construction activities are completed, restore all temporary wetland impact areas to pre-construction conditions. This includes removing haul roads (if applicable), restoring the site to the original (pre-construction) elevation and spreading stockpiled topsoil back over the wetland site. The area of temporary impacts will then be seeded, covered with straw and planted with tree seedlings to stabilize the site. Seedlings will be planted on 10-foot centers. Place a note on the present and proposed layout sheets to protect wetland areas located beyond the limits of the fill slope and proposed right-of-way.

Item #	Description	Unit
802-12.38	QUERCUS PHELLOS (WILLOW OAK SEEDLNG B.R.)	Each
802-12.35	QUERCUS NIGRA (WATER OAK SEEDLNG B.R.)	Each
802-12.18	LIQUIDAMBER STYRACIFLUA (SWEETGUM SEEDLNG B.R.)	Each
802-12.02	ACER RUBRUM (RED MAPLE SEEDLNG B.R.)	Each
802-12.07	BETULA NIGRA (RIVER BIRCH SEEDLNG B.R.)	Each

Ht = Height, BR = Bare Root

TREE PLANTING SCHEME FOR TEMPORARY WETLAND IMPACT AREAS



COORDINATE VALUES ARE NAD/83(1995) AND ARE DATUM ADJUSTED BY THE FACTOR 0.99959 & TIED TO THE TCRN

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

ENVIRONMENTAL MITIGATION PLAN

6/1/2009
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APPENDIX II

SEQUATCHIE VALLEY
MITIGATION PROJECT PROPOSAL

MARION COUNTY, TENNESSEE

July 2006

Prepared for:

Tennessee Department of Environment and Conservation
Division of Water Pollution Control
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BACKGROUND

The mitigation site is located on Shelton Road in Marion County, Tennessee; site coordinates are W85^0 32' 51", N35^0 05' 11" (Figure 1). Figure 2 is an aerial view of the site (the approximate property boundary is marked in red). The project site totals 22.83 acres and consists of approximately 16.66 acres of open land and approximately 6.17 acres of woodland (Figures 3 and 4). The site was ditched and drained prior to 1985 and the majority of it was cleared and used for crop production, primarily soybeans, since that time. The objective of this proposal is to detail how the site will be restored to wetland status with the goal of using the site to mitigate for unavoidable wetland impacts in Marion, Grundy, Hamilton, Sequatchie and other nearby counties.

The following site description is based on an evaluation conducted by Ken Morgan and Tom Roberts (MRW Properties). Agency personnel who have visited the site include Tracy Dardy, Julianna Kyzer, and Mike Lee with the Tennessee Department of Environment and Conservation (TDEC), and Mike Williams of the Tennessee Department of Transportation (TDOT).

VEGETATION

The dominant vegetation community in unaltered headwater slope wetlands in Tennessee (the Hydrogeomorphic (HGM) classification for this site) is forest composed primarily of willow oak (*Quercus phellos*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*) and similar species in the overstory. Common understory species include various dogwoods (*Cornus* spp.), ironwood (*Carpinus caroliniana*), and possumhaw (*Viburnum nudum*). Numerous other species can occur depending on individual site conditions and disturbance history. Burns and Honkala (1990) is the primary source of information used to determine the vegetation that occurs in unaltered wetlands.

The majority of the proposed mitigation site has been cleared, thus the plant community there is significantly different from that found in reference wetlands within the region. The 16.66 acre field (Figure 3) currently is a herbaceous community characterized by tall fescue (*Festuca arundinacea*), broomsedge (*Andropogon virginicus*), Johnsongrass (*Sorgum halapense*), panic grass (*Panicum virgatum*),

goldenrods (*Solidago* spp.), and blackberry (*Rubus* spp.) with soft rush (*Juncus effusus*) and fox sedge (*Carex vulpiniodia*) in small areas in which the water table is near the surface.

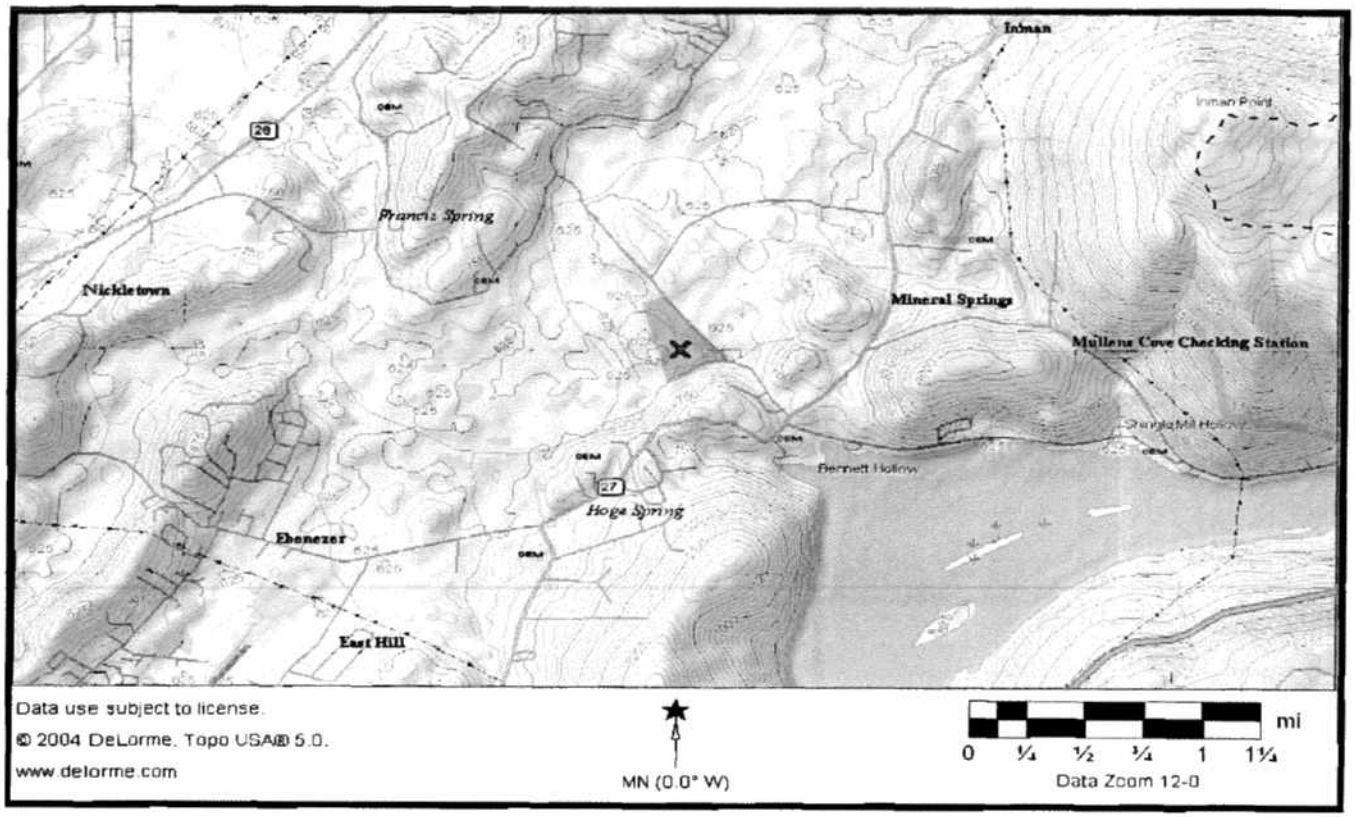

Figure 1. Approximate location of mitigation area (red X) located southwest of Mineral Springs on the Sequatchie, TN Quad.

Figure 2. Aerial view of the proposed mitigation site (22.83 acres.)

Figure 3. Photo of current condition of the 16.66 open portion of the proposed mitigation site.

Figure 4. Photo of representative portion of the 6.17 acres of forest at the proposed mitigation site.

The primary overstory species in the 6.17 acre forested portion of the site are red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), hackberry (*Celtis occidentalis*), and eastern red cedar (*Juniperus virguniana*) (Figure 4). The management history of this portion of the site is unknown, but the species composition and diameter of the trees indicates that the site has been logged in recent decades. The presence of shade intolerant sweetgum and cedar indicates that the site was much more open at some time in the past and in fact may have been cleared. The presence of cedar also indicates that the site is much drier than it was prior to drainage. Common ground-level species include poison ivy (*Toxicodendron radicans*), Japanese honeysuckle (*Lonicera japonica*), and common greenbriar (*Smilax rotundifolia*). European privet (*Ligustrum vulgare*), a common species in must of southeastern Tennessee, is found in portions of the site.

SOILS

The only soil series mapped at the site is Purdy, described taxonomically as a Typic Endoaqualt. The texture in the upper 9 inches is a silt loam, from 9 to 19 inches a silty clay loam, and from 19 to 42

inches a silty clay. It is described as occurring on flats and depressions on terraces and formed in alluvium washed in from the adjacent uplands. Purdy soils are similar to the more common Guthrie series except that they formed in alluvium rather that residuum. Both series have a fragipan in the subsoil, but the pans may be weakly developed and discontinuous. In the Purdy series, the fragipan typically occurs at 19 inches. The series is classified as "poorly drained" and is on the hydric soil list for Marion County.

Purdy soils are not well suited to row crops or even pasture although many areas in central and eastern Tennessee have been converted to such uses. The Putnam County soil survey states that "a few areas are planted to corn or grain sorghum, but yields are low and failures are common. Pasture generally is of poor quality." Regardless of the intended land use, drainage is necessary to lower the groundwater level to a depth that will allow non-adapted plants to survive and grow. In addition to the Marion and Putnam Country soil surveys, *Wet Soils of Tennessee* (Talley and Monteith 1994) was a source of information on the characteristics of the Purdy series.

HYDROLOGY

The hydrology of unaltered headwater slope wetlands in central and eastern Tennessee is dominated by down-gradient movement from the surrounding watershed mostly in the form of interflow. In wetlands with either Purdy or Guthrie soils, both the subsoil and upper horizons are wet, especially during winter and spring. Depressions in portions of some sites may pond water well into the growing season. The Purdy series is described as having an apparent high water table from 1 foot below the surface to 1 foot above the surface from November through June. Because of its landscape position, Purdy does not flood.

Current hydrology of the site is significantly altered due to a series of ditches (Figure 5) that were constructed to drain the site and convert it to agricultural production. The primary alteration is a large drainage ditch (figure 5, B) (approximately 3^{+} feet deep) that runs SW to NE and bisects the cleared portion of the property. Such ditches are effective in draining Purdy soils as they remove surface water following rainfall events and lower the groundwater table for a considerable distance. Calculations using the ellipse equation (USDA 1997) indicate such an alteration in a Purdy soil effectively will remove

"wetland hydrology" to a distance of at least 58 feet on each side of the ditch. Because of the groundwater movement is toward the ditch (due to the slope of the site), it is likely that the water table is lowered substantially further. There also is a series of smaller ditches located along the eastern portion of the site. The primary one (Figure 5, A) was a natural stream channel that has been excavated to a depth of between 2 and 3 feet; it runs the length of the site at the field:woodland interface. Other ditches are located within the forested portion of the site and drain into it. The ditches within the wooded area vary in depth, but mostly are 1 to 2 feet deep. Calculations using the ellipse equation (USDA 1997) indicate such alterations (using 1.5 and 2.5 feet as an average depth) in a Purdy soil effectively will remove "wetland hydrology" to a distance of 58 feet on each side of the ditches respectively.

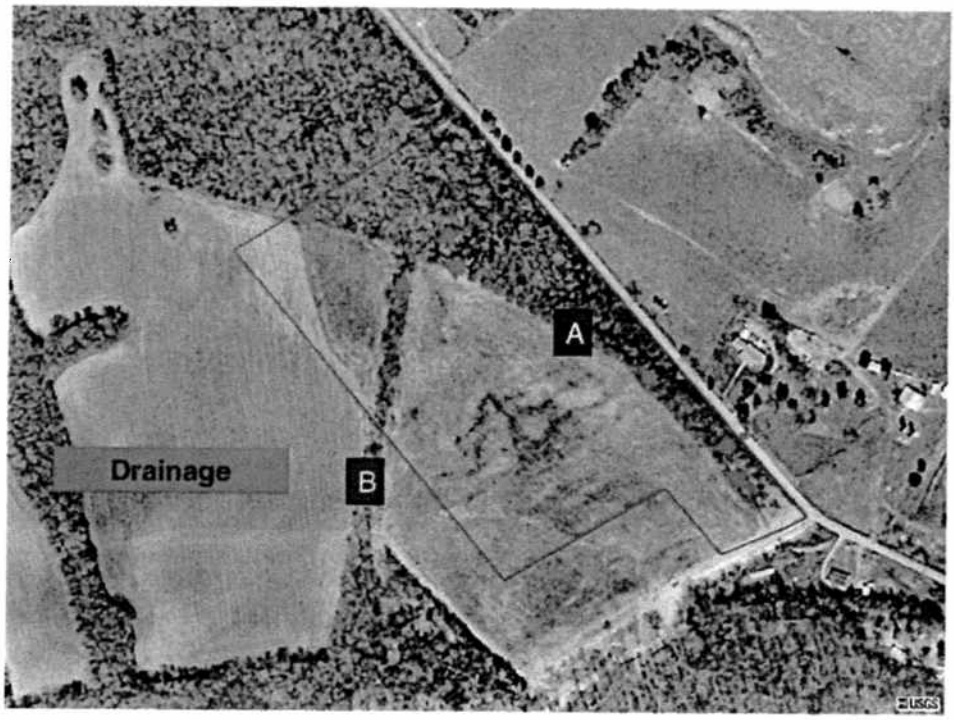

Figure 5. Aerial view showing approximate location of excavated drainage ditches.

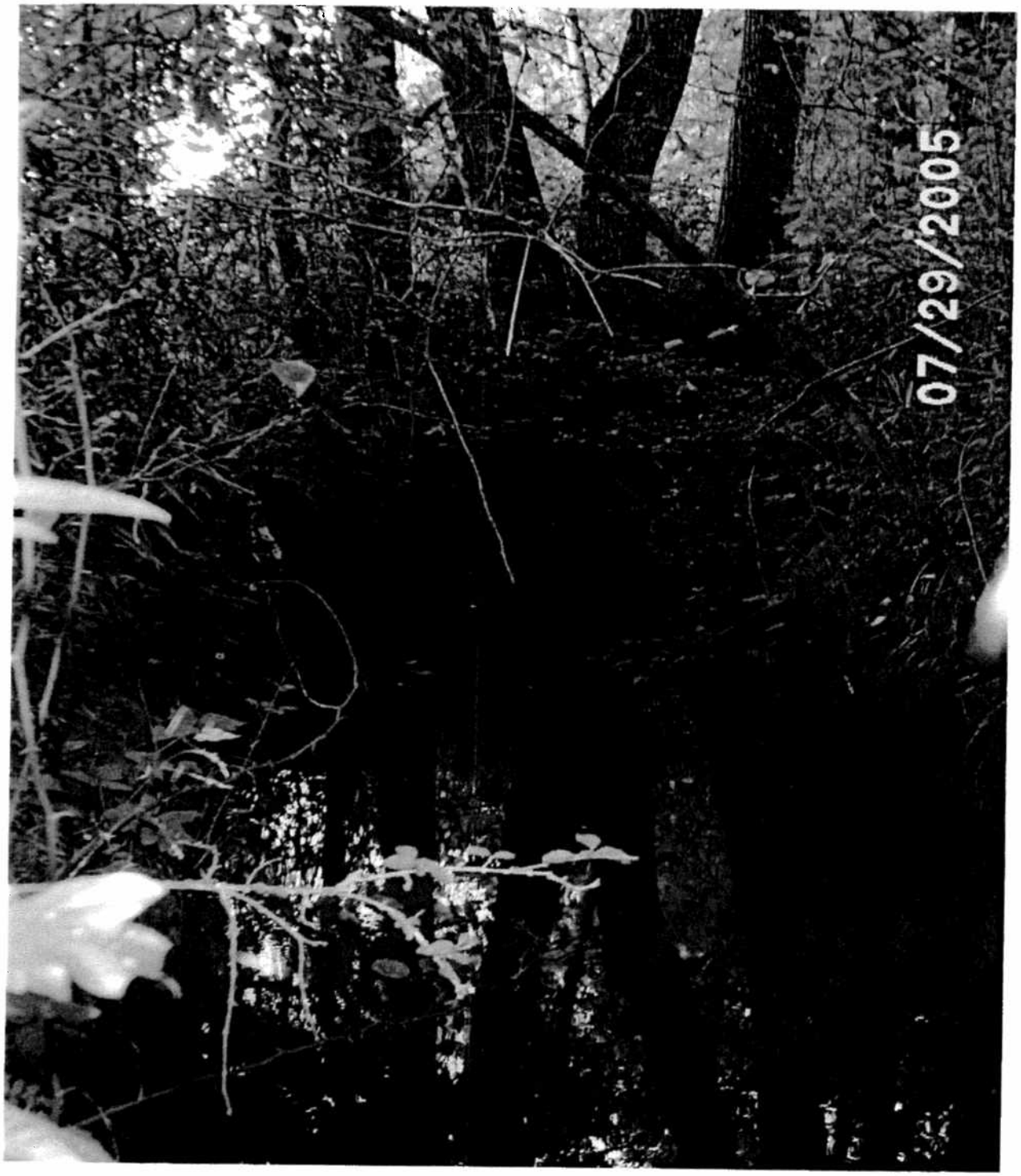

Figure 6. Photo of excavated ditch ("A") bisecting length of the site from southeast to northwest.

Figure 7. Photo of excavated stream channel ("B") bisecting site from south to northwest.

These hydrologic alterations along with the removal of the native forest community have resulted in the majority of the site no longer meeting the criteria for being considered wetland. Because these changes are reversible, the site is an excellent candidate for restoration and subsequent use to mitigate unavoidable wetland losses in the area. Sites such as this are considered the most desirable type of land for wetland mitigation because they occur in the proper landscape position and previously possessed wetland hydrology, soils, and vegetation. The likelihood of restoring wetland conditions at such sites is much higher than creating wetland conditions in upland areas.

Of the total, 16.66 acres of open land is suitable for restoration (Figure 8) and 6.17 acres of forested land is suitable for a combination of restoration and enhancement (Figure 9).

Figure 8. Aerial view showing portion of the site proposed for restoration.

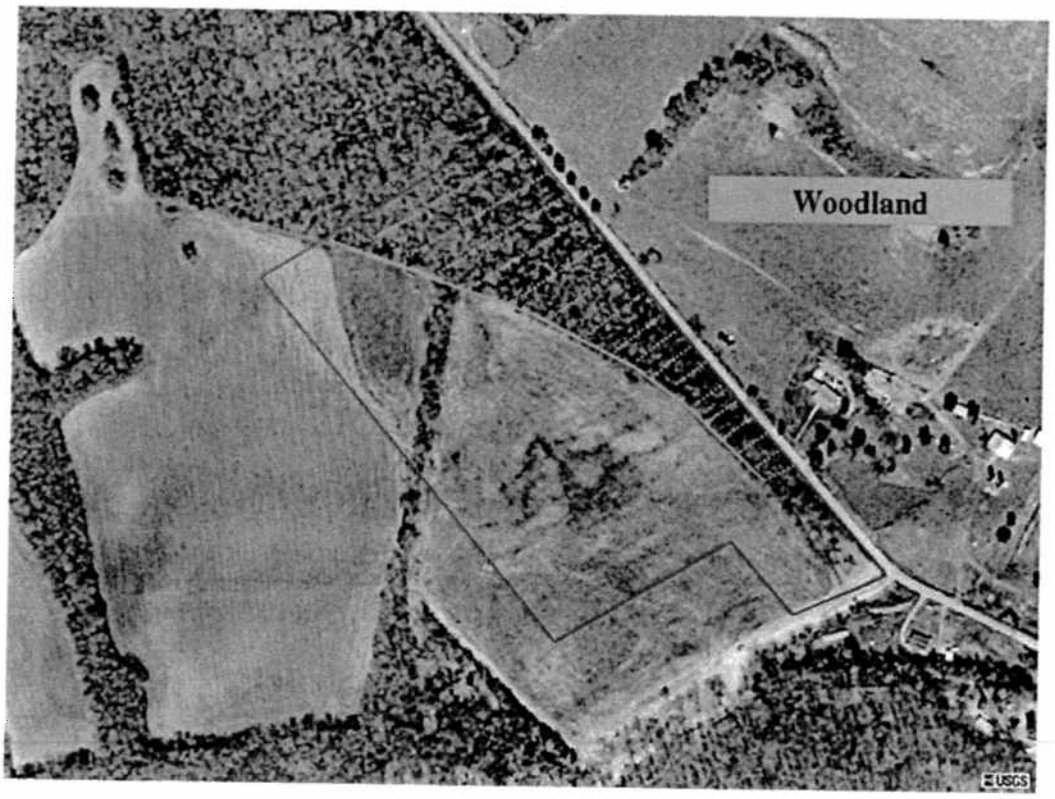

Figure 9. Aerial view showing portion of the site proposed for restoration and enhancement.

PROPOSED RESTORATION AND ENHANCEMENT

VEGETATION

Field

The 16.66 acres of cleared land will be planted with native tree species that occur in headwater wetlands in the area. Species include willow oak, green ash, cherrybark oak (*Q. pagodaefolia*), white oak (*Q. alba*), persimmon (*Diospyros virginiana*), and others recommended by local regulatory personnel. One or more of the water-tolerant dogwoods (*Cornus* spp.), ironwood, and possumhaw will be planted as understory species based on availablility. Trees will be planted on ten-foot centers along sinuous rows at a density of 450/acre.

Planting locations for each species will be determined by relative elevations of the site and the individual species tolerance to saturation and inundation. Although most of the site is relatively level, it does slope generally in a northward direction and there are portions that are somewhat lower in elevation and will be saturated or inundated for longer periods during the growing season. Overcup oak (*Q. lyrata*) which is known to occur in portions of southeastern Tennessee, will be planted in the lowest portions of the site if approved by the regulatory agencies. Willow oak, green ash, persimmon, dogwood, and ironwood will be planted at intermediate elevations. Higher portions of the site near the edge of the wetland will be planted primarily with white oak and cherrybark oak. No one species will comprise more than 40% of the trees planted. Species such as sweetgum and red maple likely will volunteer and become established at the site on their own. Once mature, this suite of planted and volunteer tree species will provide an abundance of food and cover for a variety of wildlife including mammals, birds, reptiles, and amphibians characteristic of wetlands in the area. Additionally, during the early and intermediate stages of succession, the area will be a highly diverse plant community that supports specialized species that depend on seral habitats. Examples include the common yellowthroat (*Geothlypis trichas*) and yellow warbler (*Dendroica petechia*).

Woodland

Work in the 6.17 acres of forest will entail the planting of willow in portions of the area in which the canopy is relatively open. In the remainder of the area, shade tolerant species such as ironwood, dogwoods, and possumhaw that will survive in selected areas under the existing forest canopy will be planted. Density of these plantings will vary across portions of the site and will depend largely on the density of existing understory species.

HYDROLOGY

To restore and enhance the characteristic hydrology of the site, several modifications are needed. The primary restoration activity will be to fill the main ditch bisecting the property. This will prevent the drainage of surface water and will restore groundwater hydrology to a sizable portion of the site. Care will

be taken not to damage the larger, more desirable trees that are growing adjacent to the ditch. This activity will result in a shallow swale that will facilitate the natural drainage of water from the site.

The ditches within the wooded portion of the site will be blocked or filled in several locations to slow the movement of water from the area during and following rain events. Generally, shallow ditches will be blocked whereas deeper ones will be filled. Filling of the deeper ditches will aid in the restoration of groundwater levels to pre-existing conditions.

The incised stream channel than now drains the eastern portion of the site will be modified by installing a series of shallow weirs at strategic locations. These weirs will result in a gradual increase in bed elevation by trapping sediments while still allowing the movement of fish and other stream organisms. These weirs will slow the movement of water from the site following heavy rainfall events and over time will dramatically improve the level of function in this degraded channel. As bed elevation is increased, groundwater levels adjacent to the channel in both the field and forest will be restored to near-surface levels and overbank flooding will occur during periods of high flows.

To restore a more natural overland flow pattern, a low berm will be constructed at the southeastern portion of the site to divert water to the central portion of the area. This will have no adverse impact on the stream itself as flows will remain sufficient to maintain its integrity.

Lastly, shallow micro-depressions that mimic the small concave features found in mature forested wetlands due to tree falls will be excavated in the open portion of the site. The resulting "pit and mound" topography will provide additional breeding habitat for amphibians in addition to drinking water for other vertebrates.

As shown in Appendix A, these activities will result in a total of 18.67 acres of restoration land and 4.16 acres of enhancement land. The survey was conducted by Bartlett Surveying on July 28, 2005.

PROPOSED MONITORING

Monitoring of the mitigation site will aid in determining if it is returning to pre-alteration conditions. Collection of this data will be used to determine if the project can be considered a success, or

if mid-course modifications are warranted. Monitoring of the site will take place annually for a five-year period. Details of the monitoring program are described in the sections below.

HYDROLOGY AND SOILS

Once work on the ditches, incised stream channel, and micro-depressions has been completed, shallow groundwater wells will be installed in the northwestern, northeastern, southwestern, and southeastern areas of the site. Monitoring of the 4 wells will take place periodically from early March to early June in order to determine if the hydroperiod of the site has returned to that consistent with an unaltered Purdy soil. Presence and depth of ponding in the micro-depressions will be noted. Soil from areas judged to be characteristic of the site will be described; information from the upper 18 inches of the soil profile that will be recorded includes texture, Munsell color, and types and abundance of redoximorphic features present.

VEGETATION

Monitoring of vegetation throughout the site will be conducted in late summer. In both the field and wooded portions of the site, data describing the composition of the plant community and the survival of planted trees will be collected. Transects of varying lengths will be established in each identifiable plant community. Location and number of transects will be determined prior to the first monitoring event. Data collected will include total percent cover, percent cover by species, and species richness. Percent survival of trees planted in the open area will be determined by walking rows and tallying trees as either living or dead. Percent survival of planted trees within the wooded restoration/enhancement area will be determined in the same manner.

WILDLIFE MONITORING

Utilization of the site by wildlife will be documented during site visits conducted to monitor hydrology and sample vegetation. Monitoring of wildlife will include direct observations and aural verification, as well as evidence of presence such as tracks, hair, nests, and eggs. A list of wildlife species will then be produced for each monitoring period.

PHOTOGRAPHIC DOCUMENTATION

Photographs of the mitigation site will be taken from numerous points established prior to the first monitoring event. Each point will be marked by driving a PVC pipe into the ground; GPS coordinates of each location will be recorded. Photographs will be taken at these points during every monitoring event to provide a record of the changes that take place as the plant community matures.

MONITORING REPORTS

Monitoring reports will enable the regulatory agencies to determine if the proposed mitigation is successful based on pre-determined performance standards. Reports will include locations of transects and photographic points, monitoring protocol, and results and evaluation of data collected. Specifically data on hydrology, vegetation, and soils will be evaluated to determine if the criteria for being considered jurisdictional wetland as described in the 1987 Wetland Delineation Manual (U. S. Army Corps of Engineers 1987) are met. Data collected also will be used to assess selected functions performed by the restored wetland. Note: development of Hydrogeomorphic (HGM) assessments of slope wetlands in Tennessee will be underway when the first of the monitoring reports for this site are due. Assessing the mitigation area with those models will be helpful in tracking the functional development of this site. Monitoring reports will be submitted for review to all interested regulatory agencies within 60 days of the annual monitoring event.

PERFORMANCE STANDARDS/CRITERIA

The success or failure of the mitigation efforts ultimately will be determined by the hydroperiod, vegetation structure and composition, and soil conditions that develop at the site following the restoration and enhancement actions proposed. The following performance standards/criteria will be used to make that determination.

1. The site should develop and maintain a hydroperiod that is consistent with a Purdy soil by the end of the five-year monitoring period.
2. Species in the FAC, FACW, or OBL categories should cover no less than 70% of the restored portion of the site at the end of the five-year monitoring period.

3. Survival of planted trees in both the restoration and restoration/enhancement areas will be no less than 70% at the end of the five-year period.

If any of these standards are not met at the end of the five-year monitoring period, corrective measures will be taken and monitoring will continue on an annual basis until they are met.

LITERATURE CITED

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U. S. Army Corps of Engineers. 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1. Waterways Experiment Station. Vicksburg, MS.

APPENDIX A

CURVE TABLE						
CURVE	RADIUS	LENGTH	DELTA	TANGENT	BEARING	CHORD
C1	45025.00'	415.31'	0°31'43"	207.66'	S43°49'46"E	415.31'
C2	475.00'	71.63'	8°38'25"	35.88'	S48°24'50"E	71.56'
C3	124.16'	38.27'	17°39'42"	19.29'	S51°27'53"W	38.12'

LINE TABLE		
LINE	BEARING	DISTANCE
L1	S42°38'02"W	10.19'

N

W E

S

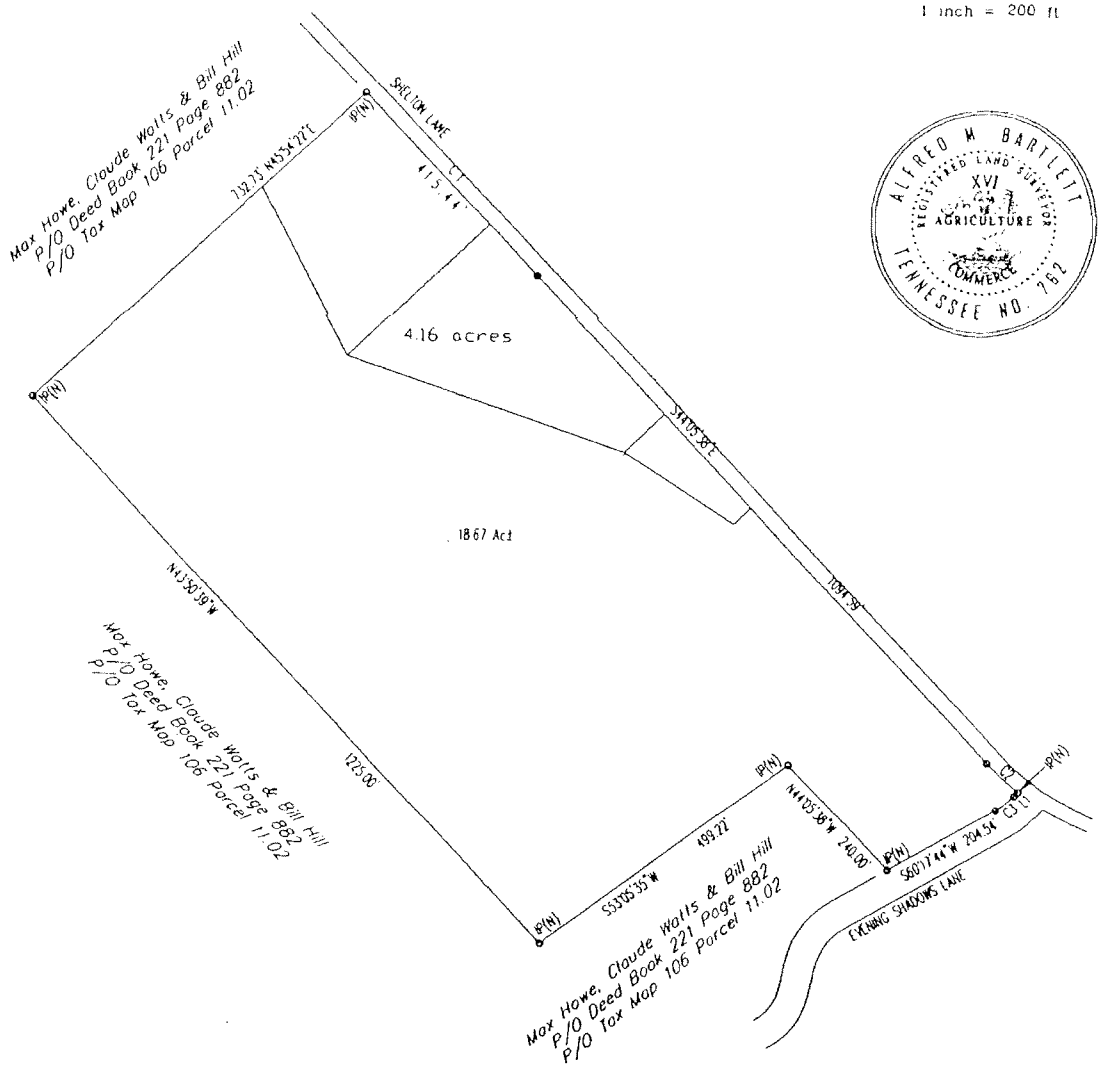
Magnetic North

GRAPHIC SCALE

200 0 100 200 400

(IN FEET)

1 inch = 200 ft



ALFRED M BARTLETT
REGISTERED LAND SURVEYOR
XVI
AGRICULTURE
COMMERCE
TENNESSEE NO. 762

PRELIMINARY

THIS SURVEY WAS DONE WITHOUT THE BENEFIT OF A TITLE SEARCH.

I HEREBY CERTIFY THAT THIS IS A CATEGORY I SURVEY AND THE RATIO OF PRECISION OF THE UNADJUSTED SURVEY IS 1:10,000 AS SHOWN HEREON

ALFRED M BARTLETT
TENNESSEE REGISTRATION NO. 1762
DATE OF SURVEY_____

LEGEND
IP(O) IRON PIN OLD
IP(N) IRON PIN NEW

Bartlett Surveying
214 East Stevens Street · Cookeville, Tn 38501
Phone (931) 526-2882 · Fax (931) 526-2885

Jim Ward

2nd CIVIL DISTRICT	TOTAL ACRES: 22.831
MARION COUNTY, TN	SCALE: 1"=200'
TAX MAP 106 P/O 11.02	DATE: 7/28/2005
P/O DK: 221 PG: 882-886	DRAWING #05-282 A3