1.0 INTRODUCTION

Advanced Ecology, Ltd. (AEL), on behalf of Mitigation Management, LLC (MML or Sponsor), is proposing to develop the Lost Creek Brake Mitigation Bank (LCBMB or Bank), in Newton County, Texas. The LCBMB is comprised of approximately 491.4 acres of spectacular baldcypress-tupelo swamp adjacent to the Sabine River that has been largely undisturbed by human activities, with the exception of a high-grading timber harvest estimated to have occurred in the late 19th to early 20th century. The Sabine River was named by Spanish explorers in the early 1700's who noted the many large baldcypress trees observed along the river, hence *Rio de Sabinas*. (TSHA 2010). Likely, many of the older baldcypress/tupelo trees presently found on the LCBMB were present during that time.

Based on a sample of increment cores, published research, regional historical accounts and remote sensing of historical aerials, there are roughly three cohorts of cypress age classes on the site. As the age of the trees in these groupings decrease, the frequency of occurrence increases. Thus, the relatively few, largest relic trees on-site may only be guessed to be approaching millennial status (likely extant well back into the precolonial era). The next cohort is estimated to vary in age from several to many centuries old, and are more numerous yet (such as the one pictured on the right). The most abundant cohort of trees is estimated at a little over a 110-130 years of age, which parallels anecdotal accounts of the last known timber harvesting activities on the tract, as well as regional historical reports. As a comparison, this harvesting occurred shortly after the industrialization of baldcypress logging, in the era of the steam donkey, the assassination of Archduke Franz Ferdinand, and the great Galveston hurricane. Most of the water tupelo trees that were not directly damaged during the harvesting activities remain. As such, many of the water tupelo trees are considerably older than the youngest cohort of baldcypress. Taken together, this site represents a "least disturbed" reference condition for alluvial river baldcypress/tupelo swamps in the lower Sabine River watershed.

Currently, ubiquitous demand for specialized wood products from mature baldcypress and tupelo trees threaten the continued integrity of this unique forested wetland community. Such pressures are projected to increase concomitant with demands of an ever expanding human population. As such, protection of these unique and difficult-to-replace habitats is critical to maintaining biodiversity within the watershed, and it is our belief that compensatory mitigation is an appropriate and practicable vehicle for accomplishing that on the LCBMB.

2.0 PURPOSE, GOAL AND OBJECTIVES

The purpose of the proposed Bank is to perpetually conserve approximately 491.4 acres of rare and difficult-to-replace aquatic resources, the majority of which are best described as mature baldcypress-tupelo dominated Palustrine Forested Wetlands (PFO) located within the lower Sabine River watershed. Due to the quality and scarcity of these forested wetland communities, preservation is the primary and obvious conservation strategy. Forest stand enhancement activities targeting invasive exotic woody species (i.e. Chinese tallow-tree) on approximately 63.4 acres will be conducted in conjunction with preservation for the Bank.

As is described throughout this document, it is the belief of AEL that the LCBMB effortlessly meets the requirements for use of preservation, outlined in Compensatory Mitigation for Losses of Aquatic Resources (CMLAR), for compensatory mitigation purposes. Therefore, the operational goal of the proposed Bank is to quantify, and make available, Functional Capacity Units (FCUs) for satisfaction of compensatory mitigation requirements for losses of aquatic resource functions and services within the geographic extent of the Service Area. Objectives of the proposed bank are to 1) provide USACE permit applicants greater flexibility in compensating for adverse impacts to the aquatic ecosystem, and 2) provide proven and higher quality methods of protection of Waters of the United States (U.S.), including wetlands.

3.0 TECHNICAL FEASIBILITY AND GENERAL NEED

This site was carefully evaluated and strategically selected for a number of reasons; 1) regulatory considerations and market conditions supporting the establishment of a mitigation bank within the watershed, 2) Population growth, land development, and habitat conversion trends at various scales (global, national, regional, and local), and relatedly 3) imminent threats to the habitat types occurring within the LCBMB. Collectively, this approach represents a watershed-oriented, landscape approach espoused by CMLAR. Because the activities planned for the site are not complex (in the case of preservation) or are comprised of routine non-intensive silvicultural prescriptions (as in the case of the proposed enhancements), this project poses low to no risk with regard to technical feasibility.

3.1 Regulatory Considerations & Market Demand

As previously mentioned, there are no existing private mitigation banks with available credits within the proposed service area of the LCBMB. Compensation for impacts requiring mitigation within this proposed service area have heretofore relied on permittee responsible mitigation or non-traditional mitigation methods. The CMLAR is clear that mitigation banks generally represent more sustainable and ecologically beneficial forms of compensatory mitigation than the other allowable options (depending, of course, on case-specific circumstances). As such, the establishment of the LCBMB in this service area will add additional mitigation options to permittees, provided in the form of scarce and highly valued forested wetland resources.

3.2 Population Growth, Land Development, & Habitat Conversion Trends

Rapidly expanding human populations place pressure on the productive potential and resiliency of natural resources. These pressures occur in multiple layers and across various mechanisms, but ultimately are traced back to consumer-driven purchases made by hundreds of millions of individuals living throughout the globe. We typically visualize cause and effect of natural resource alteration myopically, and therefore-- locally (who's cutting the timber?); while ignoring the greater and more pervasive driver behind such changes in land use or habitat structure (people use wood a lot and there are more and more people born in almost every country every day).

Human population growth and demand for wood products is omnipresent, but let's consider the following statistics as indicators for increased demands on Texas' local forested resources:

- Texas is the #2 most populous state (247wallst.com)
- Texas is #1 in population growth from 2005-2013 (osd.texas.gov)
- #1 Austin & #3 Dallas fastest growing cities and economies in the nation in 2016 (forbes.com)
- #4 Houston, #7 San Antonio, #9 Dallas, and #11 Austin most populous cities in the nation (U.S. census bureau data reef's Wikipedia.org)
- Texas population grew from 19 to 26 million from 1997-2012 (TA&M IRNR)
- In 2014, Texas's forest sector contributed $30.3 billion to Texas' economy (tfsweb.tamu.edu)
- In 2012 East Texas (80% Texas' timberland) produced $5.7 billion worth of goods and services and is a main producer of primary forest products (lumber, structural panels, paper, and pulp).
- In 2012, Texas forest product firms exported $1.8 billion worth of forest products to foreign countries.

Current and forward looking land consumption and conversion trends both within and outside of the proposed service area can be seen in Figure 1. The lower Sabine watershed has experienced moderate to high rates of conversions from 1997-2012. Given the projected growth of Texas' population to 33.6 million by 2030 (www2.twdb.texas.gov), we can expect these land use conversion trends to continue; and demographic pressures to intensify. Current population levels and resource demands based on historic patterns and forward looking projections have largely proven legitimate and realistic. People don't willingly stop reproducing (or shopping for that matter). Further, human populations don't generally experience shrinkage without some sort of catastrophic trigger (such as the bubonic plague or Spanish influenza). The population of the U.S. has increased over the last 240 years; Texas's population continues the trend of dramatic increase, as it has since achieving statehood in 1845. Texas population was estimated at 125,000 persons in 1845; then officially by the first U.S. census in 1850 at 154,034 persons (https://tshaonline.org/handbook/online/articles/ulc01). Such data only validates the real and pending threat to our ecologically valuable, perhaps fragile, difficult-to-replace, natural resources; specifically, those that are increasingly implicated in conflict between consumption or conservation.

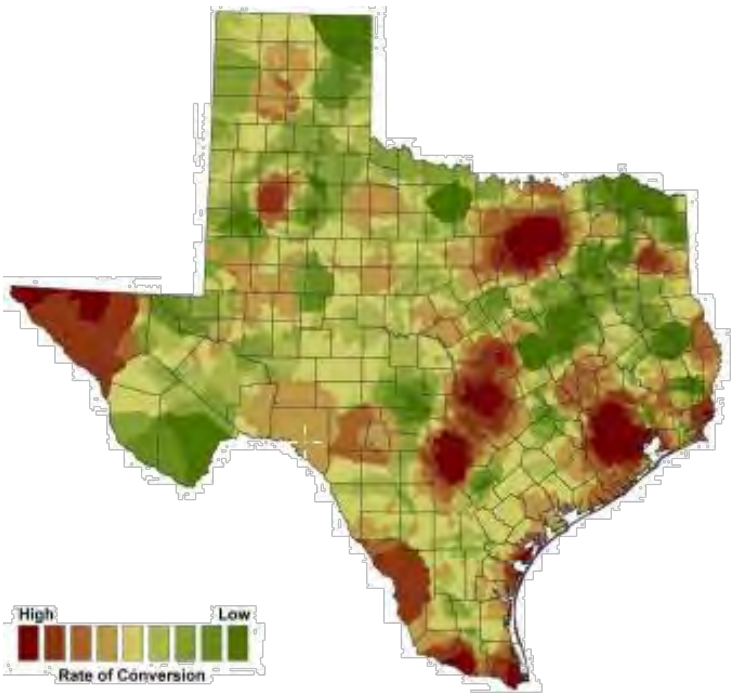


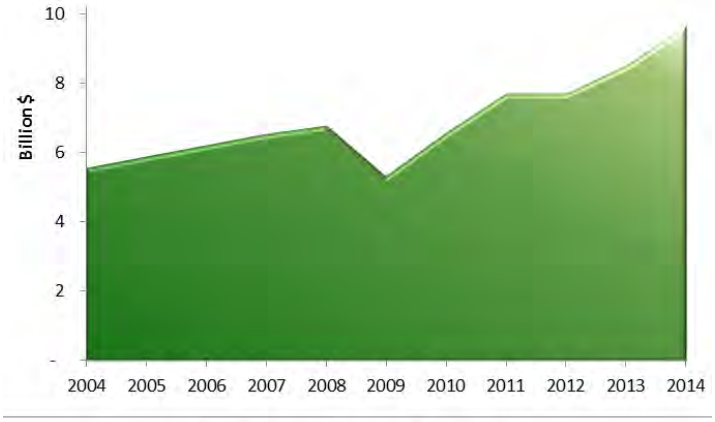
Figure 1. Land Consumption and Conservation Trends

In a global economy, such pressure defies inter-geopolitical boundaries through modes of commerce or trade. This means that one should not look just through his/her own home or local lumber yard to find evidence of forest resource demand, but must also be prepared to consider national franchises that supply forest products to consumers (Lowes or Home Depot), and then consider the wood-filled shipping containers sailing the high seas to satisfy demands of international consumers.

Figure 2. Facts about Sourcing Wood and Paper-Based Products

According to the International Agricultural Trade Report, the U.S. exported a record $9.7 billion of forest products in fiscal year 2014. Further, the U.S. is the world's 4th largest exporter of forest products, which interestingly, grew 80% from 1999 to 2014. What are we exporting and to whom are we exporting? Logs, lumber, and other products to China; assembled products to Canada; and wood fuel pellets and chips to the EU (because it's a form of renewable energy that conforms to recent environmental regulations). (FAS 2015).

Even environmental regulations themselves represent a recognition of and a coordinated response to such pressures; however, they can also function to translocate resource pressure points onto foreign soil (as in the previous example). So, without fear of redundancy, pressures on natural resources are pervasive as a result of local, national, and global human population growth requiring supplies of food, fiber, space, and energy. Whether we are talking shipping pallets in warehouses in upstate New York, baldcypress mulch in Houston residential landscapes, or wood pellets warming homes in Germany; these products can trace their roots (pun intended) back to East Texas forests.



Source: FAS Global Agricultural Trade System

Figure 3. U.S. Forest Product Exports, 2004-2014 (FY)

Beyond direct resource extraction, and affiliated with population expansion, improvements of transportation infrastructure necessary to move humans, goods, and energy is occurring within and between highly urbanized environments in Texas and Louisiana. Our sophisticated intracontinental transportation network (from high speed rails to dirt roads and interstate highways) increases access to rural farmlands, oil & gas fields, and forestlands, providing linkages and therefore growth corridors between productive lands (rural) and consumptive markets (urban).

US DOT. 2009. High Speed Rail Strategic Plan. https://www.fra.dot.gov/eLib/Details/L02833

Figure 4. Federally Designated High Speed Rail Corridors

Finally, construction of infrastructure for the movement of crude oil, natural gas, and hydrocarbons to refineries and port facilities between Texas and Louisiana, are stimulated by lifts of export bans on U.S. crude oil concurrent with Liquefied Natural Gas (LNG) export facilities coming on line along the gulf coast. Billions of private dollars have been invested to capitalize on global energy markets. Further export activity associated with of construction of the Post-Panamax Canal provides shipping route alternatives not previously available not just for the petrochemical industry, but also for other goods. Investments in expansions and other capital improvement projects within Texas ports exceeded 300 million since 2010; In 2012, Texas was ranked 2nd in the nation for waterborne commerce (485 million tons of cargo) (Texas Ports 2015-2016 Capital Program Port Authority Advisory Committee). In the near future, domestic and foreign energy markets can be expected to promote further build-out.

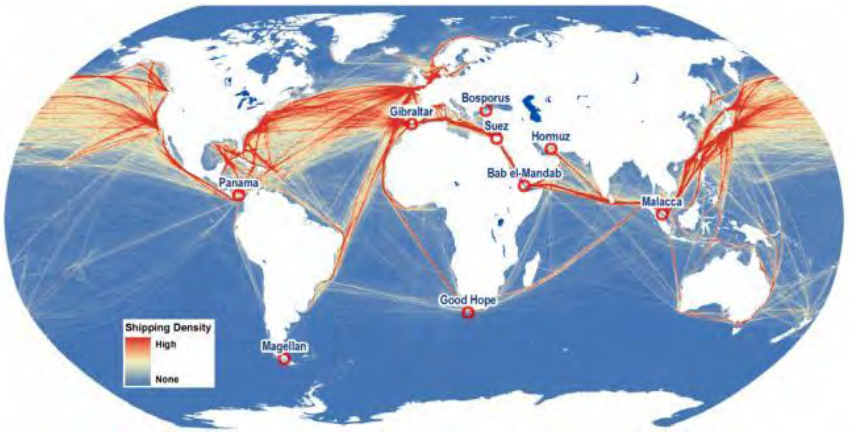


Figure 5. Globally Shipping Density

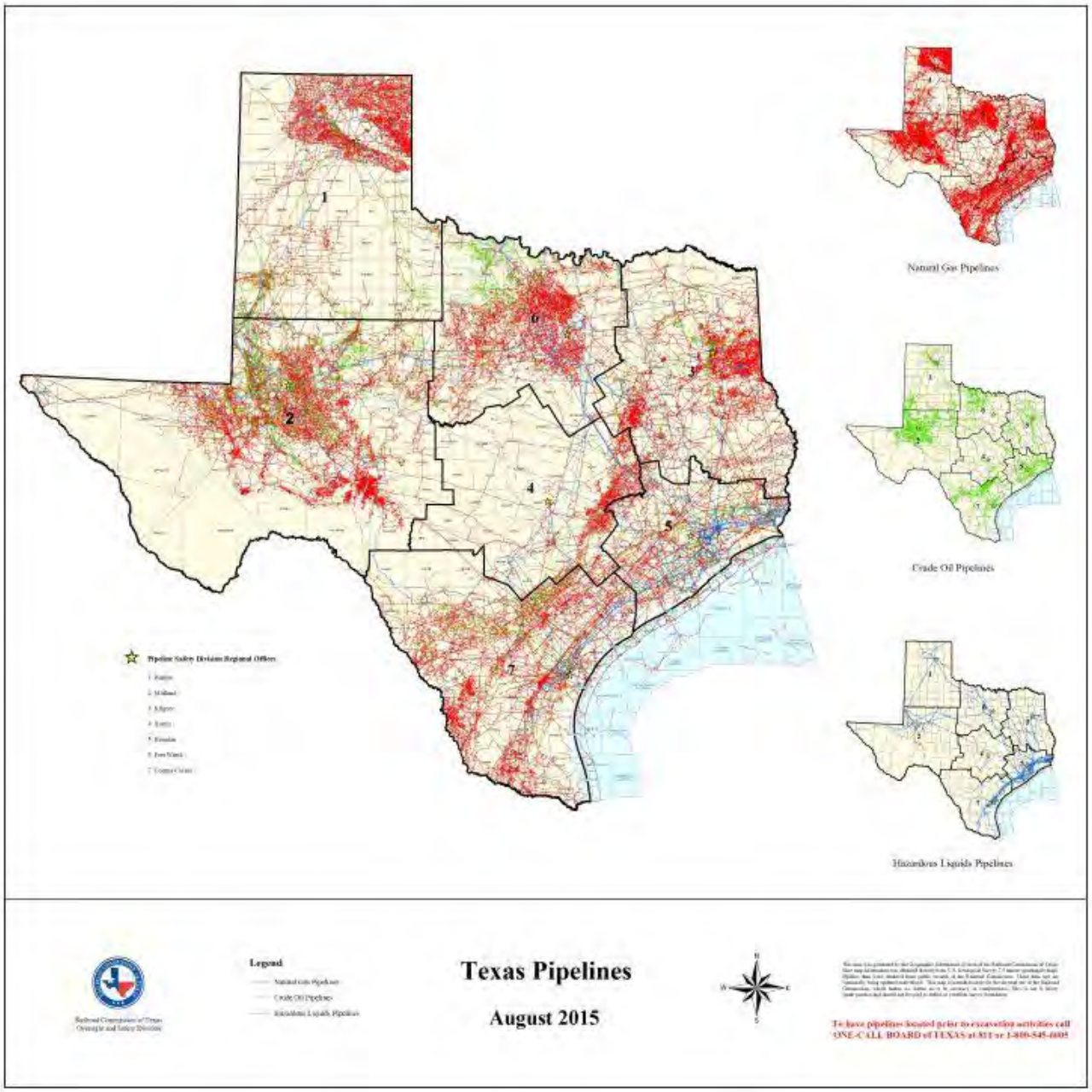


Figure 6. Texas Pipelines

3.3 Threats to Site

The biological functions of forested wetlands are heavily dependent upon the presence of the diverse, multi-level canopy structure of the forest trees and shrubs. "Silvicultural activities do not typically lead to a loss of wetland status, but may temporarily affect [one or more] wetland functions"; where "overstory vegetation is removed but hydrology is left largely intact" (Ainslie 2002). However, in the case of baldcypress-tupelo systems, the removal of the tree canopy through timber harvesting usually results in the logged site converting to freshwater shrub wetlands, when the hydrological conditions are not altered through drainage. Although the canopy removal does not alter a site's wetland status, it does radically alter the biological values (Dahl 2000).

The environmental circumstances that allow for forest regeneration must combine distinct periods of drought conditions when large areas of unoccupied (unvegetated) soils are exposed, and for there to be a source of seed to occupy the site in a very strict temporal window. Then, hydrological conditions must allow the germinated seedlings to maintain their leaf canopy above the growing-season water levels in order to survive (Mattoon 1915, Demaree 1932, Keeland and Conner 1999).

The regeneration of baldcypress, and to a large extent tupelo, is based on the need for very specific, relatively dry conditions immediately preceding the timber harvest, while there are still existing trees to serve as a seed source. Modern harvesting equipment and diverse forest product markets now allow for the harvesting of virtually all trees and species from a forested swamp. This is in direct contrast to the original harvesting a hundred years ago, when markets and machinery generally only resulted in the removal of the largest, commercially valuable baldcypress trees. Therefore, a modern harvest removes not only the forest canopy, but also the primary source of regeneration in the form of seed source (Brandt and Ewel 1989, Stanturf 2004).

However, in the lower Sabine and Neches River basins in southeast Texas, there was another form of harvesting which followed the initial baldcypress logging. The availability of modern power equipment in the post-World War I era opened up the harvesting of the large swamps which still contained heavy stands of tupelo. Excellent historical examples of this are evident in several locations in the lower Sabine and Neches basins. The Blue Elbow Swamp on the lower Sabine River just above Interstate 10 was subjected to this secondary logging operation (Walker 1975). First, canals were cleared and dredged to allow boat access. Central loading areas were then cleared, and when the timber was cut, it was pulled in by cable, being skidded through the swamp. This left the characteristic spoke-pattern of ditches, which effectively

disrupted the hydrology of these sites. Equally important was the almost total loss of seed source for a future forest (Stanturf 2004). Only clumps of baldcypress or tupelo remained, usually along the higher ridges along each side of the ditches (Walker 1975, TPWD 2003).

The LCBMB site does not exhibit the scarring that resulted from the use of these boat-mounted skidding engines. The total volumes of tupelo available further up the rivers did not allow for economical extraction of those trees. Only the very large swamps, close to the coast, provided enough timber to make this type of operation feasible.

The following images clearly show the use of this technique along the lower Neches River north of Vidor, Texas. This particular site is located at latitude 30.134715 longitude 94.083755. The 1938 photograph left shows the spoke pattern, while the 2013 image reveals the predominance of marsh grasses now on that site.

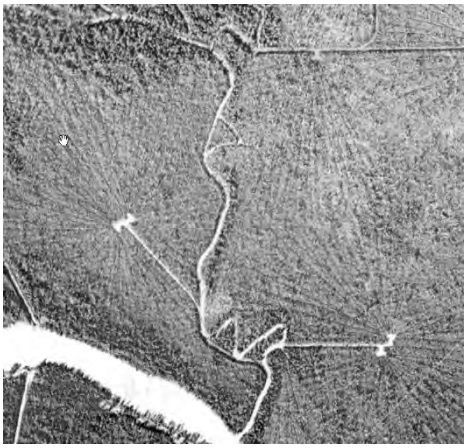


Figure 7. Tupelo Harvesting - 1938 Aerial

Figure 8. Tupelo Harvesting - 2013 Aerial

The next two photographs were taken on this site, and show the young baldcypress and tupelos along the ditch banks, as well as the large areas of marsh cutgrass (*Zizaniopsis miliacea*) that colonized the site post timber harvest.

Recently Harvested Site along Sabine River

An example of baldcypess-tupelo timber harvesting is found on an alluvial river swamp site in the Sabine River bottomlands, in Newton County, Texas about 20 air miles south southwest of the LCBMB property. This site is located at latitude 30.530627 longitude 93.750154, lying east of County Road 4110. The accompanying aerial photographs, taken from *GoogleEarth* imagery, show this site in 2009 and again in 2013. The timber harvesting was apparently done sometime in the 2011 timeframe. AEL personnel evaluated the alluvial river swamp immediately to the south of this particular site in 2013.

Figure 9. Harvested Site (Pre-Harvest in 2009)

Figure 10. Harvested Site in 2013

Specific to the Lower Sabine HUC watershed, existing global markets for various forest wood products represent the most direct and immediate threat to the trees currently located on the LCBMB. While these baldcypress-tupelo forests are prized for their scarcity, uniqueness, and size by the ecologically mindful, they are also esteemed by the economically aware for their commercial value. The very large total-volume and per-acre-volume of commercial timber on sites like the LCBMB property is very attractive, from a harvesting productivity standpoint. These sites offer an additional dividend of serving markets such as baldcypress house logs, lumber, mulch, crossties, pallets, and hardwood pulpwood.

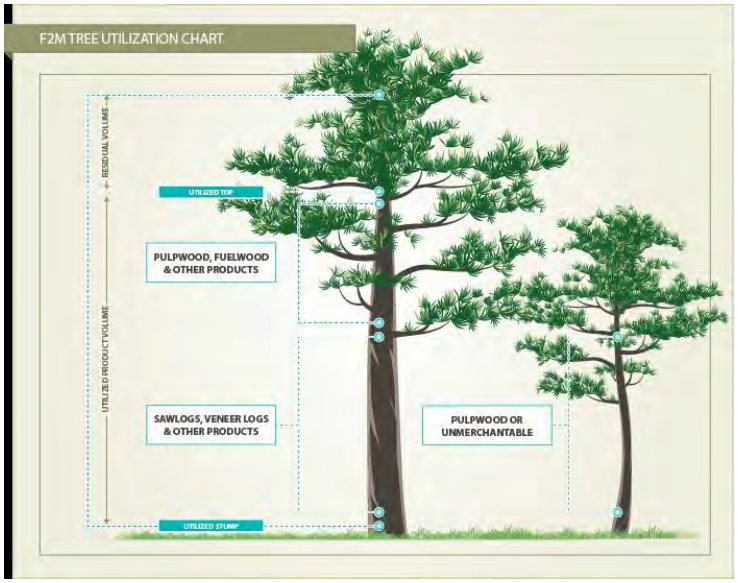


Figure 11. Tree Utilization Chart

Owning and managing land, whether by the private sector or the government, has a cost. Private lands ownership is funded through monetizing the land asset in some way (out-of-pocket, development, housing, silviculture, agriculture, resale, or recreation). While the LCBMB site appears safe (for the time being) from any direct and immediate threats posed by residential or commercial development, alterations to mature standing forest communities is a certainty absent legal protections.

Private owners, consisting of Timber Investment Management Organizations (TIMOs) and Real Estate Investment Trusts (REITs) as well as family forest owners, control 92 percent of the timberland in East Texas. The federal ownership is 5 percent, with other public ownership at 3 percent (Texas A&M Forest Service, 2010).

Much of the rural areas in East Texas at this time are more suitable for forestland investments at an appropriate economy of scale. Most land in East Texas has feasible proximity to forest product markets, and the extensive public road system enables easy transport of raw forest materials to mills, and thence finished products to domestic consumers and/or to ports such as Houston and Beaumont.

Even under good forest management regimes, shorter harvest rotations of less than 50 years are the standard for satisfying an ever-increasing market demand for renewable forest products. Ultimately, human population growth (consumers) is driving the demand for wood products. This demand (not the landowner or the logger) represents the true source of threat to the communities of the LCBMB (for additional discussion, see Appendix C).

4.0 ECOLOGICAL SUITABILITY

4.1 Project Location

The proposed LCBMB is located adjacent to the Sabine River within the intersection of the Lower Sabine HUC (12010005) and the South Central Plains Level III Ecoregion, approximately 4.5 miles northeast of the community of Bon Weir, in Newton County, Texas. The latitude/longitude coordinates for the proposed LCBMB are: 30° 48' 10.01" N; 93° 35' 53.09" W (UTM NAD 83 Zone 15N). Access to the tract is available via a public road known as Artesian Springs Road which travels along the northwest portion of the property (Appendix C, Figure 1).

4.2 Compatibility with Natural Resource Conservation Initiatives

The LCBMB consists predominantly of high quality, mature baldcypress-tupelo alluvial river swamp (Stanturf 2004) best described as scarce, economically valuable from a forest products perspective, and certainly difficult-to-replace. Conservative estimates for abundance of such habitat within the Lower Sabine HUC are ≤1%. The limited of occurrence of this habitat type within the watershed can be attributed to the construction of Toledo Bend Reservoir, historic conversions to agriculture and pine plantations using intensive mechanical site preparation and site drainage, or/or short-rotation forest harvesting regimes. The scarcity of older age baldcypress-tupelo forests within the watershed, like those on the LCBMB, are a direct result of widespread harvesting of baldcypress-tupelo swamps during the turn of the 20th century from 1880-1925 (Connor and Toliver 1990).

Since that time, harvest regimes that prevent younger trees from reaching larger size/age classes have become the norm. For this reason, and others, Brandt and Ewel (1989) estimated that only about 10 percent of baldcypress swamps found in pre-settlement times still remained in the U.S., with the greatest stocks of baldcypress tupelo swamp found in Louisiana, Florida, and Georgia.

Federally conserved lands within the lower Sabine watershed are noticeably absent. State managed lands are few; Texas Parks and Wildlife Department (TPWD) manages the Lower Neches Adams Bayou Unit (~365 acres) and the Tony Housman Blue Elbow Swamp State Park and Wildlife Management Area (and the Tony Houseman Mitigation Annex), (a total of ~3,985 ac). Forested wetlands in general, are uncommon and important enough to appreciate regulatory protections; baldcypress-tupelo swamps are rare and unique compared with more common forested wetland types; second growth baldcypress-tupelo swamps with relics, like the LCBMB, are very rare. Few wetland conservation projects exist in the

watershed, thus increasing the value of the proposed LCBMB to the watershed, and the need for protection of the LCBMB.

Because the LCBMB is an important wetland resource, its protection is compatible with, and conducive to, accomplishing the purpose, goals, or objectives of state and regional watershed initiatives, including the 2017 State Water Plan (Authorized for publication on March 3, 2016), the Texas Wetlands Conservation Plan, the TPWD Texas Conservation Action Plan, the East Texas Wetlands Project, and the Comprehensive Sabine Watershed Management Plan. The purpose of these state and local watershed protection initiatives can principally be summed up as this: to promote efficiency and sustainability between human uses of Texas' natural resources and to preserve the integrity of those resources through various conservation measures for the benefit of all future users of Texas' ecosystem services and values. Whether express or implied, wetlands banking or compensation projects are included as conservation projects in such initiatives. More specifically:

- TPWD's Texas Wetlands Conservation Plan includes: "Encourage broader application on private lands of mitigation banking programs to compensate for wetland losses in the same watershed."
  - Inform landowners of mitigation options.
  - Encourage cooperative private banks between adjacent landowners
  - Enhance interagency mitigation banking programs to better conserve existing natural wetland habitats.
- Texas Conservation Action Plan states: "...purpose is to provide a statewide 'roadmap' for research, restoration, management, and recovery projects addressing Species of Greatest Conservation Need (SGCN) and important habitats.

Notably, the proposed Bank is located on a reach of the Sabine River included in The Nationwide Rivers Inventory, and identified by TPWD as an Ecologically Significant River and Stream Segment. This reach is recommended for inclusion in the proposed Texas Natural Rivers System due to possession of "Outstandingly Remarkable Values" for scenery, recreation, and wildlife values including high water quality/ exceptional aquatic life/ high aesthetic value/exceptional aesthetic value. Perpetual protection of a unique and rare resource such as the LCBMB will help to ensure that these communities remain intact for future generations.

4.3 Proposed Service Area

The proposed service area is depicted in Appendix C, Figure 6 and described below. Land holdings of the state of Texas are excluded from service area coverage.

1. Primary Service Area – HUC 12010005 – Lower Sabine (Texas only)
2. Secondary Service Area – HUC 12010004 – Toledo Bend Reservoir wholly contained within the Galveston District (Texas)

4.4 Baseline Conditions

Adjacent Land Uses

The proposed bank is surrounded by large forested landholdings held by both private and commercial entities. These lands are managed primarily for recreation and to provide a renewable source of wood-based forest products. Unlike the "cut out and get out" era, modern forestry practices undertaken by professional forest managers are considerably different from those prior to the emergence of social environmental reforms of the 1960's and 70's. Sustainable forestry practices apply management strategies that maximize production for wood products in high commercial demand, but do so without irreparably harming the ability of a site to recover from harvesting activities (i.e. remain capable of producing forest products into the future). While timber harvest results in changes to site specific forest communities, wetland functions on adjacent privately owned woodlands remain intact.

William Ainslie, Region 4 Environmental Protection Agency, reported primary causes of forested wetland conversions to uplands in the southern U.S. were due primarily to clearing and draining for agriculture, urban and rural development, and intensive silviculture where drainage occurred (Wear and Greis, 2002). He further reports that any direct effects of harvesting are temporary (specifically related to the physical and chemical functions) and localized to harvested sites (specifically, the removal of overstory vegetation). In comparison with other prevailing consumptive land uses (e.g. urban, agriculture, livestock/cattle ranching), silvicultural disturbance is relatively low and infrequent. Mr. Ainslie provides evidence supporting the previous statement by his review of various peer-reviewed research specific to potential effects of silviculture on forested wetlands in general. Variability in hydrology, soil properties, community resiliency, and ability to regenerate among such communities can be considerable; these communities are not addressed individually). The following summary statements are paraphrased or taken directly from Ainslie (2002):

- Disturbance regimes under typical bottomland hardwood silvicultural harvesting programs typically range from 20-50 years (varies by site characteristics such as soil types and hydrology which effect tree growth rates and thus time of harvest). This is much less frequent of a disturbance regime than any other non-conservation oriented land-use (such as agriculture, cattle, urban, etc.). It should be noted that the harvesting schedule above may not apply to alluvial river baldcypress-tupelo swamps in near permanently flooded hydroperiods, where conditions necessary for natural regeneration may not occur for decades.
- Under a clearcutting/natural regeneration management regime, hydrologic responses are typically short-term elevations in water table from reduced evapotranspiration, which is quickly negated (<2 years) by resprouting vegetation.

- Soil compaction can occur locally within skidding ruts, but may be temporary depending on the soil type and hydrology. Sedimentation effects considered small and longevity brief.
- Few generalizations can be made regarding biogeochemical cycling and nutrient retention functions due to variability in community response to harvest, time between disturbance, and the inability of current scientific methods to detect subtle biogeochemical changes resulting from silvicultural activities.
- The most apparent change resulting from silviculture is the removal of the tree canopy.
- Regenerating harvested communities quickly return to pre-harvest species composition. Exceptions to this would be baldcypress-tupelo sites such as LCBMB, where ideal conditions for natural regeneration may occur only very rarely.

While adjacent properties are anticipated to continue to undergo normal silvicultural operations in the future, no negative effects to the functionality of the preserved LCBMB are anticipated. In fact, diversity of age classes represented by the habitats that surround the LCBMB can be considered a benefit for various forest dependent or early successional forest wildlife species. Similarly, Mr. Ainslie noted a growing recognition of a lack of early successional forest limiting biodiversity in the Eastern U.S. Such diversity contributes to biological functions related to habitat connectivity ($V_{connect}$, Riverine Forested Interim HGM).

Finally, The LCBMB is a relic community (by human standards) spanning several centuries, representing a reference condition for baldcypress/tupelo swamps in the watershed (Devall 1998). The present functional capacity of the site is high, and has persisted through numerous harvesting operations on adjacent lands over the last century alone, and the construction of the largest reservoir in the south, Toledo Bend Reservoir. Provided this site is approved as a mitigation bank, the functions can be anticipated to persist indefinitely into the future. Because few lands within the watershed are legally dedicated to conservation purposes, conservation of the LCBMB will contribute greatly to sustainability of such communities and attendant functions provided within the watershed.

Site History

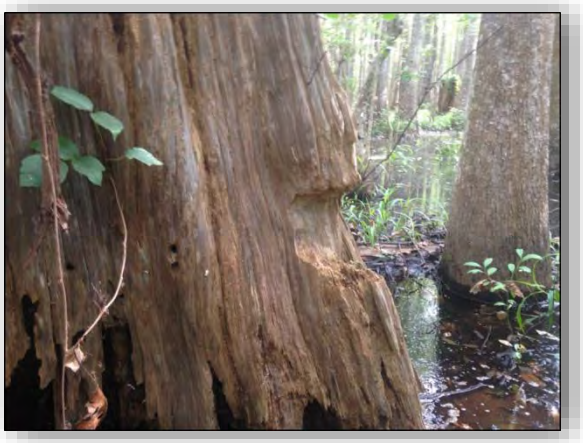
The previous landowner was a small family-owned land and timber company. The company liquidated its forest landholdings of which the subject property was a part. Surrounding lands are owned predominantly by large forest real estate investment trusts, timber investment management organizations, private companies and/or private individuals. All lands are currently under active management for sustainable production of forest wood products (e.g. Crown Pine Timber LP, Hancock, and Texas Timberlands), or in the case of the smaller tracts, as homesteads (Appendix C, Figure 2).

The proposed LCBMB is located entirely within a mature, baldcypress-tupelo alluvial river swamp, denoted as "Lost Creek Break" on the United States Geodetic Survey (USGS) 7.5 minute topographic quadrangle (Figure 3, Appendix C). When correctly spelled, a "brake" is defined by Wilbur R. Mattoon (1915) as

"practically pure stands in the back swamps, ox-bows, or cut-offs, and the deep swampy portions of alluvial river floodplains."

Aerial photographs (Appendix A) validate the USGS designation and show that the proposed Bank acreage has been dominated by an intact forest canopy since the earliest available images for the area (1939). Due to the proximity of this tract to the Sabine River and historical accounts, it can be assumed that the large, sound baldcypress on this site were selectively harvested through high-grading during the late 1800's to early 1900's. High-grading harvesting targeted the older baldcypress trees, as they were the source of the high-value heartwood. Such approaches were typical of that period, when large baldcypress trees were still located in readily accessible areas near major waterways, such as the proposed Bank (Stanturf 2004).

This harvesting methodology generally required crosscutting the tree from springboards which were inserted into the bole of the tree from boats during high water events. Harvesting was required during these periods in order to float the timber out to the river as overland transport was not feasible. The use of this technique is evident by observation of remnant decadent stumps (some still 85 inches in diameter at breast height), cut at approximately 8 to 10 feet from ground level, which is indicative of springboard harvesting from boats (Walker 1975).



Despite this historic harvesting over 100 years ago, many large, relic trees still remain on the site. Baldcypress very often becomes "pecky" with age – as limbs and tops are broken by windstorms, or woodpeckers excavate holes, a specific fungus invades the tree trunk. The wood becomes laced with cavities, thence producing the popular "pecky cypress" lumber. Over time, this pecky wood results in a live tree with massive hollows in it. Many of the largest baldcypress trees on the LCBMB site are hollow, and most likely were already hollow when the site was harvested, thus they were passed over and left behind.

Baseline Characterization

A site visit with agencies participating on the Interagency Review Team (IRT) was conducted on September 4, 2014. Secondarily, the U.S. Army Corp of Engineers (USACE) conducted a follow-up site visit with AEL staff for purposes of confirming the wetland delineation and baseline conditions on February 24, 2015. Presently, the USACE is in the process of finalizing the jurisdictional determination and baseline functional assessment. Once that action is completed, wetland habitat acreages will be revised to reflect the final acreages and baseline functional scores, as verified by the USACE.

The Bank is composed primarily of PFO1/2C and PFO1/2F habitat characterized by high quality baldcypress-tupelo swamp (Attachment A). The wetland areas of the proposed Bank are subdivided into five Assessment Areas (AAs)(Appendix C, Figure 4), primarily distinguished by trees per acre (TPA) and Basal Area per acre (BA/A) differences as relates to geographic location. The majority of the proposed Bank acreage is baldcypress-tupelo swamp reflecting an approximate average of 450 TPA and 200 square feet of BA/A.

The SWG Forested Riverine HGM Interim model (iHGM) was used to quantify the baseline conditions of the creditable acreage of the proposed Bank (Attahcment A). FCUs produced by areas proposed for enhancement or preservation will be calculated by quantifying the estimated loss of function from baseline conditions (with regard to the quality of the resource) resulting from non-404 regulated activities (e.g. timber harvest).

Commonly occurring species within the Bank are baldcypress, tupelo, maple, sweetgum, ash, Virginia sweetspire, hazel alder, arrowhead, *Carex atlantica,* possumhaw, and swamp cyrilla. Many of the large senescent tupelo had typical top breakage but were still living along with scattered, large relic baldcypress trees. Several slightly elevated ridges or remnant natural levees of historic Sabine River meander scars, are located within the property and are easily identifiable on the aerial imagery, DEM, and topographic map (Attachment C). These areas are distinguishable by a slight rise in elevation and shift in species composition and dominance; notably including laurel oak within the canopy and Chinese tallow in the midstory. These elevated areas, or portions thereof, still display wetland characteristics and maximum iHGM variable sub-index scores. Only the occasional isolated Chinese tallow seedling was observed outside of these elevated areas during the wetland delineation and baseline determination field work and do not represent a distinguishable component of the plant community on the majority of the proposed Bank acreage.

For additional detailed descriptions and documentation of the vegetation, soils, and hydrology are contained within the revised wetland delineation and baseline characterization report dated December 18, 2015 (Attachment A).

5.0 MITIGATION WORK PLAN OVERVIEW

Ecological function within the watershed can be optimized by protection of this extensive, baldcypress-tupelo swamp. Due to value and the nature of the current communities, a preservation/enhancement management strategy is currently proposed for the site in order to maintain a diverse, contiguous, mature, PFO baldcypress-tupelo dominated conservation area. Portions of the site (AA 4) will benefit from enhancement actions designed to bolster the existing, native vegetative composition. These strategies are discussed respectively in the following section.

Preservation

AAs 1-5 (476.2 acres) provide wetland function approaching the maximum capacity as evaluated using the iHGM. Preservation of these areas assist in maintaining a level of function in the watershed that is at risk due to habitat degradation through non-404 regulated activities. Attention to the preservation approach for this area was founded in the unique and difficult-to-replace baldcypress-tupelo habitat in which the proposed Bank is located. Indications are that the probability of threat of loss is increasing substantially for forested wetlands, especially mature baldcypress-tupelo stands. Therefore, growing awareness of these issues in natural resource conservation is among the factors included in the site selection process.

This site meets the requirements for preservation for the following reasons (CMLAR 2008):

1) The preserved resource provides critical physical, chemical, and biological functions to the watershed,
2) The preserved resource significantly contributes to the ecological sustainability of the watershed,
3) The preserved resource is under direct threat of destruction or adverse modification, and
4) The preserved resource will be permanently protected using a conservation easement that is held by a third party.

Enhancement

AA 4 (63.4 acres), although currently exhibiting high functional values as stated above, would benefit from the removal of Chinese tallow-tree, an infamous exotic invasive species of southern bottomland hardwood forests. While this activity would not quantifiably increase the iHGM values above the baseline due to the insensitivity of the model to such actions, it would certainly directly improve habitat functions for native species.

6.0 ASSURANCE OF WATER RIGHTS

As has been previously discussed, the site has existed in its present condition for well over a century. The current hydrologic regime, permanent to semipermanent inundation, is anticipated to persist indefinitely. There are no reservoir projects planned in this section of the Sabine River (Texas draft 2017 state Water plan).

Texas surface water is owned by the state and held by the state in trust for public use. The right to utilize this public resource (a "water right") is governed by a dual-doctrine system; created from a merging of the riparian and prior-appropriation doctrines. Since 1913, surface water rights (both perpetual and limited-term) are granted by permits awarded by the Texas Commission on Environmental Quality (TCEQ). Currently, Texas State law prohibits the issuance of water rights permits for instream flows for environmental needs (§ 11.0237, TX Senate Bill 3, Texas Water Code).

The Sabine River Compact, an agreement between Texas and Louisiana, establishes a minimum flow rate within the Sabine River. Any unappropriated water in the lower reach of the Sabine River below the junction of the Sabine River and the Texas/Louisiana Stateline (not contained in or released from a reservoir) is divided equally between the two states. In addition, any reservoir proposed for construction below the Sabine/Stateline junction is subject not only to approval by both Texas and Louisiana, but also by congressional approval as the Sabine River is an interstate navigable water. As outlined in the 2012 State Water Plan, there are no new reservoirs proposed for construction in the Sabine Basin.

In the portion of the Sabine River Basin located in Texas, the Sabine River Authority (SRA) possesses the majority of the senior water rights both above and below Toledo Bend Reservoir and maintains run-of-the-river (aka "diversion") rights in Newton and Orange Counties. SRA holds water rights of 238,100 ac-ft. per year from Lake Tawakoni, 188,660 ac-ft. per year from Lake Fork, 750,000 ac-ft. per year from Toledo Bend Reservoir and 147,100 ac-ft. per year from the Sabine River. The reliable supply from SRA's Lower basin sources (Toledo Bend Reservoir and Canal System) is approximately 1.3 million ac-ft. per year (ETRWP 2011). As a result of the ownership of these water rights as relates to the Sabine River Compact, the SRA is the primary responsible party to assure the minimum downstream flow to Sabine Lake.

In 2007, the 80th Texas Legislature created the Environmental Flows Advisory Group. The group was tasked with establishing appropriate environmental flow standards for each river basin and bay system in the state. Subsequently, *The Sabine and Neches Rivers, and Sabine Lake Bay Environmental Flow Standards* were established by the TCEQ (2012) from recommendations made by the Basin and Bay Area Stakeholder Committee (BBASC) and the Bay and Basin Expert Science Team (BBEST). These flow standards were established in order to maintain the substantially sound ecological environments of the Sabine and Neches Rivers, their associated tributaries, Sabine Lake Bay, and the associated Sabine-Neches estuary. Summarizing the effects of the established standards: "The commission [TCEQ] finds that these sound ecological environments can be maintained by a set of flow standards that implement a schedule of flow quantities that contain subsistence flow, base flow, and one level of high flow pulses at defined measurement points." (TCEQ 2012)

As such, future water rights permitting in these river basins are subject to the established subsistence, base, and high flow pulse requirements. Therefore, it is anticipated and expected that the existing hydrologic regime in the Sabine River Basin will remain, at a minimum, at its present state, even in the presence of additional permitting of junior water rights. In summary, the BBEST (2009) states, "Climatic conditions and flood events are expected to produce these levels of flow even with full use of existing water rights and realistic projections of water supply development." Their findings further state, "evidence indicates that high-pulse flows and overbank flows will provide sufficient flow to maintain the existing dynamic equilibrium within these two riverine basins [Sabine and Neches]." For more information, please see the document entitled, *Environmental Flows Recommendation Report: Final Submission to the Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Area Stakeholder Committee, Environmental Flows Advisory Group, and Texas Commission on Environmental Quality* (BBEST 2009).

This information supports the conclusion that long-term site hydrology is naturally sustainable for the proposed Bank. Therefore, the acquisition and protection of water rights for environmental needs is not only unnecessary to assure sustainable site hydrology, but is already addressed by the state of Texas, as stated above.

7.0 ESTABLISHMENT AND OPERATION

The Bank will be established in association with the Interagency Review Team (IRT) and developed in accordance with the requirements specified in CMLAR §332.8(d)(6). The process for developing and establishing a mitigation bank outlined in the appurtenant regulations will be followed. This process will result in the development of a mitigation banking instrument that details the specific terms and conditions by which the bank will be operated by the Sponsor, and utilized by clients of the Department of the Army. The final approved instrument will be developed in consultation with agencies representing the IRT and the interested general public.

Ownership of Bank Lands

All real property to be included within the Bank is owned by the Sponsor, and will be pledged for use in the Bank consistent with the MBI. The Sponsor shall be responsible for developing, operating, and maintaining the Bank subject to the requirements of the MBI, and will serve as the long-term manager until such time as those responsibilities are transferred to a long-term steward pursuant to CMLAR.

8.0 SPONSOR QUALIFICATION

AEL is a unique family of companies with a diverse pool of talented ecologists and business professionals. The firm has been in the natural resource management business since 1979 and has established and managed more than 20 successful mitigation banks and approximately 35 permittee-responsible mitigation projects involving wetland, stream, and endangered species in multiple states, multiple USACE districts, and across a wide range of habitat types.

Our Story

The history of AEL actually began with the creation of Bird Forestry Services (BFS) in 1979, which developed as a traditional forestry consulting business. In 1994, AEL was created in the form of an affiliated business to focus solely on environmental and wildlife consulting. In 2006, the two businesses reorganized so that BFS became a wholly owned subsidiary of AEL. At that same time, the owners of AEL also made a decision to forego traditional environmental consulting and focus instead on creating a portfolio of company owned and operated mitigation and conservation projects. As of 2016, that number of projects has increased to more than 20 successful mitigation banks and approximately 35 permittee-responsible mitigation projects. Since that time the forestry component of the business has grown to currently manage more than 150,000 acres and has extensive experience in restoring and managing forest systems, particularly hardwood communities. Most recently, AEL further expanded its forest management expertise by consolidating with another forestry consulting firm formerly known as Crawford Forestry. The forestry group now operates as Bird/Crawford Forestry Consultants.

Essential elements of the AEL Story also include the development of other integral business units or specialized companies. Siva-Tech South is a firm specializing in vegetation management including site restoration, tree planting, and invasive species control. In addition to supporting AEL projects, Silva-Tech has conducted over 50,000 acres of habitat management on private and public lands. In 2007, AEL also developed Mitigation Solutions USA (MSUSA), which has become a national leader in the marketing and selling environmental credits. In 2011, AEL partnered with TerraNative, an expert in using native seedlings to improve the outcomes of environmental restoration projects. The partnership has resulted in the creation of a hardwood nursery in Huntsville, Texas with a priority of conducting project-site specific seed collections and producing custom grown seedlings for each AEL project. In an effort to produce the highest quality project sites, AEL has also created TerraStone Land Company. The company's primary goal is to locate and secure the necessary real-estate in each of AEL's ecological target markets.

Collectively these firms all work together in a capacity and process unique to the ecosystem marketplace.

9.0 LONG-TERM MANAGEMENT AND MAINTENANCE

Site Protection

The conservation values of the site will be protected by a conservation easement (CE) held by Texas Land Conservancy (TLC), a nationally accredited land trust, in good standing with the Land Trust Alliance. TLC holds numerous easements throughout Texas on USACE-approved mitigation sites sponsored by AEL, MML, or affiliates, as well as for other bank sponsors.

Mineral Resources

As is the case with most fee-simple real estate acquisitions in Texas, the subsurface mineral's estate (oil and gas rights) of the proposed Bank is not owned by the Sponsor, nor available for purchase. In recognition that surface landowners in the state of Texas cannot wholly control or restrict access to the subsurface estate, the Sponsor will develop a mineral's management plan for inclusion within the DMBI. The mineral's management plan typically includes setting aside upland or non-credit areas owned fee simple by the Sponsor to serve as potential development areas for activities that may be incompatible with site protection provisions. Importantly, CE endowments to TLC for compensatory mitigation projects normally include funding specifically for Mineral's Damage Restoration, in the event activities occur sometime in the future. This approach constitutes an important component of the framework for mineral's management of wetland compensation sites in the state of Texas, given the applicable laws.

The probability of future disturbance to the surface resources within the LCBMB from minerals extraction/exploration activities is minimal for several reasons. Once the site is approved and conserved as a wetlands compensation site by multiple federal and state resource agencies, most prospective permittees are incented by project schedules and costs to avoid such "high profile" sites. Secondarily, entitled credit values vs raw land values also serve as an economic disincentive to oil and gas companies required to provide proportional financial compensation to the bank owner/sponsor for "lost credits" as well as additional compensation for impacts to regulated habitats. However, when avoidance isn't practicable for any particular project, all Department of the Army (DA) permittees proposing to impact baldcypress/tupelo wetlands in the state of Texas must pre-notify the USACE prior to initiation of construction in accordance with the Nationwide Permit Regional Conditions, or as part of a standard individual permit. In all cases, the USACE assumes the responsibility for reviewing and approving any permit applications (including compensatory mitigation plans contained therein), and therefore are able to exercise regulatory discretion to ensure any jurisdictional wetland impacts are adequately and appropriately compensated for. These various factors, either circumstantially or directly, represent limitations on the ability of any third party subsurface estate owner to promote or cause harm to the highly valuable surface resources conserved by the surface estate owner.

Finally, according to data made publically available by the Rail Road Commission of Texas, the area in the direct vicinity of the LCBMB is not productive from an energy perspective. Oil and gas wells located near the LCBMB are either plugged or were dry holes (see Figure 12, below). The area is outside of any of the state's top 20 producing oil and gas fields further north and west.

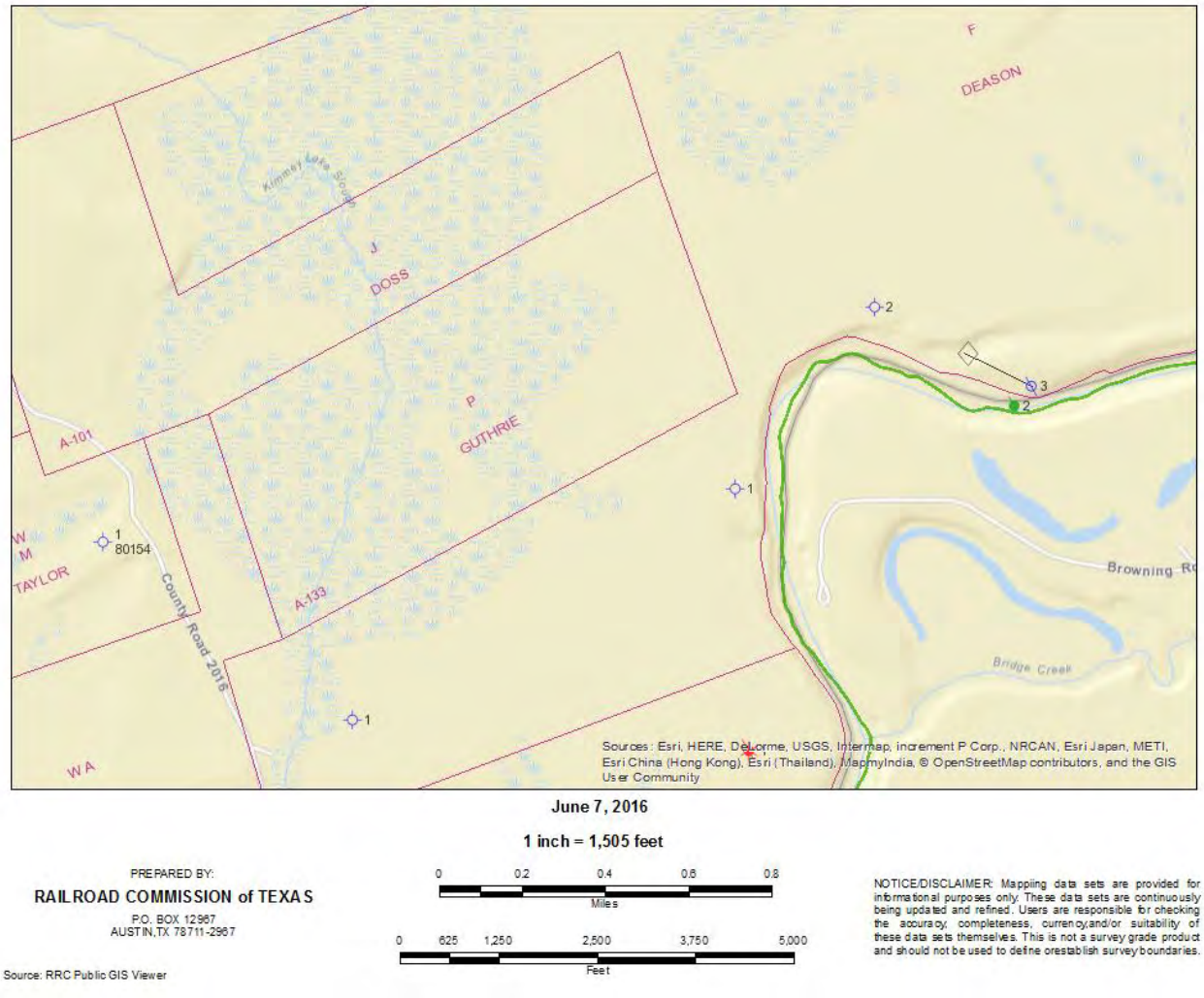


Figure 12. Dry Holes and Plugged Wells in the Vicinity of LCBMB.

Long-term Management & Maintenance Financing

Long-term management activities (e.g. boundary maintenance/signage, invasive exotic species monitoring and management, etc.) will be detailed in the draft mitigation banking instrument (DMBI). Such activities will be funded via long term financial assurances mechanism payable to a beneficiary and/or the long-term manager (if different from the Sponsor); justification of funding amounts to be provided within the DMBI. Provisions for transfer of long-term management responsibilities from the sponsor to another entity will also be included within the DMBI.

10.0 ADAPTIVE MANAGEMENT

The adaptive management framework is based upon the performance standards that serve to indicate the success of the management activities through regular monitoring. Implementation of any adaptive management plan(s) will be based upon the following general analysis (Martin et al. 2005):

1. Compare the analysis of the monitoring data to the performance standards
2. Evaluate whether the site is progressing toward the desired outcome(s)
3. Determine whether any corrective measures are necessary, and, if so, what type
4. Implement any prescribed corrective measures
5. Continue monitoring site progression toward the desired outcome(s)

In the event that monitoring or other information indicates that the LCBMB is not progressing towards meeting the performance standards as anticipated, the Sponsor shall notify the USACE as soon as possible. The Sponsor will submit to the USACE an adaptive management plan identifying the adaptive management considerations, proposed measures, and an appropriate schedule for implementation of any measures (Items 1-3, above). The USACE, in coordination with the IRT, will evaluate and pursue measures to address any adaptive management considerations. The USACE, in coordination with the IRT, will consider whether the LCBMB is providing ecological benefits comparable to the original objectives. The USACE, in consultation with the IRT and the Sponsor, will determine the appropriate measures to rectify any adaptive management considerations. These measures may include, but are not limited to, site plan modifications, design changes, revisions to maintenance requirements, revised monitoring requirements, revised performance standards, and a resulting reduction or increase of credit calculations. The measures must be designed to ensure that the modified compensatory mitigation project provides aquatic resource functions comparable to those described in the mitigation plan objectives. Performance standards may be revised in accordance with adaptive management to account for measures taken to address deficiencies in the compensatory mitigation project. Performance standards may also be revised to reflect changes in management strategies and objectives if the new standards provide for ecological benefits that are comparable or superior to the approved compensatory mitigation project. No other revisions to performance standards will be allowed except in the case of natural disasters. The streamlined review process may be used for any changes to the MBI reflecting adaptive management. The procedure for the streamlined review process provided in CMLAR will be followed.

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Appendices and Attachment

Appendices

A. Aerial Imagery ☐
B. Project Figures ☐
C. LCB Unregulated Threat Analysis ☐

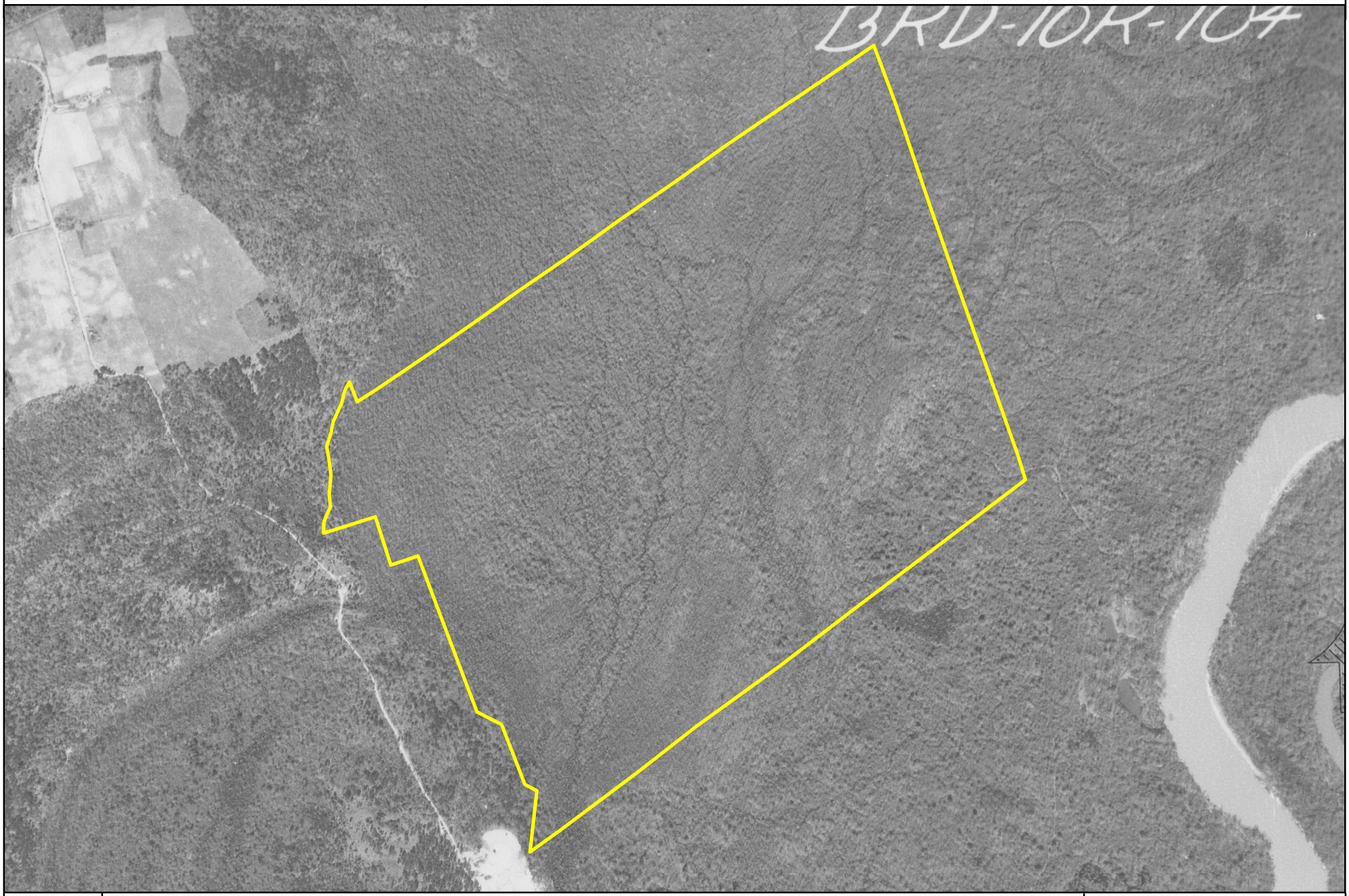
Attachment

A. Baseline Conditions ☐
   1) *Delineation of Waters of the U.S., Including Wetlands* ☐
   2) *Baseline Wetland Functional Assessment* ☐

Appendix A

Aerial Imagery

1939 Aerial Imagery
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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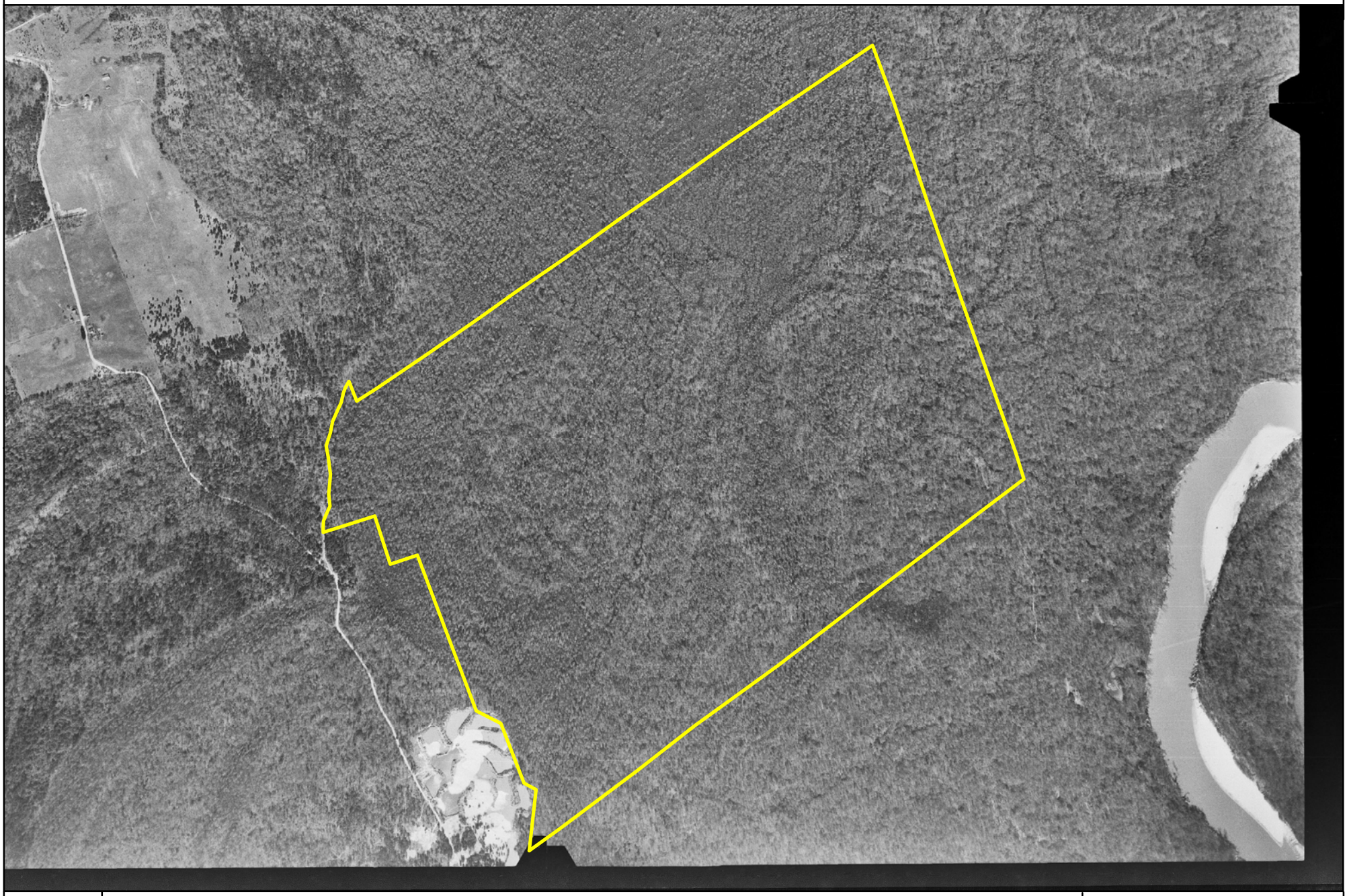
This map was generated by Advanced Ecology, LTD. using GIS (Geographical Information System) software. No claims are made to the accuracy or completeness of the data depicted in this map or to the map's suitability for a particular use. The information depicted may contain inaccuracies and is provided "as is".

Drawn By: Dan Johnson
Date: April 4, 2014

ADVANCED ECOLOGY

1954 Aerial Imagery
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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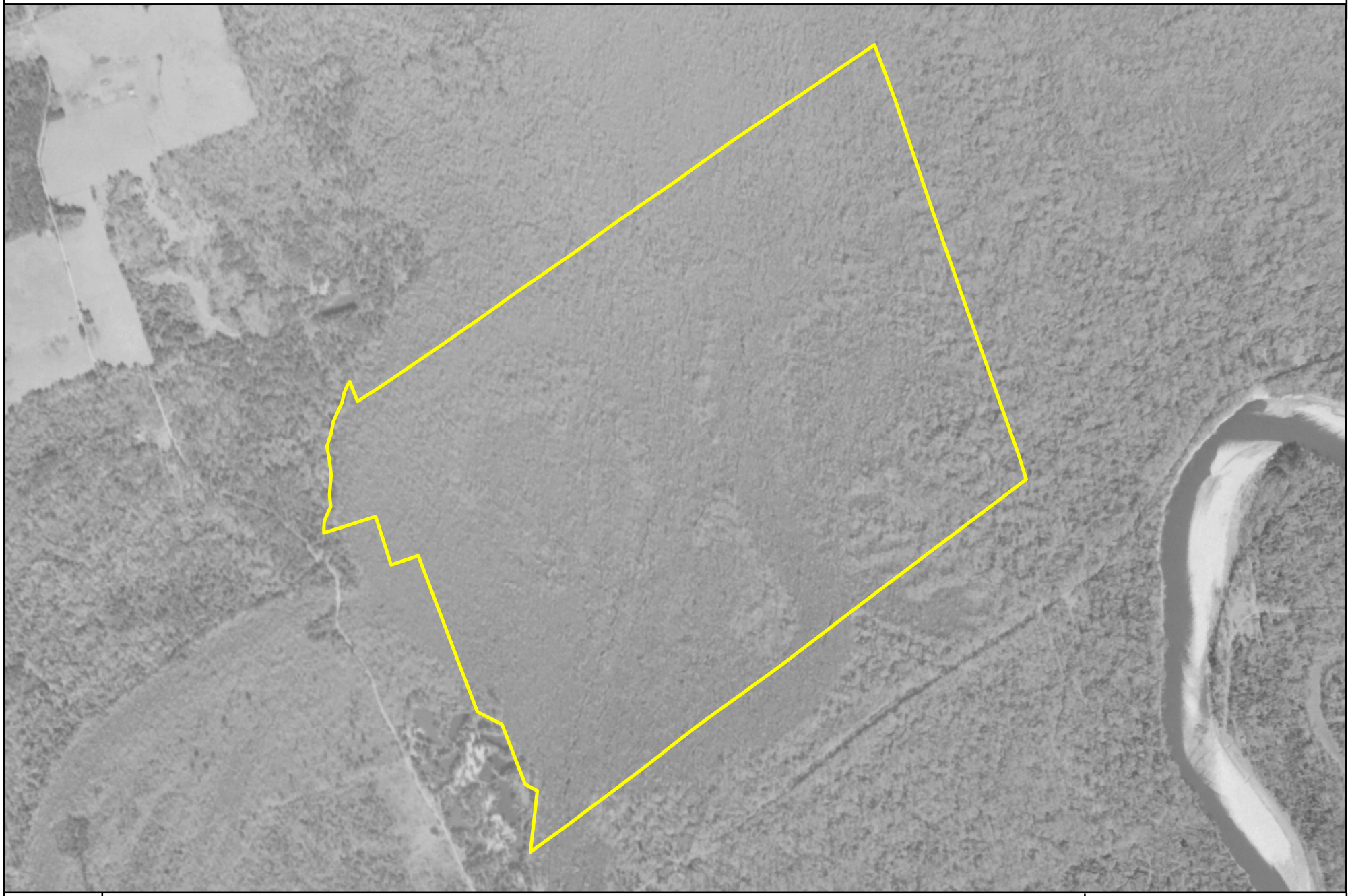
1976 Aerial Imagery
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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Date: April 4, 2014

ADVANCED ECOLOGY

1981 Aerial Imagery
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas

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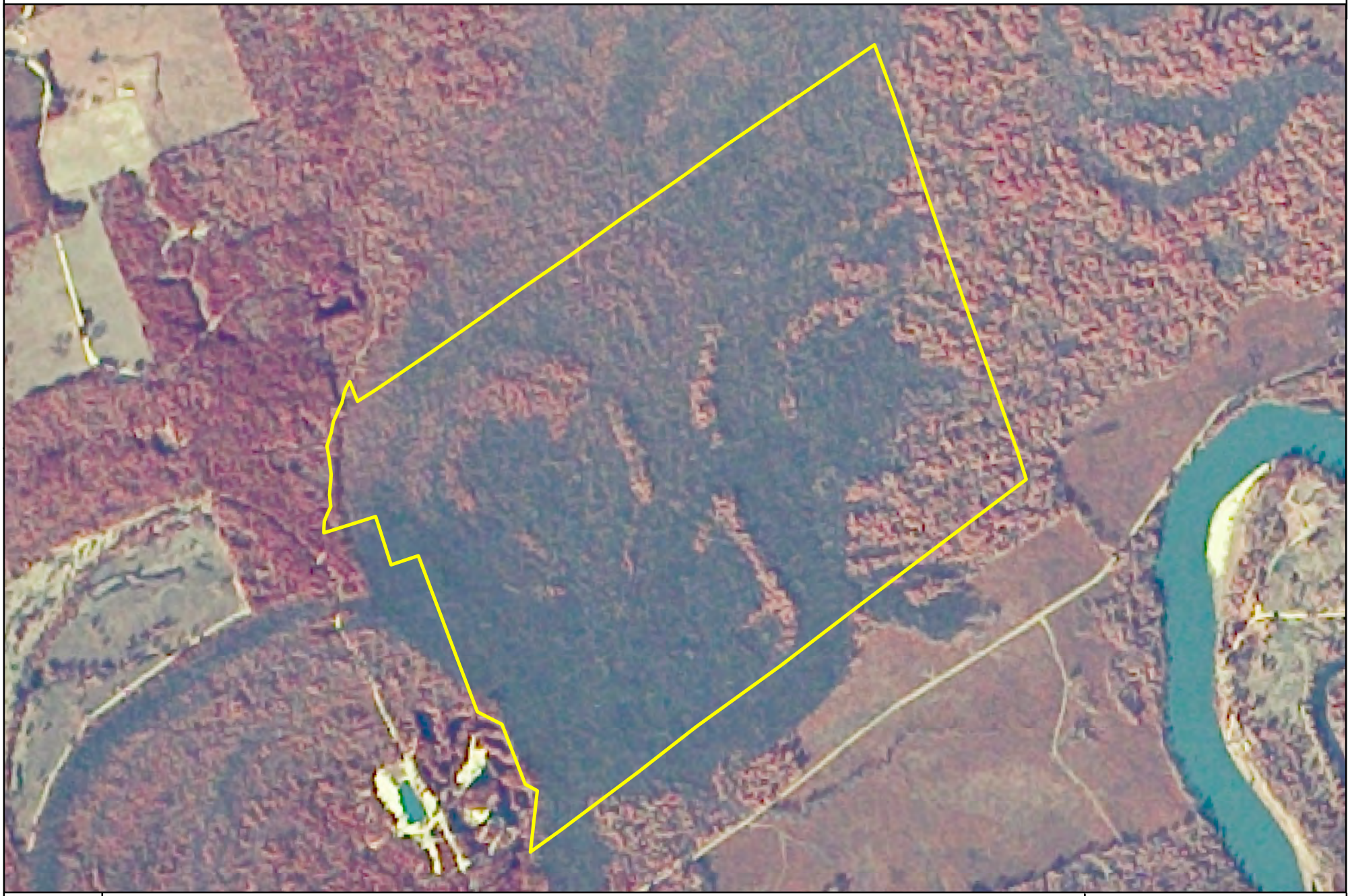
Date: April 4, 2014

ADVANCED ECOLOGY

1985 Aerial Imagery
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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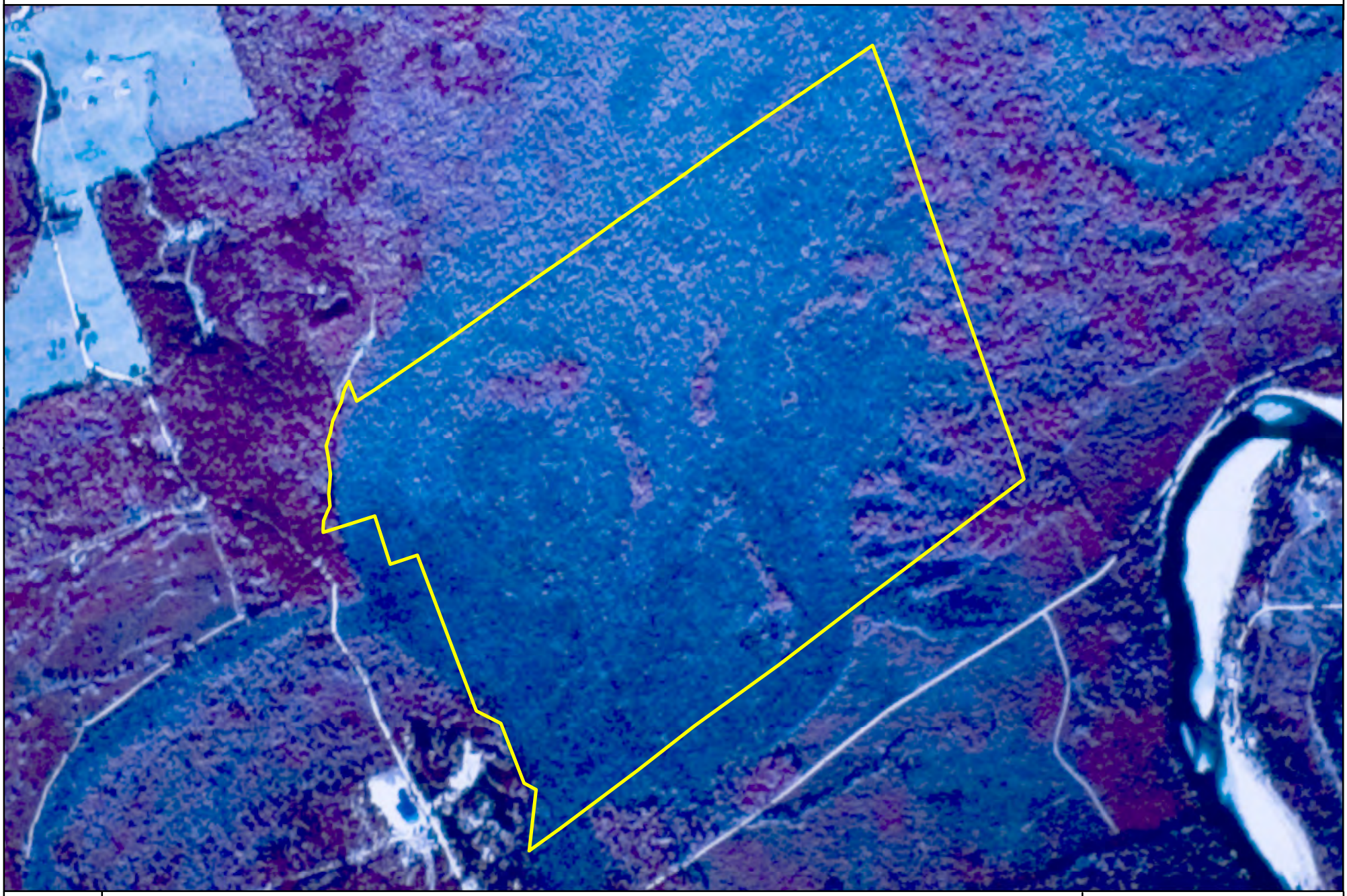
Date: April 4, 2014

ADVANCED ECOLOGY

1989 Aerial Imagery
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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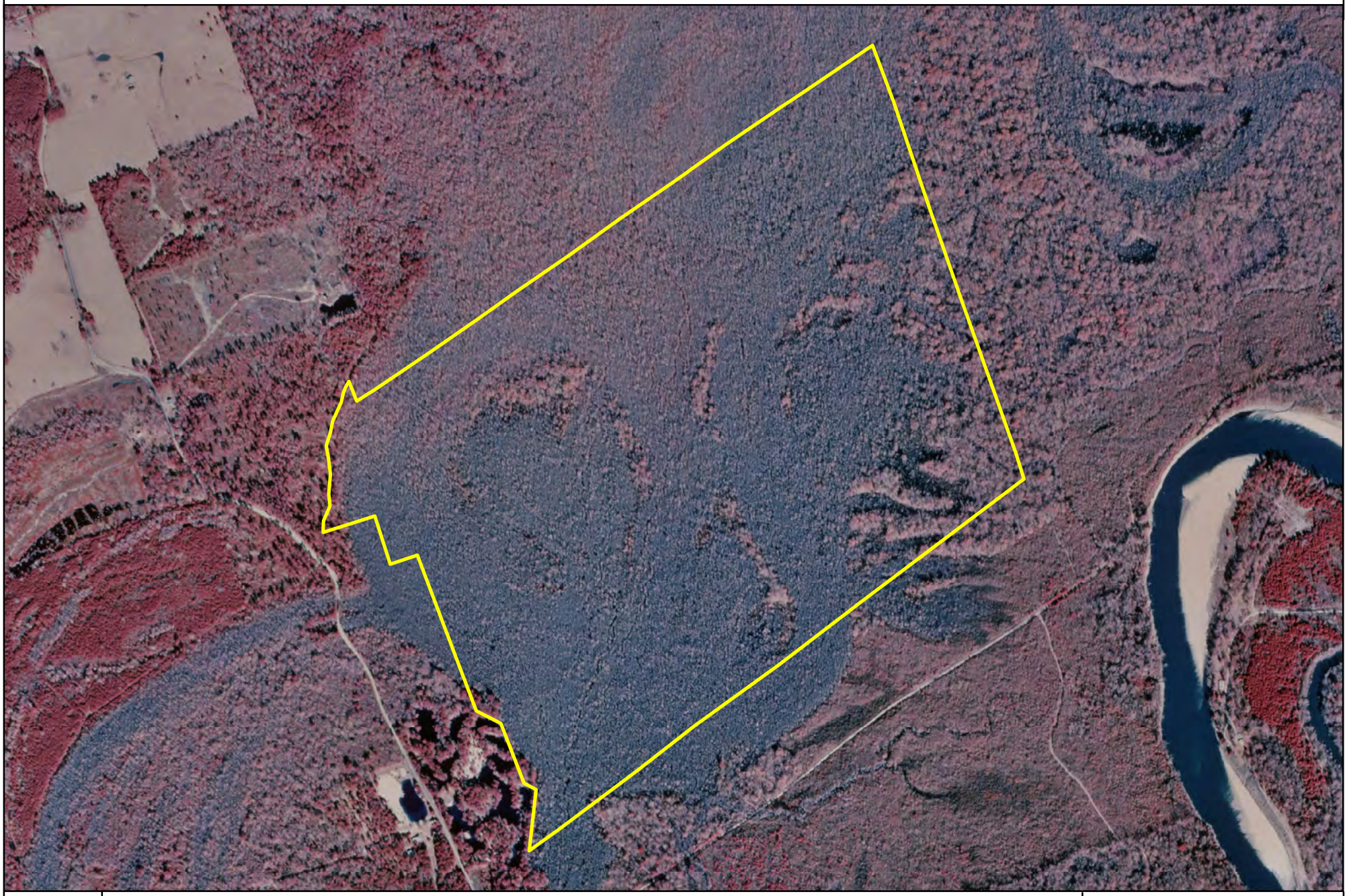
Date: April 4, 2014

ADVANCED ECOLOGY

1996 Aerial Imagery
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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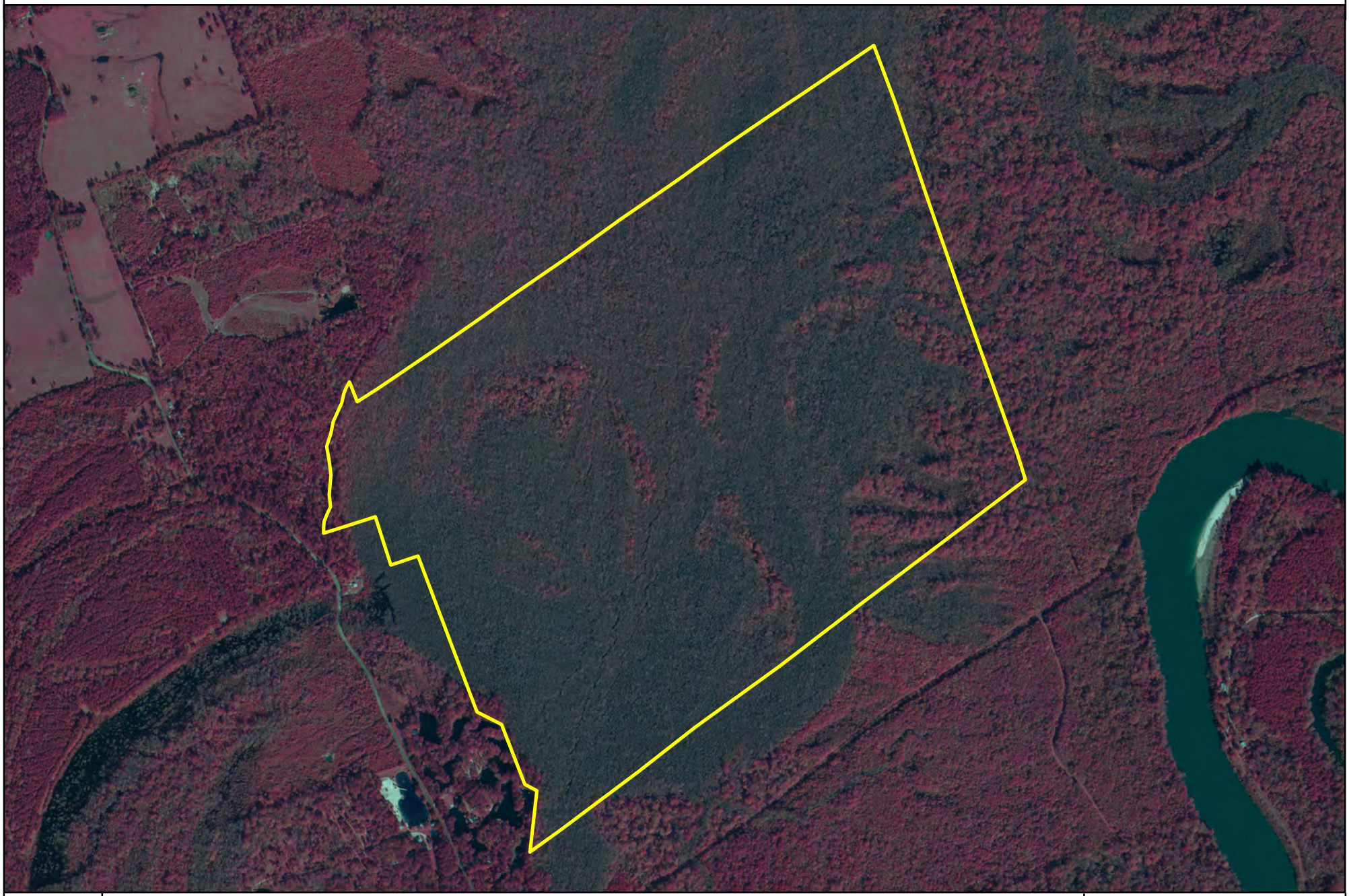
Date: April 4, 2014

ADVANCED ECOLOGY

2004 Aerial Imagery
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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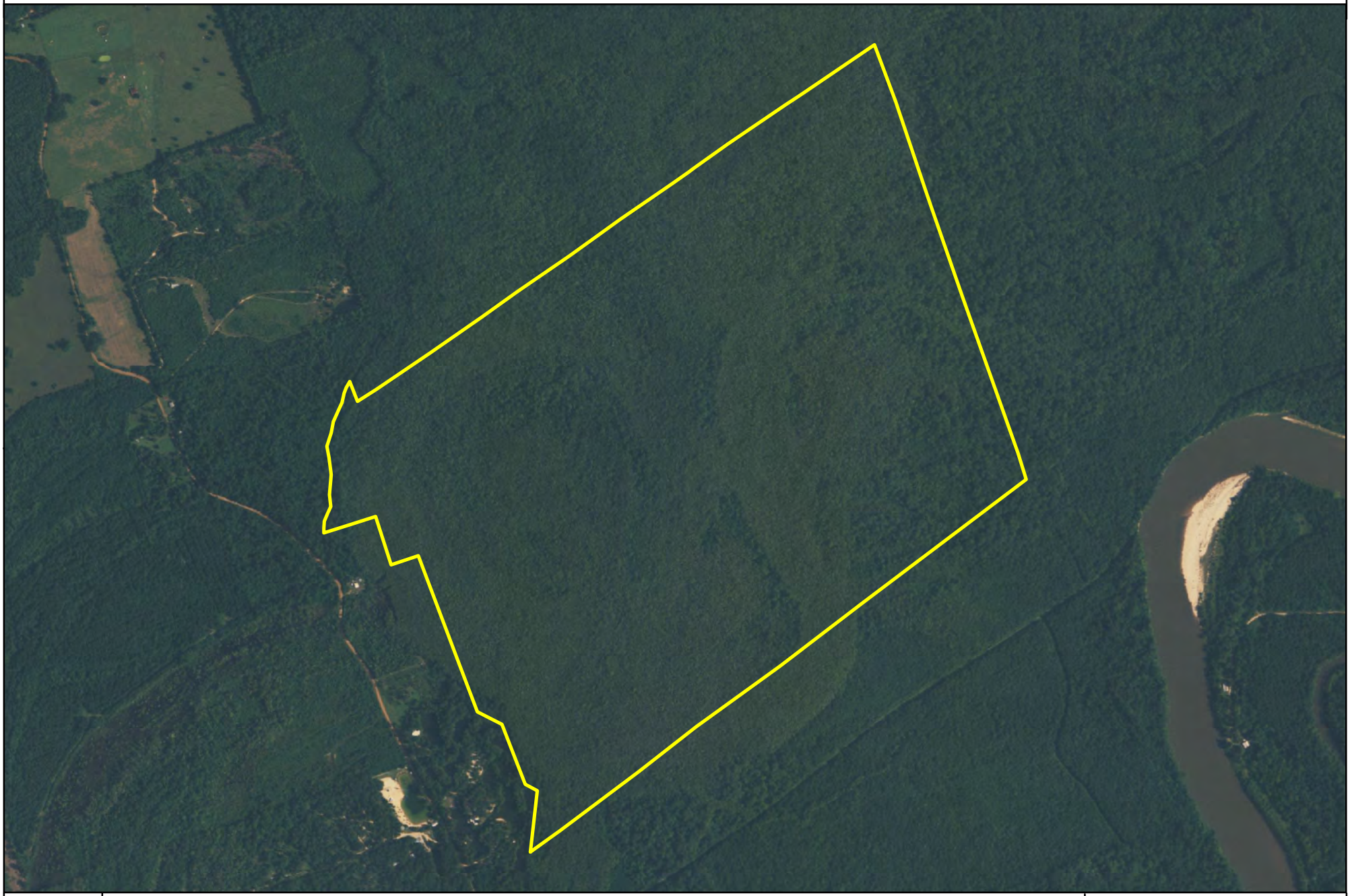
ADVANCED ECOLOGY

2005 Aerial Imagery
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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Date: April 4, 2014

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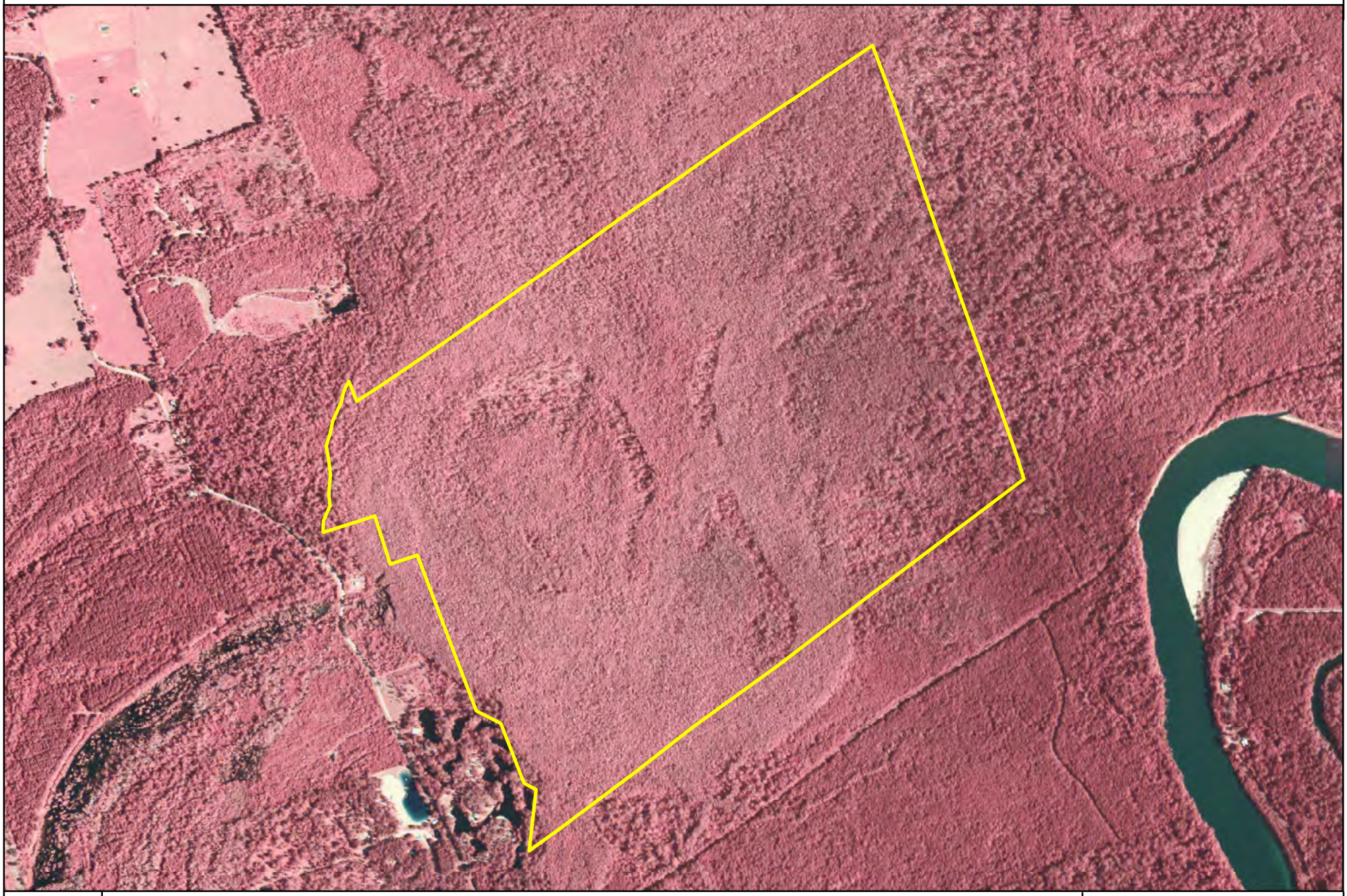
2006 Aerial Imagery
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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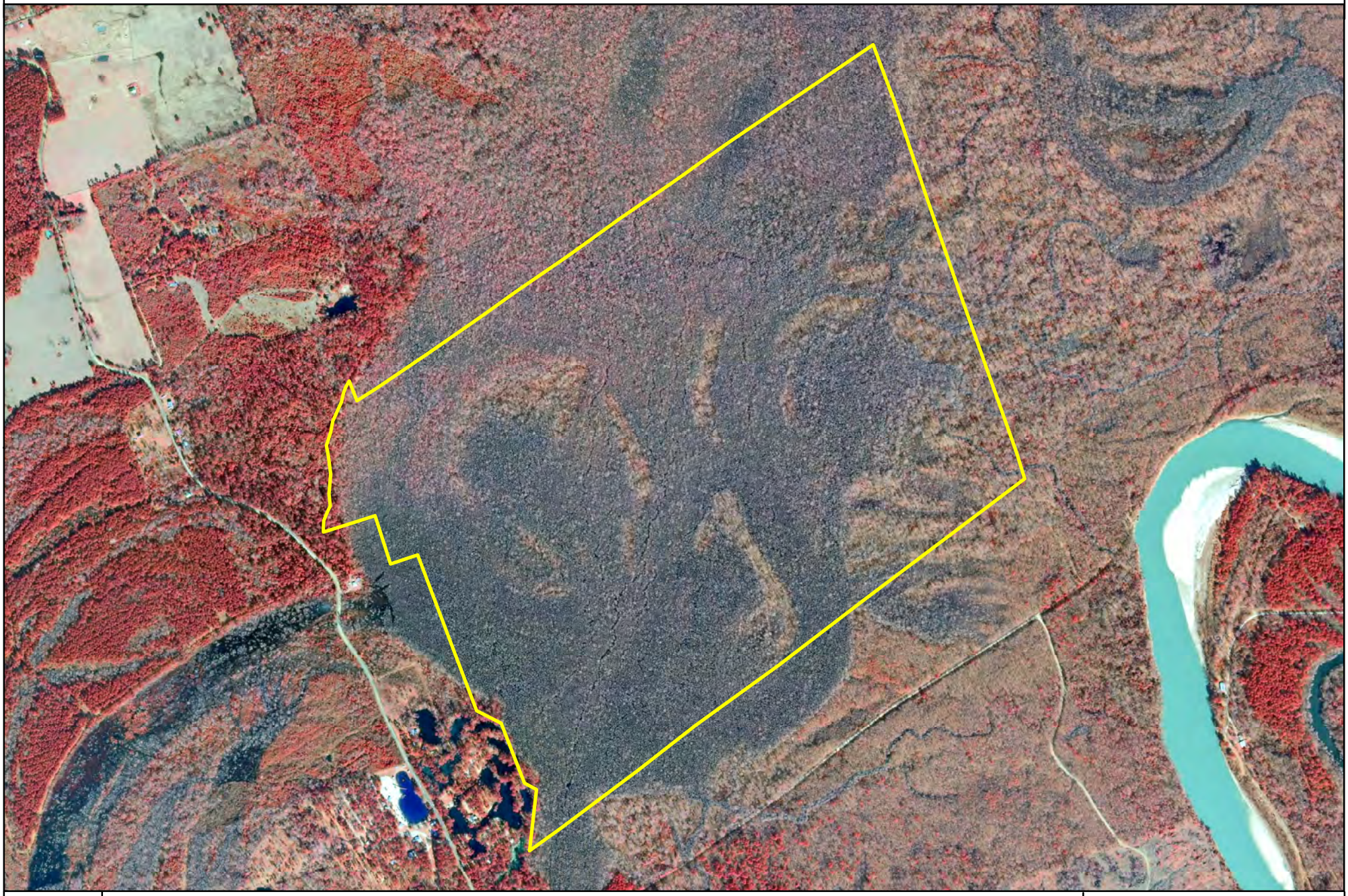
2008 Aerial Imagery
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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Drawn By: Dan Johnson
Date: April 4, 2014

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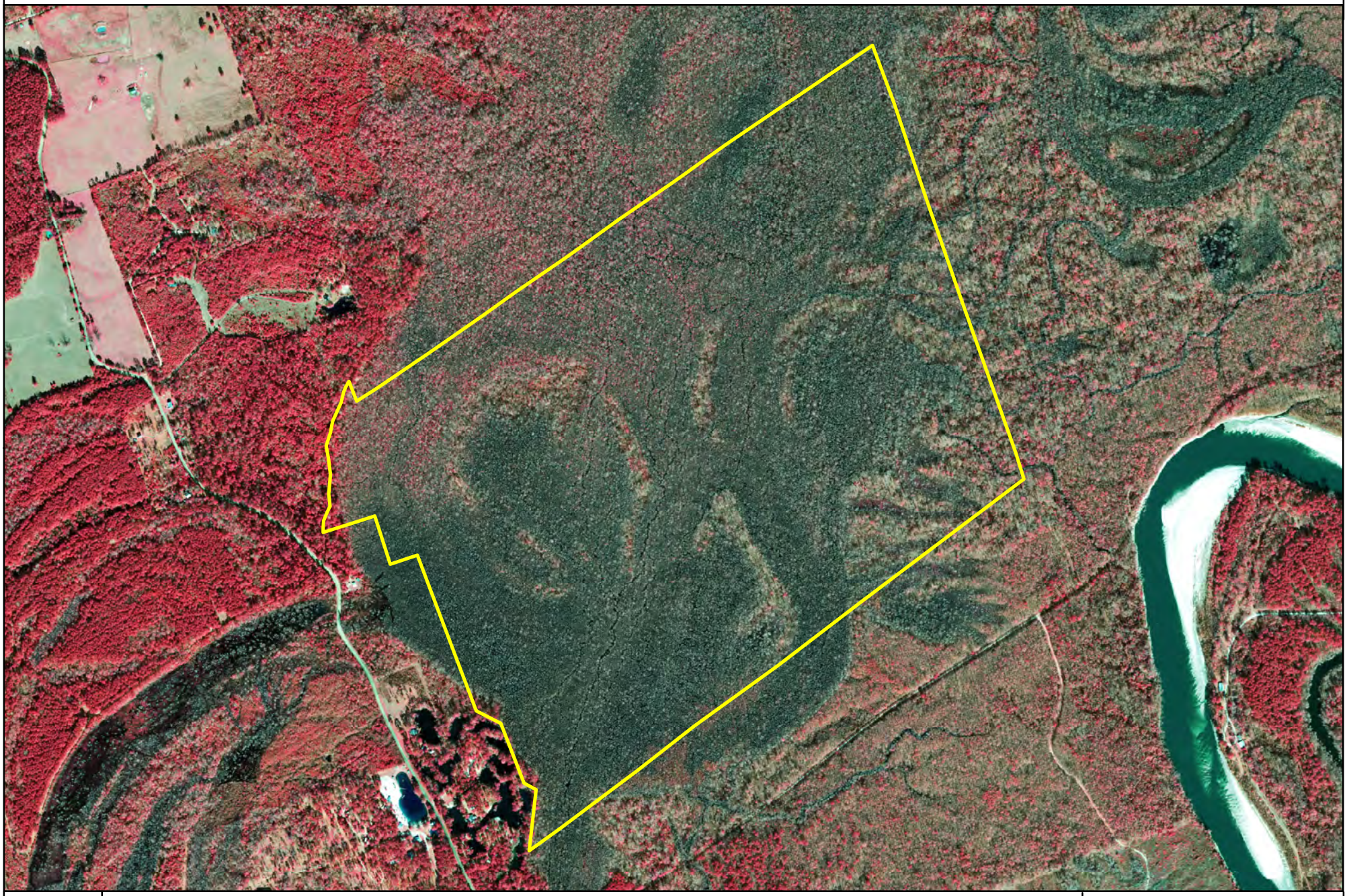
2009 Aerial Imagery - CIR
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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Drawn By: Dan Johnson
Date: April 4, 2014

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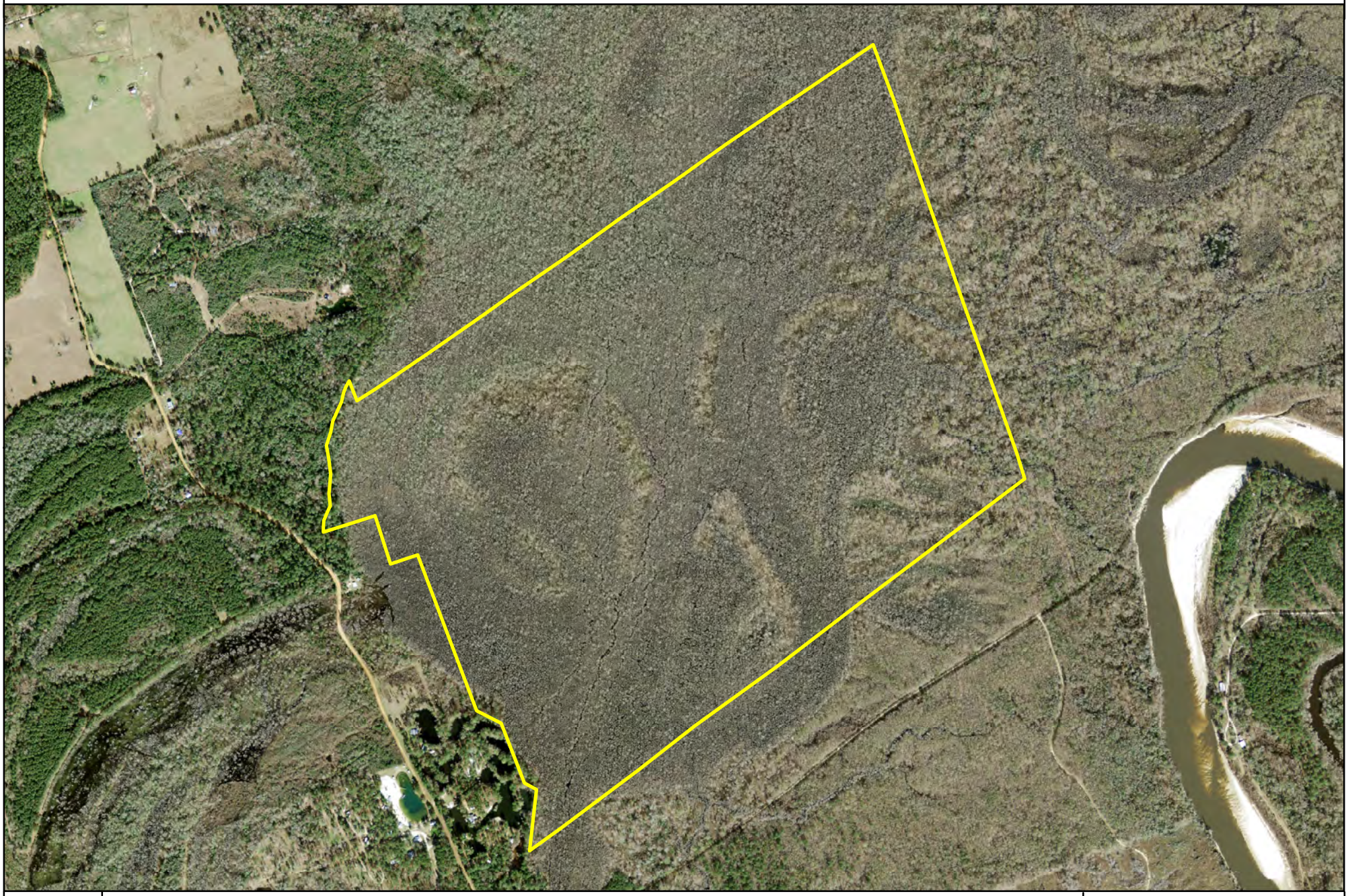
2009 Aerial Imagery - NC
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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Date: April 4, 2014

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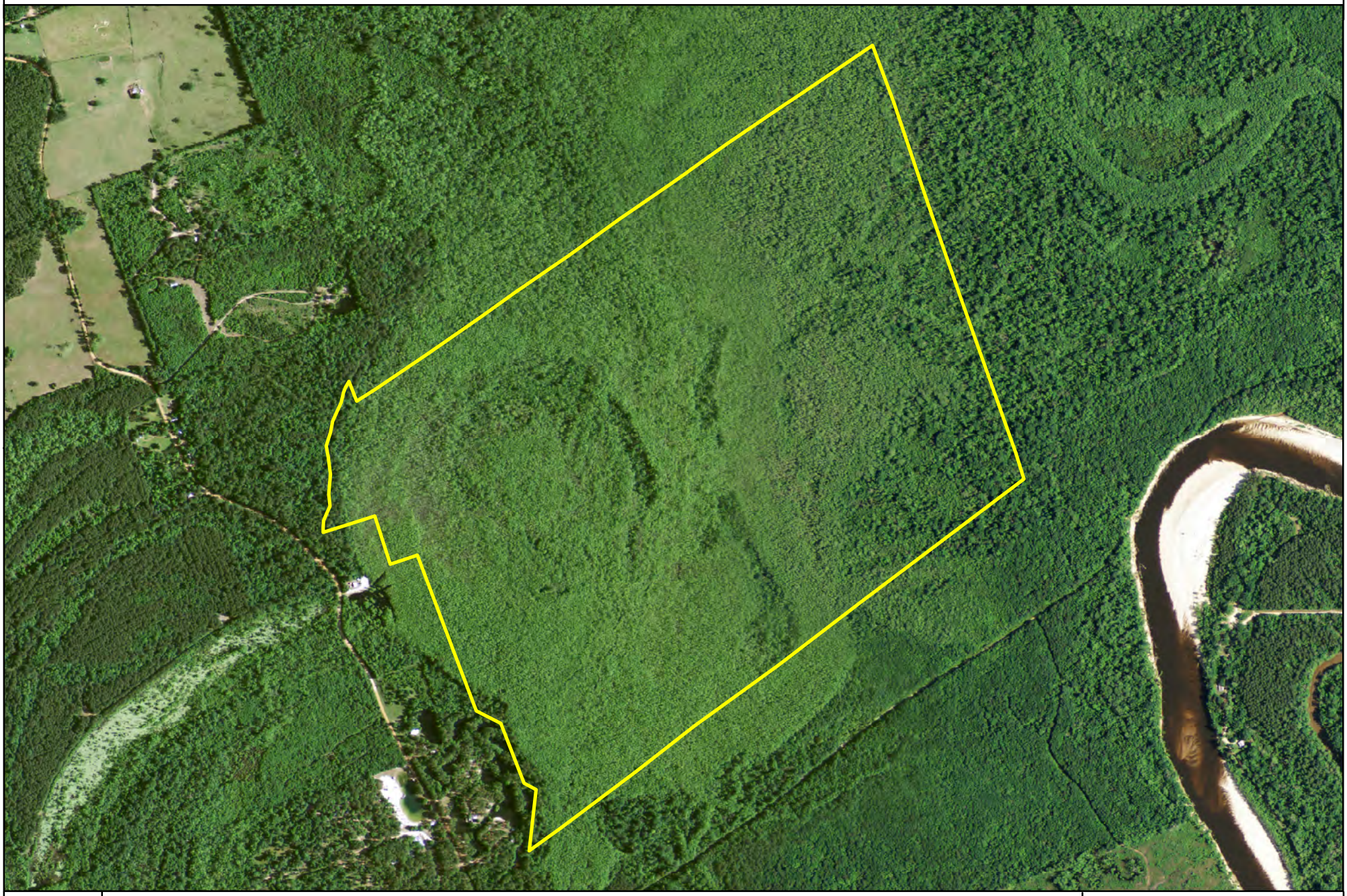
2010 Aerial Imagery
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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Date: April 4, 2014

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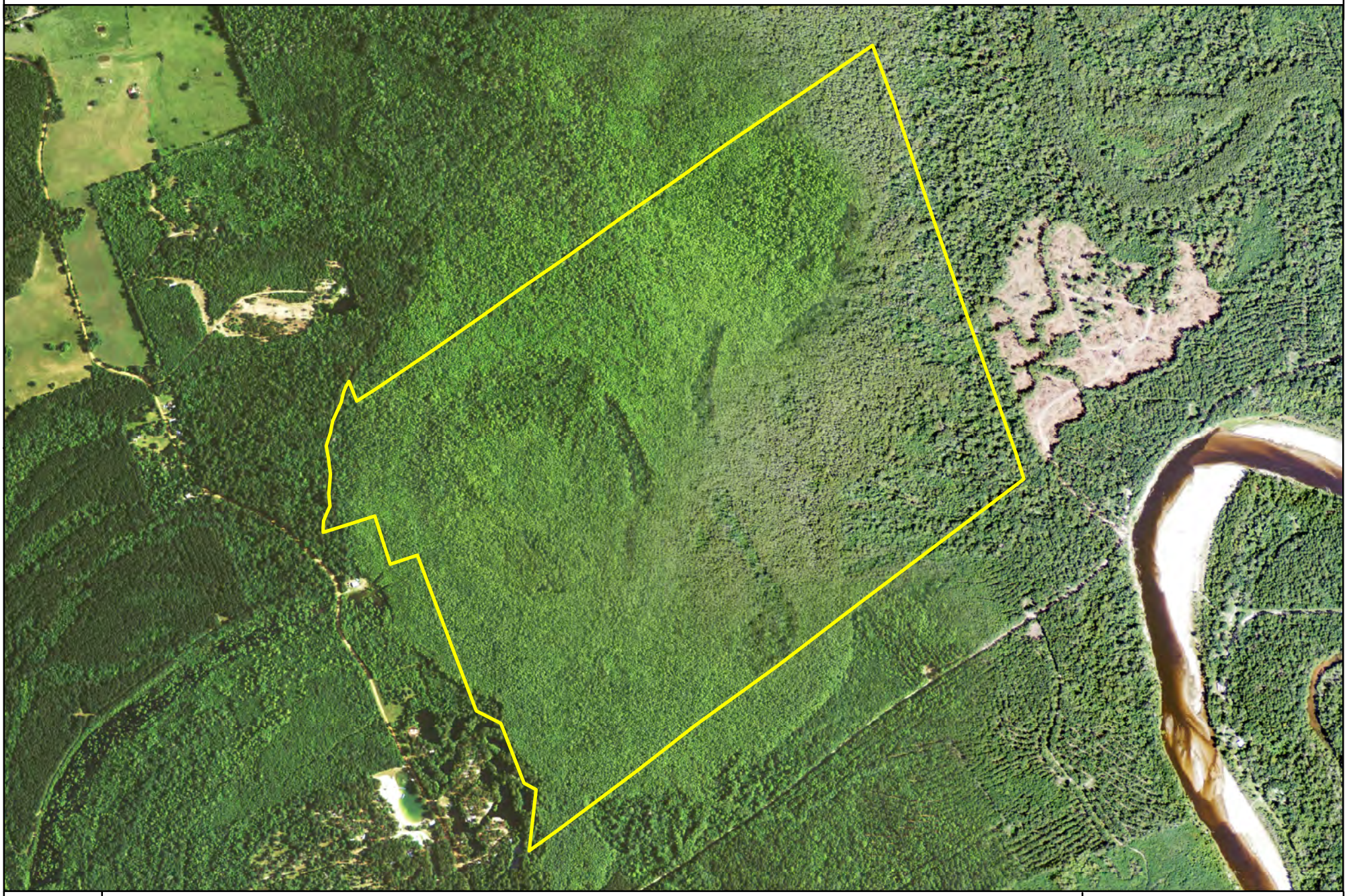
2012 Aerial Imagery
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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Drawn By: Dan Johnson
Date: April 4, 2014

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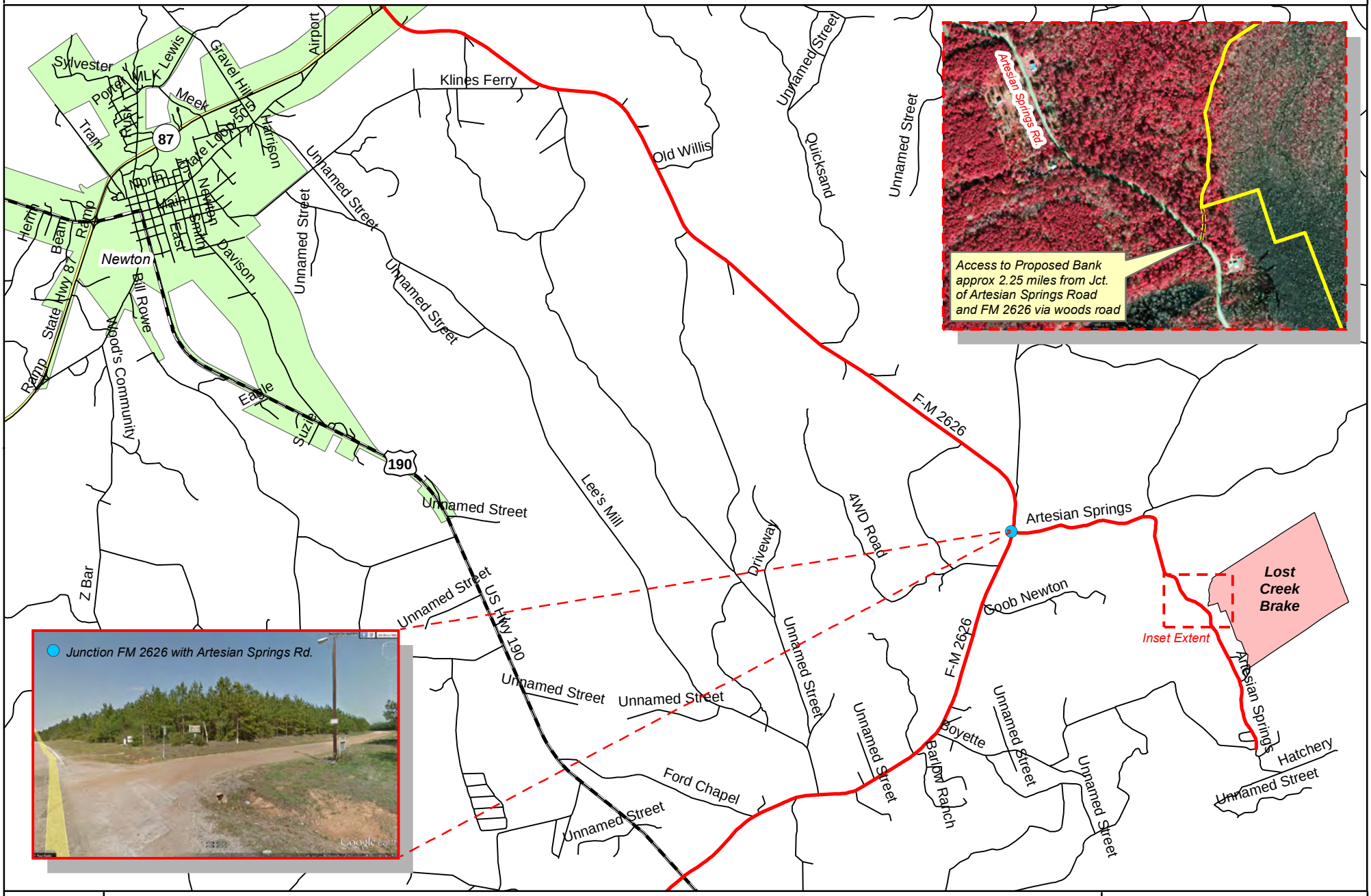
Appendix B

Project Figures

Figure 1
Location Map
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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Date: April 3, 2014

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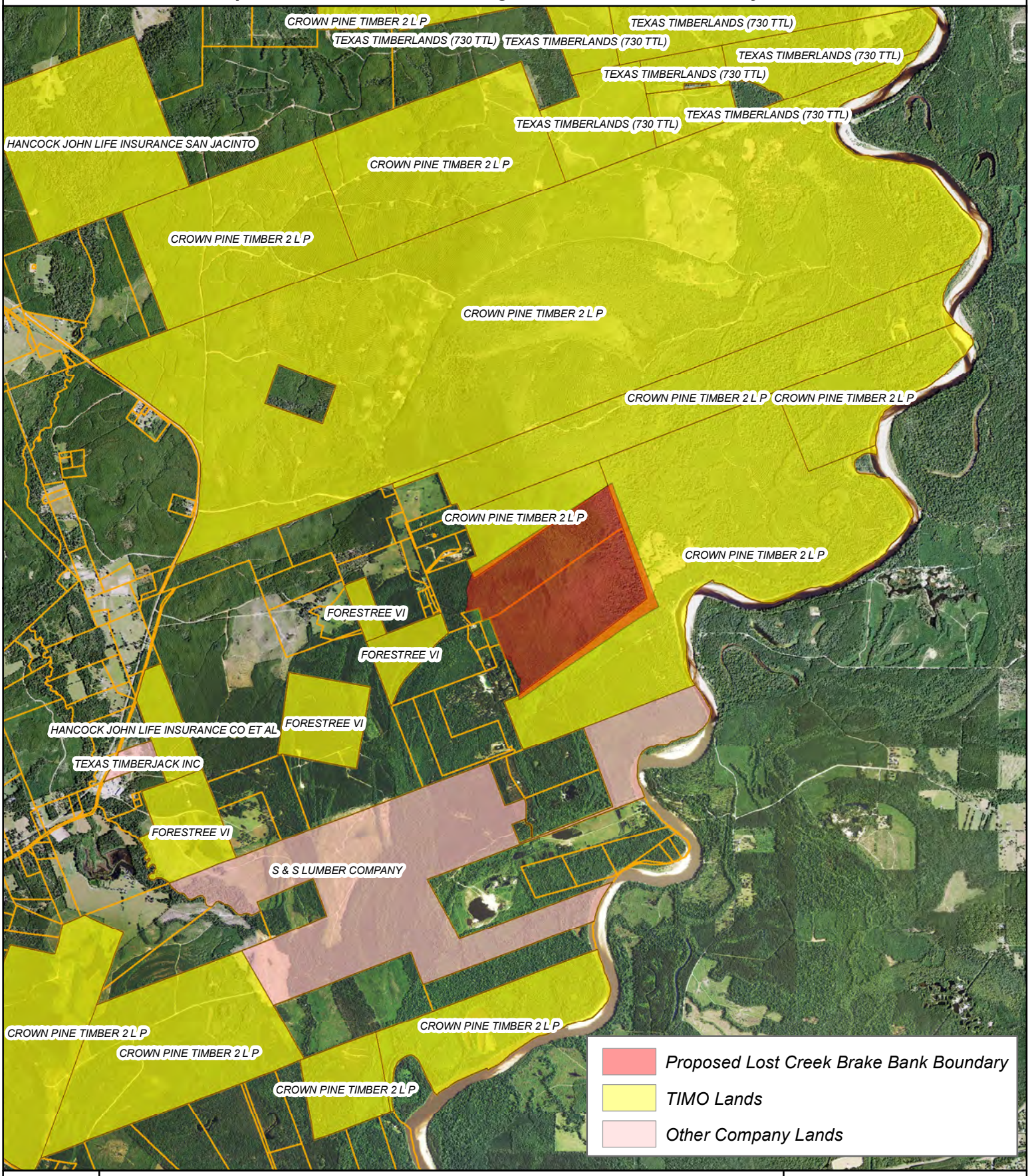
Figure 2
Adjacent Timber Company and Similar Lands
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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Date: April 4, 2014

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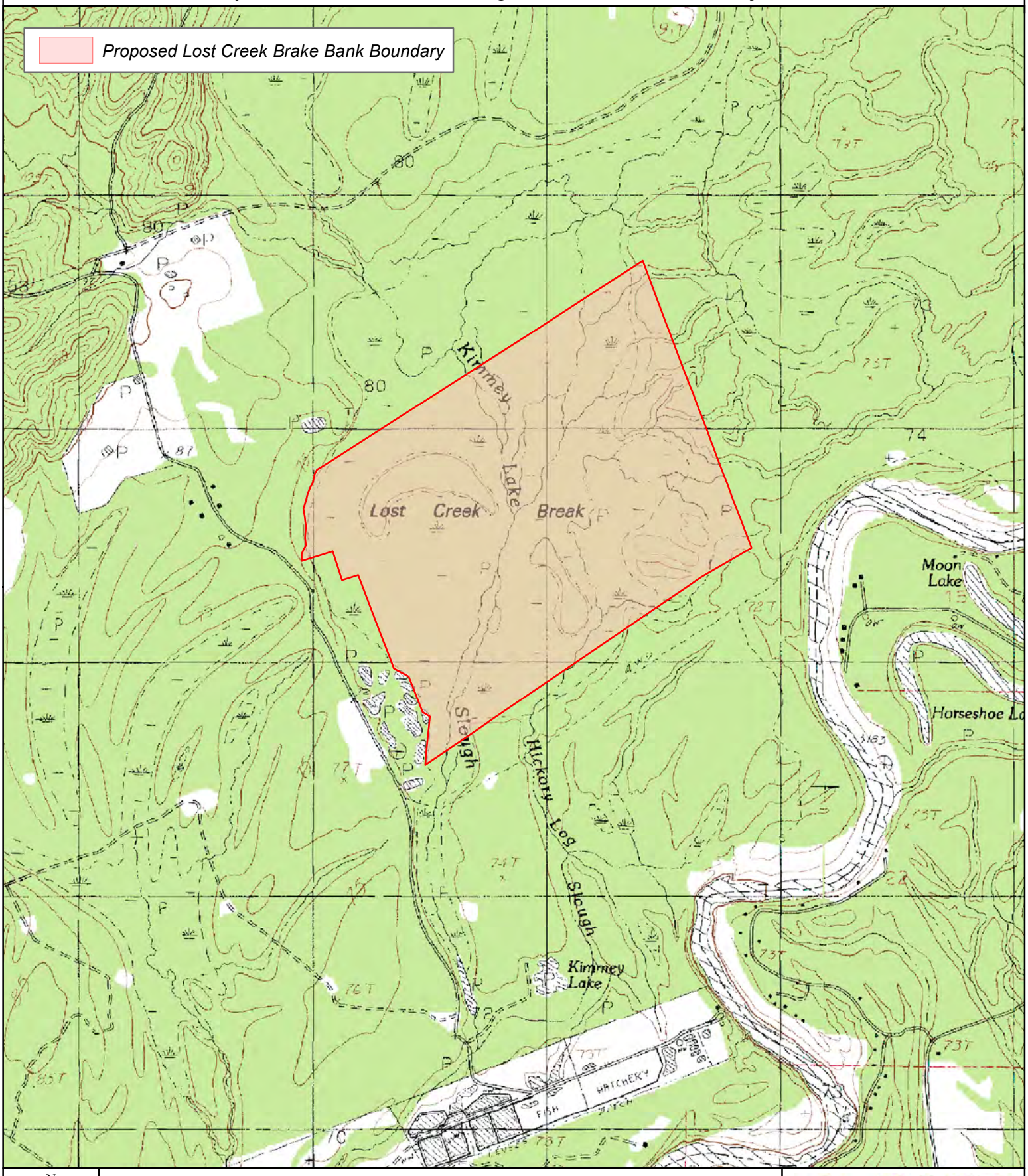
Figure 3
USGS 7.5 Minute Topographic Quadrangle - Merryville North
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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Date: April 4, 2014

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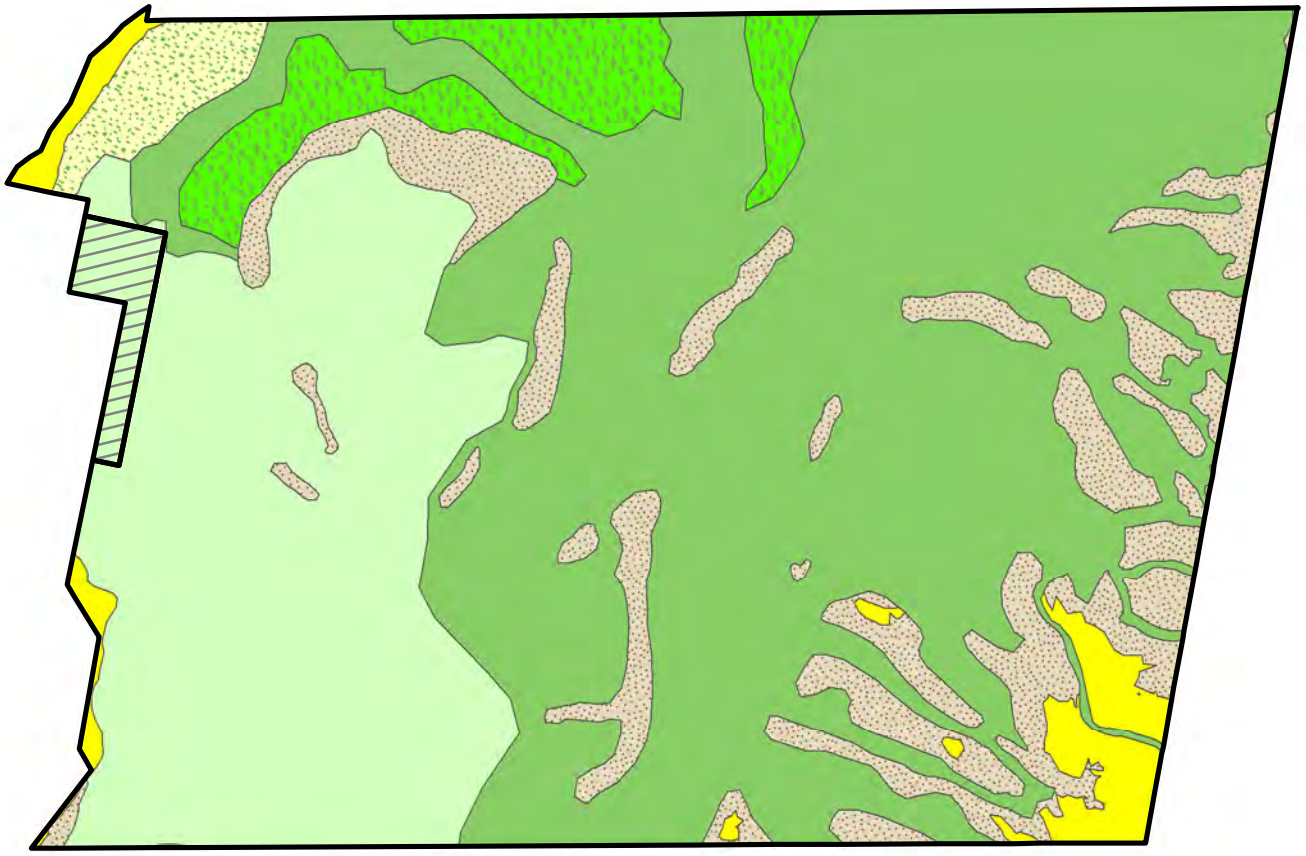
Figure 4A
Proposed Lost Creek Brake Mitigation Bank
Assessment Areas



Proposed Mitigation Bank: +/- 491.4 acres
AA 1: +/- 257.3 acres
AA 2: +/- 26.2 acres
AA 3: +/- 8.8 acres
AA 4: +/- 63.4 acres
AA 5: +/- 120.5 acres
Upland: +/- 15.2 acres
Adjacent Mitigation Area: +/- 5.5 acres
AA 5: +/- 5.5 acres

4/13/2016

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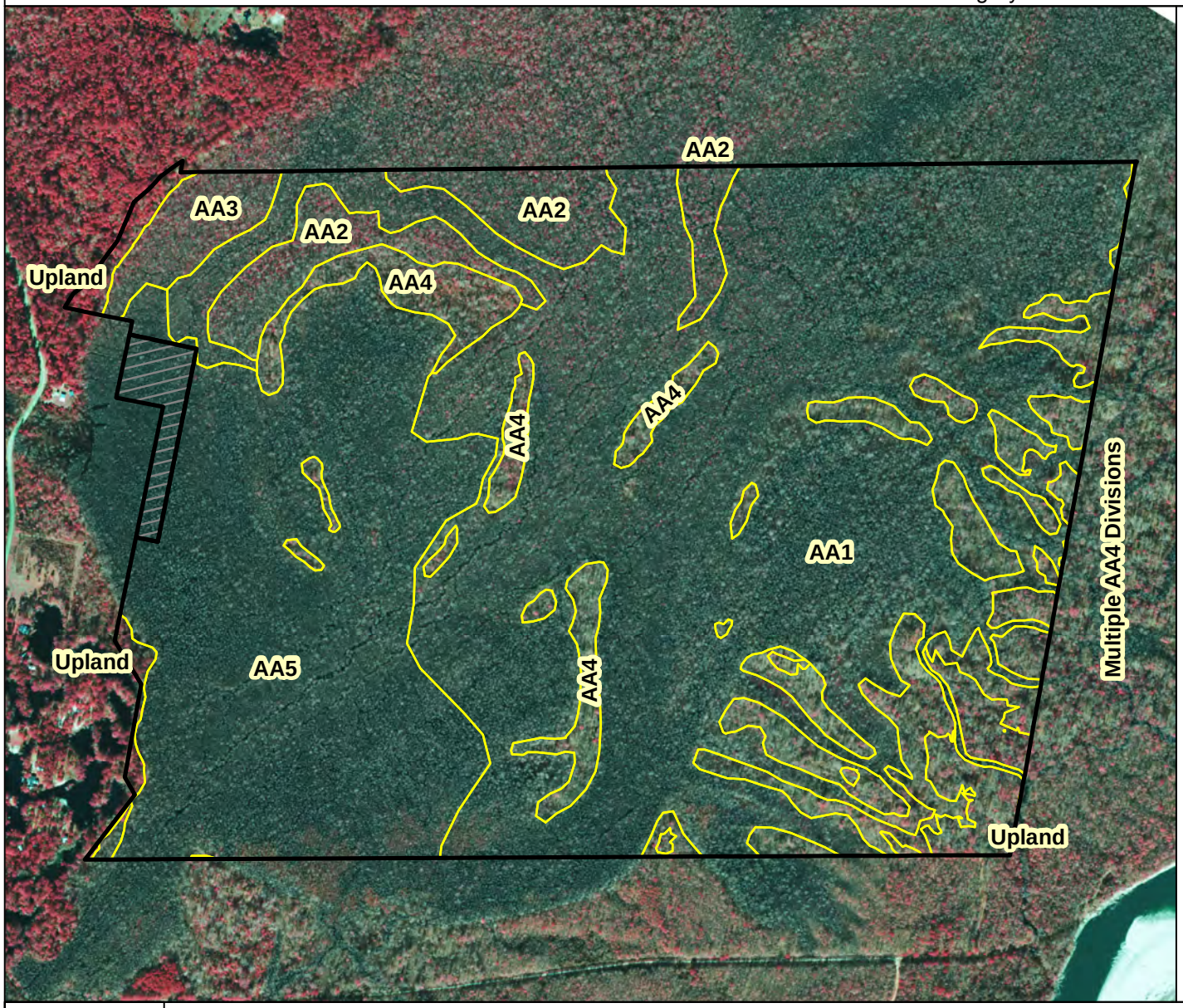
Figure 4B
Proposed Lost Creek Brake Mitigation Bank
Assessment Areas with 2009 CIR Aerial Imagery



Assessment Area Divisions

Proposed Mitigation Bank: +/- 491.4 acres

AA 1: +/- 257.3 acres

AA 2: +/- 26.2 acres

AA 3: +/- 8.8 acres

AA 4: +/- 63.4 acres

AA 5: +/- 120.5 acres

Upland: +/- 15.2 acres

Adjacent Mitigation Area: +/- 5.5 acres

AA 5: +/- 5.5 acres

4/13/2016

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Imagery: 2009 TOP

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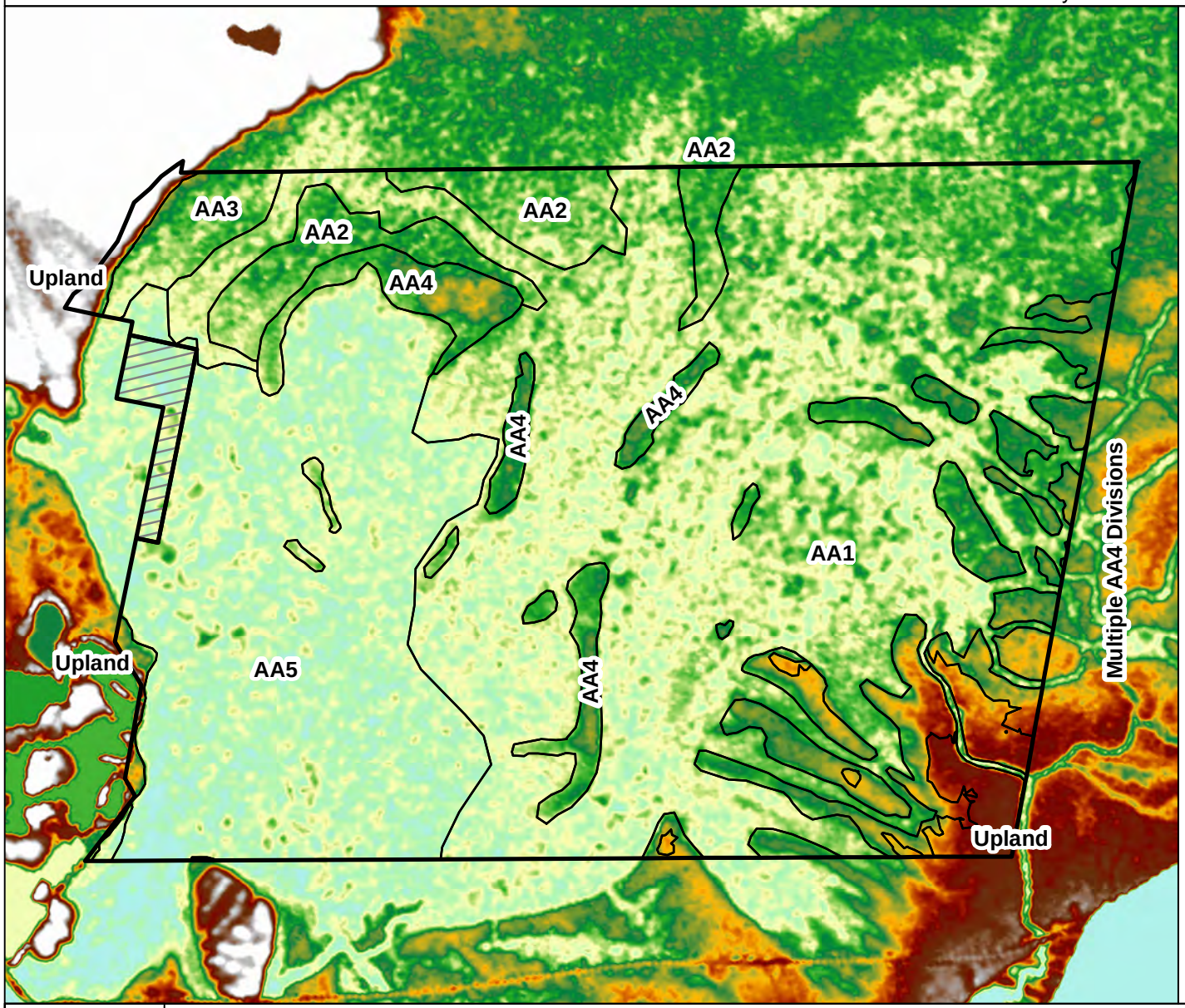
Figure 4C
Proposed Lost Creek Brake Mitigation Bank
Assessment Areas with National Elevation Dataset Overlay



Assessment Area Divisions

Proposed Mitigation Bank: +/- 491.4 acres

AA 1: +/- 257.3 acres

AA 2: +/- 26.2 acres

AA 3: +/- 8.8 acres

AA 4: +/- 63.4 acres

AA 5: +/- 120.5 acres

Upland: +/- 15.2 acres

Adjacent Mitigation Area: +/- 5.5 acres

AA 5: +/- 5.5 acres

4/13/2016

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Base Map: USGS NED

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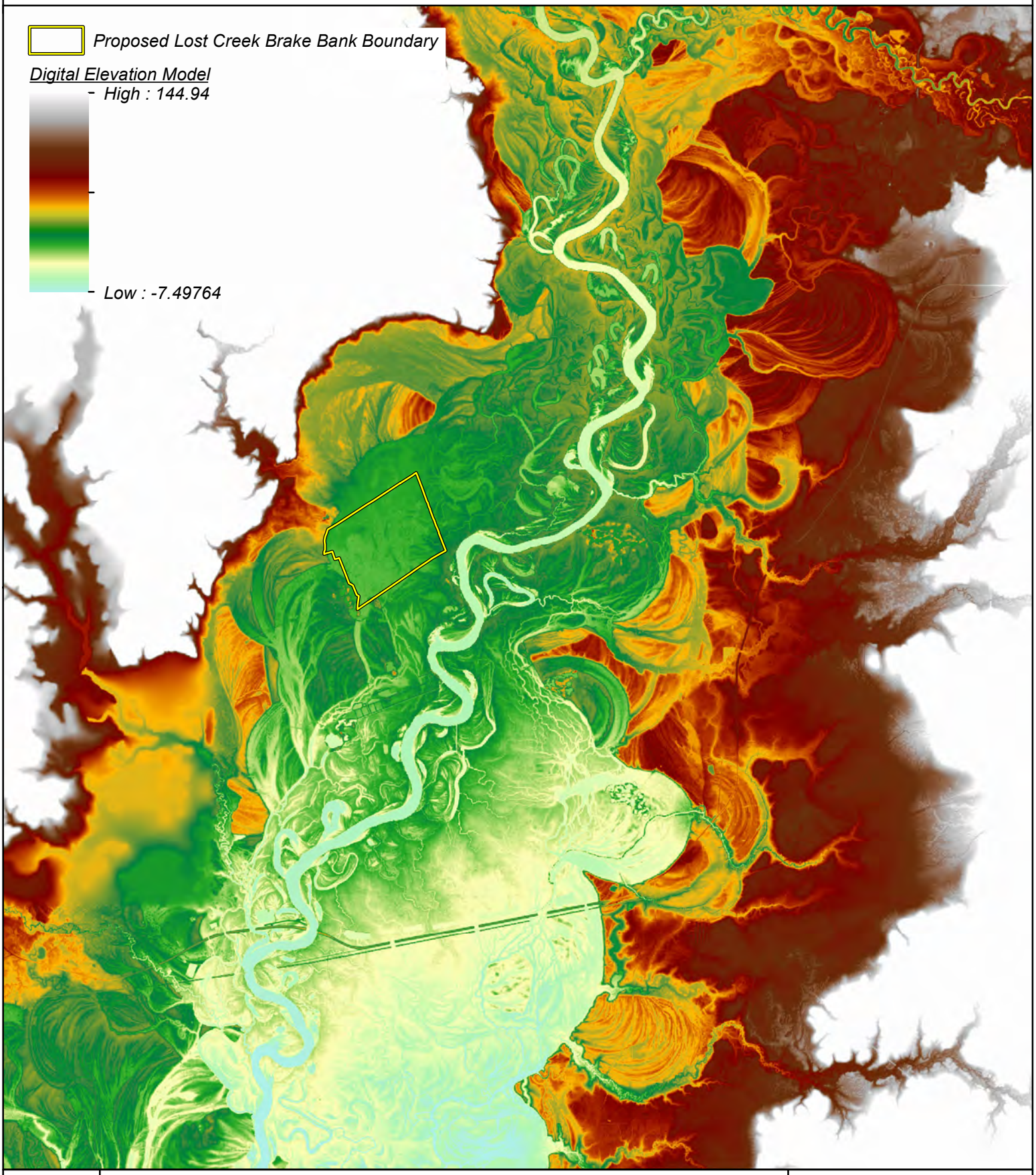
Figure 5A
Digital Elevation Model - Sabine River Basin Extent
Proposed Lost Creek Brake Mitigaiton Bank, Newton County, Texas



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This map was generated by Advanced Ecology, LTD. using GIS (Geographical Information System) software. No claims are made to the accuracy or completeness of the data depicted in this map or to the map's suitability for a particular use. The information depicted may contain inaccuracies and is provided "as is".

Drawn By: Dan Johnson
Date: April 4, 2014

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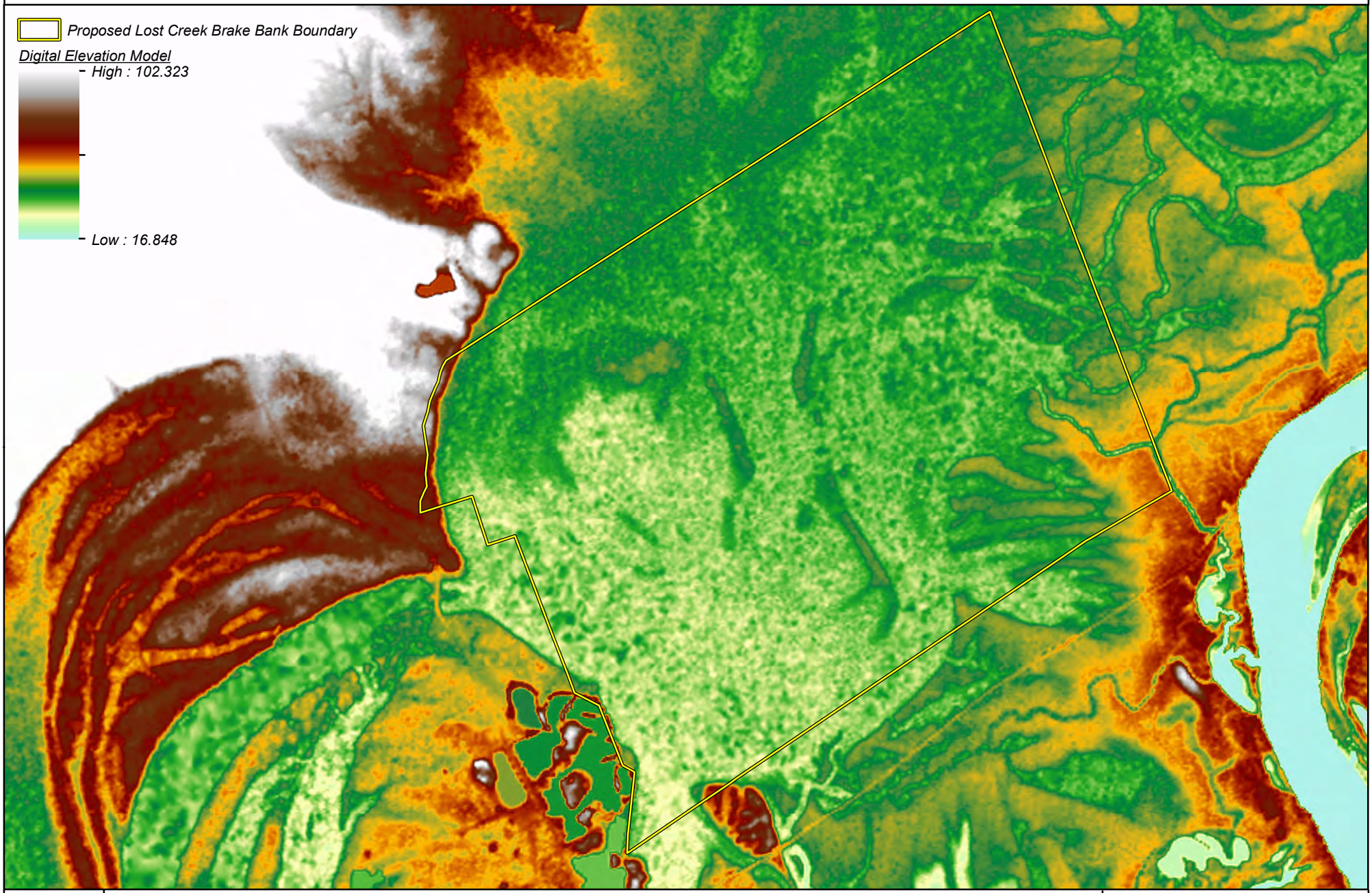
Figure 5B
Digital Elevation Model - Local Extent
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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This map was generated by Advanced Ecology, LTD. using GIS (Geographical Information System) software. No claims are made to the accuracy or completeness of the data depicted in this map or to the map's suitability for a particular use. The information depicted may contain inaccuracies and is provided "as is".

Drawn By: Dan Johnson
Date: November 18, 2013

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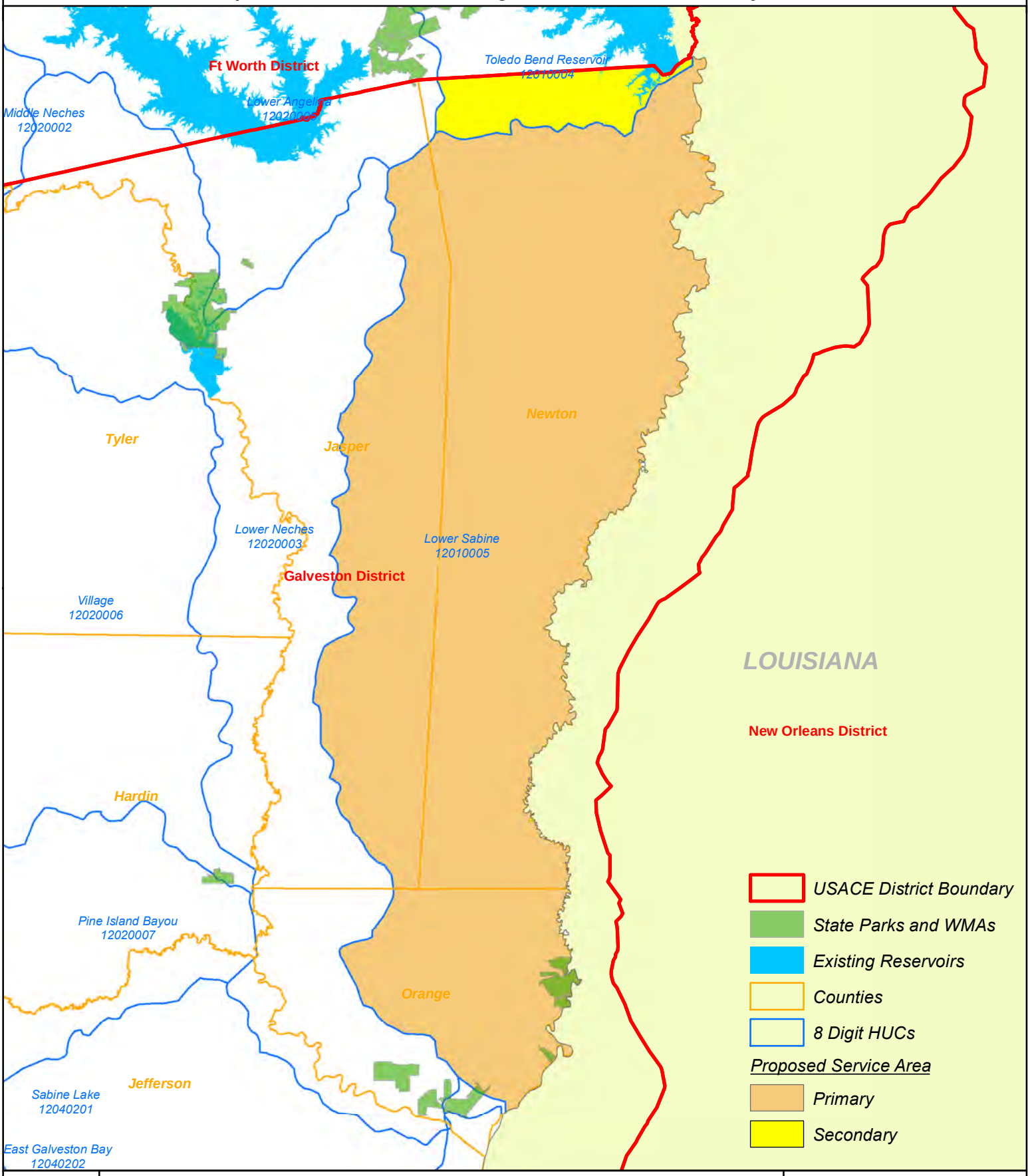
Figure 6
Proposed Geographic Service Area
Proposed Lost Creek Brake Mitigation Bank, Newton County, Texas



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This map was generated by Advanced Ecology, LTD. using GIS (Geographical Information System) software. No claims are made to the accuracy or completeness of the data depicted in this map or to the map's suitability for a particular use. The information depicted may contain inaccuracies and is provided "as is".

Drawn By: Dan Johnson
Date: April 4, 2014

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Appendix C

Threat Analysis

Evaluation of Unregulated Threat to Wetland Function

Lost Creek Brake Tract – Lower Sabine 12010005

Advanced Ecology, Ltd.
October 2014 – Updated March 2016

Abstract

Hardwood forest product markets, specifically those which accept baldcypress and tupelo, have been in high demand for many years. This demand has driven the development of specialty logging operations to procure product for both high-end and biomass hungry markets. The Lost Creek Brake tract possesses attributes which make it desirable from a forest products standpoint; specifically, the presence of a significant baldcypress component and close proximity to numerous mills servicing hardwood timber markets. This potential for removal of the standing timber is real and unregulated and, due to the narrow margin of suitable conditions needed for establishment, may have long-term effects on the tract's wetland functional capacity.

History of Threat Development

Many regions are characterized by vast forests, some largely untouched, some heavily utilized, some carefully tended for the long term. The upshot is that wood products were significant in the rise of civilizations and continue to insure resources for the needs of mankind. Wood is important to our well-being. Our record reveals that we often allow our zeal to overcome our wisdom. So it is with forests.

Early in the history of our nation, people who occupied the extensive eastern forests recognized the inherent worth of these natural resources, particularly as material for construction of buildings. Interestingly, colonization experienced a springboard to success by the fortunate emigration of Finlanders to the Delaware River Valley. Arriving with these people of the Finlander culture was the architectural knowledge and behavioral willingness leading to the widespread understanding of ways that became generally conventional methods of building log houses, outbuildings, and, ultimately, early commercial structures (Jordan and Kaups 1989). This knowledge facilitated a settlement process. John Boles, writing in the introduction to Plain Folk of the Old South (Owsley 1949), summarized the movement; [Jordan and Kaups (1989) also explain this behavior of Finlanders.]:

> *A small number of men would come west first, looking for likely sites that resembled where they had come from, and perhaps erecting a quick cabin and putting initial crops in the ground to support the larger group that came later.*
>
> As per later settlers, Boles stated: *They sought good stands of timber, plentiful sources of water, and fertile land that produced bountiful crops.*

The stands of Lost Brake—quietly situated in initial obscurity in Southeast Texas—ultimately came to be enveloped in this settlement process. Sitton and Conrad (1998) state:

> *Several generations of Southerners gradually had spread across the longleaf "pine barrens" from Virginia, through Georgia, Mississippi, Alabama, and Louisiana, until they reached the end of the great forest west of the Trinity River.*

As permanence creeped west with the frontier, enterprise joined to these vast forest resources. Sitton (1995) described what eventually happened:

> *Commercial uses of the resources of the woods and river began with the first settlement, but they increased enormously in scale of environmental impact after market access improved with the coming of the railroads in the 1880s.*

Smith (1986) explains the nature of the threat and impact of this era:

> *The sawmiller's habit of exhausting the timber at one location and then moving on was soon referred to 'cut out and get out". About 1880, scarcely after getting started around the Great*

Lakes, lumbermen and timber speculators began to buy tracts of longleaf pine in Louisiana and Mississippi, and shortleaf pine in southeastern Missouri.

These people finally came to the forests of East Texas.

This history is about acknowledging the substantial depth and powerful intensity of the pervasive, persistent demand for wood products, and the hardened determination to provide the supply from what was regarded then as abundant forest resources. The baldcypress and tupelo stands of Lost Brake are not exempt from these relentless market phenomena.

Historic and Market Context

Early baldcypress and tupelo harvesting was along rivers where transport was done simply by floating logs to the mills. Notably, these stands were readily accessible from steamboats that could bring crews and supplies to the logging operations as this method developed (Kane 2004). Trees would be deadened by girdling, usually in the fall and winter, so they would dry while standing, thus assuring that the logs would float when felled. When spring floods came, loggers would harvest the dead trees, and then were able to float the deadened logs (Sitton 1995).

In this early phase, baldcypress brakes along sloughs, oxbows, and creeks with some condition of high-water access to the major rivers soon were depleted of the larger trees. The invention of the pullboat around 1890 along with the expansion of local tram lines and regional to nationwide railroad systems opened up more of the baldcypress-tupelo swamps to logging. This meant that logging baldcypress was no longer dependent upon spring flood events. Loggers could access trees further back from the rivers in a more dependable fashion (Brandt and Ewel 1989; Burns 1980).

The increase in baldcypress and tupelo log supplies provided the raw material for large sawmills to be established, as opposed to the smaller, more localized mills of the past. The Lutcher and Moore Mill, demonstrating the enterprise of northern lumbermen moving south, with its attendant log boom on the Sabine (for river-transported logs) was the first big mill in East Texas (Sitton 1995). The increase in supply and access to railroads led to an intense nation-wide marketing effort by baldcypress mills around the turn of the century. Since so much construction and infrastructure then depended upon wood, a source of weather-resistant lumber was welcomed. The harvesting of baldcypress increased dramatically from 1890 to 1915. However, by 1925 the supply of virgin baldcypress had dwindled, with most of the large mills closing during the Great Depression (Sitton and Conrad 1998; Burns 1980).

Baldcypress and tupelo harvesting continued on a smaller scale after the 1930's, but with the regrowth of baldcypress-tupelo, forests the market demands for it have grown to include house logs, furniture stock, pulpwood and landscaping mulch in addition to lumber. The building of extensive highways and all-weather roads coupled with increasingly efficient mechanized logging equipment has allowed economically-viable harvesting on previously impractical forested lands (Brandt and Ewel 1989). A case in point in Newton County, Texas (south of the Lost Creek site) is a baldcypress swamp which was logged

around 2011. This site can be viewed on Google Earth imagery at Lat 30°31'50.74"N Long 93°45'2.10"W. The November 10, 2011 imagery is the earliest imagery of this harvest; while earlier imagey shows the intact swamp.

Tupelo wood has been in high demand for many years, especially in the manufacturing of furniture stock, boxes, baskets and crates. Prior to the mid-1900's, wood was the primary material for shipping containers of all types and sizes, and tupelo was the wood of choice. With the changing logging technology, the harvesting of tupelo tracked along the same lines as baldcypress, since it occurs in the same forest type. Today tupelo is in demand for pulpwood, especially for high-grade book and magazine papers, as well as for interior parts of furniture, shipping containers, crossties and wood baskets. It is used extensively in the veneer and plywood industry. Woodcarvers constitute a substantial demand source, especially for carving ducks and other wildfowl (*Wood Database*; Silvics of North America).

Site Timber Characteristics and Value

The existing forest on the Lost Creek Brake site was evaluated by a senior-level professional forester experienced in baldcypress-tupelo forest inventory. Increment coring data indicates that anecdotal site history information gleaned from locals and adjacent landowners is correct, in that the forest products on this site were last harvested around 1900 to 1910. The approximately 100-year old forest is estimated to contain around 58,000 tons of merchantable forest products, which is about 108 tons (about four semi-truck loads) per acre.

This is a substantial volume of timber, both in total and on a per-acre basis. This forest, with its excellent public road access and good timber market location, offers a high volume of relatively accessible baldcypress, tupelo and miscellaneous hardwood. A reasonable estimate of the timber value, standing on the stump, taking harvesting and hauling costs into account, based on $5.00 per ton to the landowner, would yield about $300,000 in timber value to the landowner. Exhibit "C" is a specific offering letter from a Southeast Texas timber purchasing and harvesting contractor.

Specific Markets

The following is an overview of the kinds of hardwood, baldcypress and tupelo based forest products facilities in the Texas and Louisiana area that utilize the tree species that occur on the Lost Creek Brake site. Miscellaneous hardwoods include oaks, sweetgum, ash, elms, hickories and sugarberry. Exhibit "A'" shows the locations of these facilities, while Exhibit "B" is a tabular listing of them by facility type. The facilities which are shown to utilize baldcypress and/or tupelo also process miscellaneous hardwoods in their operations; and in some cases, pine timber as well.

Baldcypress Lumber and House Logs

At least nine wood-based manufacturers in East Texas and Louisiana specifically use baldcypress in their operations. Two of these utilize the whole log for house logs, being Elder Hardwoods at Kirbyville and Satterwhite Log Homes at Longview (Exhibit "D"). The other seven mills produce baldcypress lumber products, with the Texas mills being Wilcox Timber & Lumber at Rusk, Cypress Lumber at Mt. Pleasant, and M&M Lumber at Houston. Louisiana mills specifically utilizing baldcypress include Gandy Tie at Florien, Bunkie Wood at Bunkie, Davis Lumber at Provencal, and Rockin "C" at Pitikin. (Texas A&M Forest Service; Louisiana Forest Products Directory). Other hardwood sawmills utilize baldcypress on an order-by-order basis.

Tupelo Lumber

Water tupelo (*Nyssa aquatica*) and swamp tupelo (*Nyssa sylvatica var. biflora*) are two very closely related species that commonly make up a large percentage of the merchantable trees in typical baldcypress/tupelo swamps. Texas Basket at Jacksonville, Texas, manufactures wood baskets and uses tupelo to augment the sweetgum that makes up most of their supply. In Louisiana, Bunkie Wood, Martco at Alexandria, Harralson Tie at Anacoco and Hannah Manufacturing at Winnfield specifically advertise that they purchase tupelo logs.

Paper Industry

The WestRock paper mill at Evadale, Texas, is a large paper mill utilizing an almost even split between pine and hardwood pulpwood, producing 619,000 tons of bleached paperboard annually. The paperboard is used for aseptic, food service products, office products, general packaging, graphic liners, and other paper products. Other papermills in the region utilizing hardwoods include the WestRock mill at Hodge, Louisiana, International Paper at Mansfield, Louisiana, and International Paper at Queen City, Texas. Hardwood pulpwood markets translate into the utilization of very small trees, generally being those that are about six to seven inches in diameter, as measured 4.5 feet above ground level. The market for these products is large and sustained.

Landscape Mulch Operations

This market has seen robust growth over the past several decades. The mulch market is linked to the landscaping business associated with residential and commercial properties and the markets they drive. The proximity of the Houston metroplex creates great demand for these products. The tops and limbs of both hardwoods and baldcypress are utilized for landscaping mulch. There are at least nine mulch-producing operation sites identifiable in the East Texas area alone (Texas A&M Forest Service). Three of these facilities specifically produce baldcypress mulch in addition to other hardwood and pine mulches.

Crosstie / Pallet / Hardwood Lumber

A robust market for miscellaneous hardwood timber exists in the area, with over twenty-five permanent-sited sawmills being located in East Texas and in Louisiana. This does not include the small "Wood-mizer" type portable mills, some of which are sited in permanent facility locations. The larger hardwood mills produce all manner of products that utilize mixed hardwoods, such as railroad cross ties, pallet and

shipping lumber, construction mats, hardwood dimensional lumber and some veneer. The hardwood sawtimber market has seen a significant increase in demand and pricing over the past decade (Texas A&M Forest Service; Louisiana Forest Products Directory).

Fuelwood (Biomass) Demand

Additionally, the forest industry uses large amounts of fuelwood to internally generate electric power to help run the facilities. The demand for fuelwood is brisk, with forest-based mills within a 150-mile radius of this site using between five and six million tons of biomass annually, as of 2008 (Texas A&M Forest Service 2009). A 100-megawatt biomass power plant was added subsequently at Sacul, Texas, requiring about a million tons of wood per year. In addition, a 50-megawatt biomass electric generation plant at Woodville began operations in the summer of 2014, and utilizes around a half-million tons of forest-based wood per year. Small-diameter trees, large brush, tops, limbs and other harvesting debris are utilized in biomass plants. These two facilities serve to add increased market demand on baldcypress and hardwood forest resources.

Ecological Effects of Current Harvesting Technology

Early harvesting was targeted at large baldcypress that were deadened ahead of harvesting and floated out to the rivers. Pullboat logging had a greater effect on the skid rows and the remaining trees than early technique. Both methods left trees behind for seed source, and did nominal damages to the underlying soil structure except in the pullboat skid rows (Brandt and Ewel 1989).

The advent of tracked excavator harvesting (known as shovel or swamp logging) since the early 1980's has allowed extensive and intensive harvesting of timber in wet locations. This system involves cutting the smaller diameter trees and laying them down as a road bed, allowing access to the interior of a forested parcel. The larger timber is harvested and skidded out on the constructed road. These road bed trees are removed as skidding is completed, resulting in a clearcut forest. Modern logging with in-the-woods machinery causes soil compaction at a level unseen in previous harvesting practices (Brandt and Ewel 1989; Priegel 1981).

Modern markets for baldcypress lumber remain stable so production of sawlog timber continues to be worthwhile. However, recent innovations in forest product development led to profitable growth in market demand for baldcypress mulch and tupelo wood pulp, both natural resources of southern swamps. The vigor of the emerged markets coupled with the capabilities to meet demand by current harvesting technology brings challenges to maintaining sustainable use of these forests.

The mulch and pulpwood markets initiated near-complete utilization of small baldcypress trees, tops and limbs. The harvesting of the virgin baldcypress was restricted to the large sawtimber-grade trees for producing the heartwood lumber, thus leaving behind the smaller trees. This in turn provided a seed

source for natural regeneration of the baldcypress. In the absence of seed source, baldcypress regeneration is inconsistent (Brandt and Ewel 1989).

The environmental conditions favorable for regeneration of baldcypress-tupelo swamp forests occur very infrequently. This predicament is exacerbated by impoundments that alter hydroperiod factors and, consequently, affect baldcypress and tupelo seed dispersal and seedling growth (Palta, Richardson, and Sharitz 2003; Schneider and Sharitz 1988; Davidson 2006; Kennedy 1970). Successful baldcypress and water tupelo regeneration from seed requires extended dry periods for the seedlings to grow tall enough to survive future flooding (Keeland and Conner 1999). Early height growth is important because seedlings can be killed in as little as 10 to 12 days of total submergence during the growing season (Demaree 1932). Stump sprouts do not guarantee successful regeneration of baldcypress-tupelo forests (Kiem etal 2006; Kennedy 1982).

In addition, insect and animal herbivory are known to impact the growth of both species and adds to the adverse site conditions commonly found in these swamp forests (Conner etal 2002). Planting success has been shown to be problematic due to the rigorous site and hydroperiod conditions, as well as not being cost effective given the long-term growth period required for merchantable timber growth (Keim etal. 2006; Conner etal 2002).

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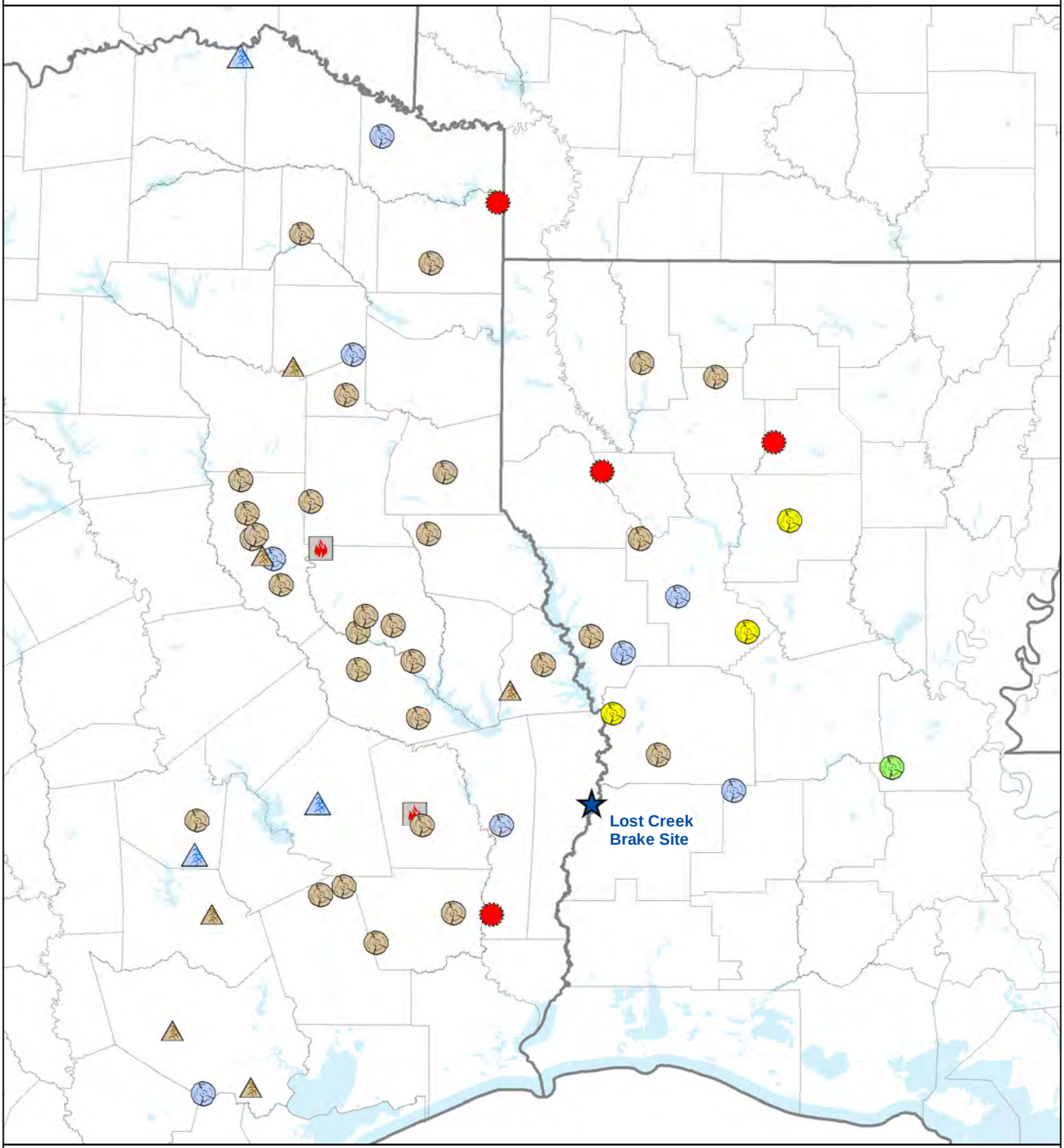
Exhibit A

Exhibit A
Forest Products Facilities Utilizing Baldcypress, Tupelo, and Hardwoods



Lost Creek Brake
Paper Mill
Biomass
Baldcypress Lumber
Tupelo Lumber
Baldcypress/Tupelo Lumber
Miscellaneous Hardwood Lumber
Cypress Mulch
Hardwood Mulch

N
W E
S
3/31/2016

0 25 50 75 100 125 Miles

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MN

Exhibit B

Exhibit B
Forest Products Facilities Utilizing Baldcypress, Tupelo, and Hardwoods

Company	City	State	Category
Arrington	Jacksonville	TX	Miscellaneous Hardwood Lumber
B&B Tie Co.	Minden	LA	Miscellaneous Hardwood Lumber
B&S Hardwood, Inc.	Gibsland	LA	Miscellaneous Hardwood Lumber
Batson Lumber Co.	Batson	TX	Miscellaneous Hardwood Lumber
Bobo Lumber Co.	Longview	TX	Miscellaneous Hardwood Lumber
Bunkie Wood Products	Bunkie	LA	Baldcypress/Tupelo Lumber
Carrizo Wood Products, Inc	Nacogdoches	TX	Miscellaneous Hardwood Lumber
Crosscut Hardwood	Alto	TX	Miscellaneous Hardwood Lumber
Cypress Lumber Co.	Mt. Pleasant	TX	Miscellaneous Hardwood Lumber
Davis Lumber	Provencal	LA	Baldcypress Lumber
Elder Hardwoods	Kirbyville	TX	Baldcypress Lumber
G & S Lumber Co.	Nacogdoches	TX	Miscellaneous Hardwood Lumber
G. D. Edgar Lumber Co., Inc.	Hemphill	TX	Miscellaneous Hardwood Lumber
Gandy Tie and Timber	Florien	LA	Baldcypress Lumber
Gillespie Lumber Ltd	Nacogdoches	TX	Miscellaneous Hardwood Lumber
Hannah Manufacturing	Winnfield	LA	Tupelo Lumber
Harralson Tie & Lumber Co.	Anacoco	LA	Tupelo Lumber
Hilton Lively Renewable Power Project	Woodville	TX	Biomass
Hope AgriProducts	Livingston	TX	Cypress Mulch
International Paper Co.	Queen City	TX	Paper Mill
International Paper Co.	Mansfield	LA	Paper Mill
Jemasco, Inc.	Paris	TX	Cypress Mulch
Landscapers Pride	New Waverly	TX	Cypress Mulch
Living Earth	Houston	TX	Hardwood Mulch
Living Earth	Pineland	TX	Hardwood Mulch
Lufkin Creosoting Co., Inc.	Lufkin	TX	Miscellaneous Hardwood Lumber
M & H Crates, Inc.	Jacksonville	TX	Miscellaneous Hardwood Lumber
M & M Lumber Co.	Houston	TX	Baldcypress Lumber
Martco	Le Moyen	LA	Tupelo Lumber
Maxwell Lumber Co., Inc.	Bullard	TX	Miscellaneous Hardwood Lumber
Natural Earth Technology	Rusk	TX	Hardwood Mulch
New Earth Soils & Compost	Conroe	TX	Hardwood Mulch
Nix Forest Industries, Inc.	Timpson	TX	Miscellaneous Hardwood Lumber
Novus Wood Group	Houston	TX	Hardwood Mulch
Oliver Bros. Lumber Co.	Huntsville	TX	Miscellaneous Hardwood Lumber
Phillip Forest Products	DeKalb	TX	Baldcypress Lumber
Rockin "C" Sawmill	Pitkin	LA	Baldcypress Lumber
S&S Lumber Co.	Etoile	TX	Miscellaneous Hardwood Lumber
Sabine Wood Products	Many	LA	Miscellaneous Hardwood Lumber
Satterwhite Log Homes	Longview	TX	Baldcypress Lumber
Southern Hardwood Co.	Zavalla	TX	Miscellaneous Hardwood Lumber
Southern Power	Sacul	TX	Biomass
Sparks Lumber Co.	Coushatta	LA	Miscellaneous Hardwood Lumber
Sparks Lumber Co.	Carthage	TX	Miscellaneous Hardwood Lumber
Tanner Services, LLC	Kountze	TX	Miscellaneous Hardwood Lumber
Texas Basket Co.	Jacksonville	TX	Miscellaneous Hardwood Lumber
Thick-N-Thin Inc.	Cleveland	TX	Miscellaneous Hardwood Lumber
Townley Lumber Co.	Henderson	TX	Miscellaneous Hardwood Lumber
VitalEarth Resources	Gladewater	TX	Hardwood Mulch
Ward Timber Co.	Linden	TX	Miscellaneous Hardwood Lumber
WD Chips	Rosepine	LA	Miscellaneous Hardwood Lumber
WestRock	Evadale	TX	Paper Mill
WestRock	Hodge	LA	Paper Mill
Wilcox Timber & Lumber	Rusk	TX	Baldcypress Lumber
Woodville Hardwood	Woodville	TX	Miscellaneous Hardwood Lumber
Y Lumber Co.	Rye	TX	Miscellaneous Hardwood Lumber

Exhibit C

Exhibit "C"

Brocks Logging, Inc.

3469 FM 1010
Cleveland, Tex 77327
Off: 281-593-1531
Fax: 281-593-0812

Mitigation Management, Ltd.
2557 State Hwy 7 East
Center, Tex. 75935

November 4, 2014

Brock's Logging, Inc. would be pleased to purchase all merchantable timber standing, growing and located upon approximately 522 acre in the James Doss Pleasant Guthrie Surveys, Abstracts 101 and 133, Newton County, Texas.
The details on per-ton pricing for baldcypress sawlogs, mixed-species hardwood sawlogs, hardwood pulpwood and baldcypress top mulch material will be negotiated dependent on current market pricing and conditions. We would ask that the landowner be able to provide proof-of-title to the subject timber.

If you are interested in selling your timber to Brock's Logging, please give us a call or contact us by email.

Thanks again,

Brocks Logging, Inc.
Paul Brockner
Off: 281-593-1531
Cell: 281-593-8676
brockslogging@aol.com

Exhibit D

100 Years and Building

A Campaign to Support the TFA Education & Office Building

Chris & Margie Streck
Cliff J. Sunda
In Memory of Lonnie Grissom Sr. by Tejas Equipment, Inc.
Temple-Inland Foundation(Paul Hugon Matching Gift)
W.R. "Bill" Tetley
Trinity Neches Forest Landowner Association Inc.
Melinda T. Vance
Jeff & Stacy Waits
Wakefield Corporation
Dr. Hiram Arnold Memorial by Gordon & Geneva Walker
Doug Dvorman Memorial by Gordon & Geneva Walker
George F. Weick, Jr.
Roberta F. Wygant
Roy Zenor
Richard Zingula
Jeffrey Zwolinski
Charles & Betty Zimmerman

Attachment A

Baseline Conditions

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2557 St Hwy 7 E, Center, TX 75935 • P 936.598.3053 • F 936.598.9579 • www.adv-eco.com

December 18, 2015

Mr. Sam Watson
U.S. Army Corps of Engineers
Regulatory Branch
2000 Fort Point Road
Galveston, TX 77553

Re: Updated Baseline Assessment (Wetland Delineation and iHGM Functional Assessment) for the proposed Lost Creek Brake Mitigation Bank

Mr. Watson,

Enclosed herewith please find the revised Baseline Assessment for the Proposed Lost Creek Brake Mitigation Bank (Bank). The revised Baseline Assessment includes an updated wetland delineation and iHGM assessment. On January 28, 2015 AEL biologist Chance Kimbrough and Hayley Steele met with USACE staff Mr. Sam Watson and Mr. Kenny Jaynes to tour the Bank and verify the Baseline Assessment. During the verification site visit Mr. Jaynes directed AEL staff to re-evaluate the wetland boundary delineated in the SE corner and to further assess the gentle elevation changes along the eastern and southern boundaries of the Bank to verify the initial classification of potentially jurisdictional wetland habitat.

In early November of 2015, AEL biologists Keith Webb, Jay Deatherage and Chance Kimbrough returned to the Bank site to re-evaluate the wetland boundaries and further assess the areas in question. A summary of the changes to the Baseline Assessment are detailed below.

- The Bank was surveyed and the total Bank acreage was revised from 535 acres to 491.4 acres
- Potentially jurisdictional habitat found on the Bank was reduced from 522 acres to 476.2 acres.
- Non-jurisdictional habitat found on the Bank was increased from 13.0 acres to 15.2 acres
- A 5.5 acre portion of the Bank was removed and utilized as a PRM site (SWG-2014-00837).
- The Functional Capacity Index (FCI) for each iHGM category remained the same, however because of the reduction of potentially jurisdictional acreage found on the Bank the number of Functional Capacity Units (FCUs) were reduced.

We thank you for your time and effort and look forward to continued success with our agency partners throughout the Galveston District.

If you have any questions or comments regarding this request please feel free to contact me by phone at (936) 598-9588 ext. 12 or by email at ckimbrough@adv-eco.com.

Sincerely,

Chance Kimbrough
Applied Ecologist
Advanced Ecology, LTD
Enclosures as noted

ADVANCED ECOLOGY

enhancing natural resource value

Baseline Wetland Functional Assessment

Lost Creek Brake Tract
Newton County, Texas

Prepared For

Mitigation Management, LLC.
c/o J. Mike Bird
2557 State Hwy. 7 East
Center, TX 75935
936.598.9588
1.800.780.9105

Prepared By

Advanced Ecology
Revised December 2015

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www.advancedecology.com

Table of Contents

Baseline Wetland Functional Assessment

1.0 Introduction

Advanced Ecology, Ltd. (AEL), on behalf of Mitigation Management, LLC (MML), was contracted to conduct a baseline wetland functional assessment (BWFA) on approximately 491.4 acres (project site) located near the Sabine River in Newton County, Texas (Appendix A, Figure 1).

The objective of this study was to determine the baseline functional capacity of the project site. The functional assessment is based on the hydrogeomorphic (HGM) approach, which is a method used to assess the functional condition of a specific wetland system, or Assessment Area (AA), across a wide range of physical conditions.

The following is a summary report describing the methods and findings of the functional assessment.

2.0 Methods

During the 2014 and 2015 study, AEL reviewed background information and conducted a wetland delineation and wetland functional assessment. The Interim HGM (iHGM) approach allows for the classification of wetlands based on the functions related to hydrologic, biologic, and chemical processes, and habitat present. The iHGM utilized during this study was wetland habitat specific and performed for each AA included in the project site. Based on the habitat types located within the project site (palustrine forested), the Riverine Forested iHGM was utilized to calculate the baseline wetland capacities of the AAs. The following section describes procedures utilized during the iHGM assessments. The iHGM was obtained from the following U.S. Army Corps of Engineers (USACE) resource:

http://www.swg.usace.army.mil/BusinessWithUs/RegulatoryBranch/Wetlands/FunctionalAssessment.aspx

2.1 SWG Riverine Forested HGM Interim

Methods used to collect and analyze data for the iHGM followed the USACE procedures outlined in the *SWG-Standard Operating Procedures (SOP); Using HGM to determine Potential Wetland Functions and the Appropriate Compensatory Mitigation for Unavoidable Wetland Impacts* and *A Regional Guidebook for Application of Hydrogeomorphic Assessments to Riverine Low Gradient Wetlands.*

AEL evaluated topographic maps, soil surveys, recent and historic aerial imagery, and field reconnaissance to aid in assessing wetland functional values.

A total of three (3) model functions were evaluated with this functional assessment.

Function 1: Temporary Storage and Detention of Storage Water (TSSW)

Function 2: Maintenance Plant and Animal Communities (MPAC)

Function 3: Removal and Sequestration of Elements and Compounds (RSEC)

A total of fifteen (15) model variables were utilized to assess the above 3 model functions.

1. Duration of Flooding (V_{dur})
2. Frequency of flooding (V_{freq})
3. Topography (V_{topo})
4. Coarse Woody Debris (V_{cwd})
5. Woody Vegetation (V_{wood})
6. Tree Species (V_{tree})
7. Tree richness/diversity (V_{rich})
8. Tree Basal Area (V_{basal})
9. Tree Density ($V_{density}$)
10. Midstory (V_{mid})
11. Herbaceous Layer (V_{herb})
12. Detritus ($V_{detritus}$)
13. Redoximorphic process (V_{redox})
14. Sorptive Soil Properties (V_{sorpt})
15. Connectivity to other habitats ($V_{connect}$)

In order to determine the subindex values of the iHGM variables, each AA was sampled in the field, and a comprehensive desktop review of aerial maps and available literature was performed.

Temporary Storage and Detention of Storage Water (TSSW)

This function refers to the potential storage and retention of water, primarily through location and slope. Variables used to calculate this function include Duration of Flooding, Frequency of Flooding, Topography, Coarse Woody Debris, and Woody Vegetation.

The assessment model for calculating the functional capacity index (FCI) is as follows:

[{ Vdur X Vfreq } 1/2 X { Vtopo + Vcwd + Vwood } / 3] 1/2

Maintain Plant and Animal Community (MPAC)

This function describes the ability of a wetland to support and maintain both flora and fauna. Variables used to calculate this function include Tree Species, Coarse Woody Debris, Tree richness/diversity, Tree basal area, Tree density, Midstory, Herbaceous layer, and Connectivity to other habitats.

The assessment model for calculating the FCI is as follows:

[Vtree + Vcwd + Vrich + [{ Vbasal + Vdensity } / 2] + [{ Vmid + Vherb } / 2] + Vconnect] / 6

Removal & Sequestration of Elements & Compounds (RSEC)

This function describes the ability of a wetland to export or import nutrients and organic carbon via flushing, deposition, and erosion. Variables used to calculate this function include Woody Vegetation, Frequency of Flooding, Duration of Flooding, Topography, Coarse Woody Debris, Detritus, Redoximorphic process, Sorptive Soil Properties.

The assessment model for calculating the FCI is as follows:

[Vwood + Vfreq + Vdur + [{ Vtopo + Vcwd + Vwood } / 3] + [{ Vdetritus + Vredox + Vsorp } / 3] / 5

3.0 RESULTS

Through the review of aerial imagery, National Wetland Inventory (NWI) mapping, LiDAR DEM, and field reconnaissance, AEL determined that there were Five (5) AAs located within the approximately 491.4 acre project site. These AAs were classified by forest stand characteristics, soils, hydrology, and elevation. These specific variations in AA characteristics are described in detail in the document entitled *Delineation of Waters of the U.S. including Wetlands – Lost Creek Brake Tract, Newton County, Texas* dated December 2015. Representative site photos from each AA are included in Appendix C. The AAs were labeled as follows:

AA 1 - Seasonally Flooded, Broad-Leaved Deciduous Forested Habitat (PFO1/2C) – 257.3 acres
AA 2 - Temporarily Flooded, Broad-Leaved Deciduous Forested Habitat (PFO1A) – 26.2 acres
AA 3 - Temporarily Flooded, Broad-Leaved Deciduous Forested Habitat (PFO1A) – 8.8 acres
AA 4 - Temporarily Flooded, Broad-Leaved Deciduous Forested Habitat (PFO1A) – 63.4 acres
AA 5 - Semipermanently Flooded, Broad-Leaved Deciduous Forested Habitat (PFO1/2F) – 120.5 acres
Non-wetland Habitat* - 15.2 acres

*not assessed using the iHGM

Appropriate plot level data was collected at a 10^{th} acre representative plot within each AA in order to address the needs for evaluating the AA with the SWG Riverine Forested iHGM (Appendix A, Figure 2). The data were then utilized to assign a value for each subindex variable. Each subindex variable was then utilized to determine the FCI for each wetland function (TSSW, MPAC, and RSEC). An FCI is an estimate of the capacity of a wetland to perform a function relative to other wetlands. The FCIs were then multiplied by the total acreage of the AA to determine the amount of functional capacity units (FCUs) for each AA present. Calculations for each AA are found in Appendix B, Figures 1-5.

4.0 DISCUSSIONS AND CONCLUSIONS

The palustrine forested wetland habitats found on the project site were of high quality. Vegetation was typical of that for cypress-tupelo swamps (i.e. cypress, tupelo, red maple, swamp cyrilla, evergreen bayberry, sweetgum, and oak species). These wetlands generally exhibit seasonal or year round soil saturation or ponding. The iHGM functional assessment reflects initial conclusions of staff biologists after initial site reconnaissance. The preservation potential for this property is substantial. Wetland function within the watershed can be optimized by protection of this extensive cypress-tupelo swamp. Due to ecological value and the nature of the standing communities, a preservation/enhancement management strategy is appropriate for the site in order to maintain a diverse, contiguous, mature, PFO cypress-tupelo conservation area. Portions of the site (AA 4) will benefit from enhancement actions designed to bolster the existing, native vegetative composition.

Appendices

A. Project Figures ☐

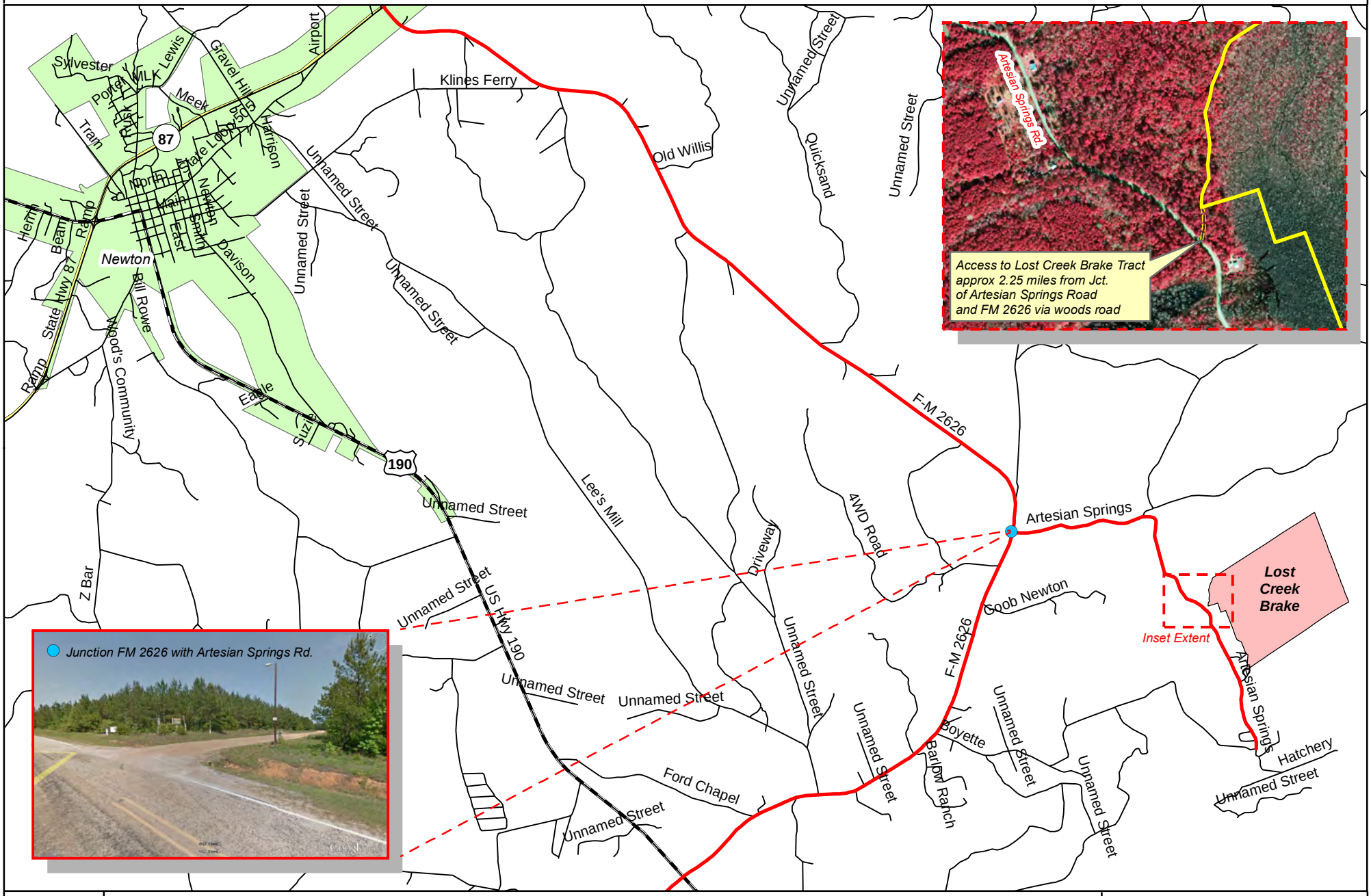
B. SWG Riverine Forested iHGM Figures ☐

C. Site Photos ☐

Appendix A

Project Figures

Figure 1
Location Map
Lost Creek Brake Tract, Newton County, Texas



N
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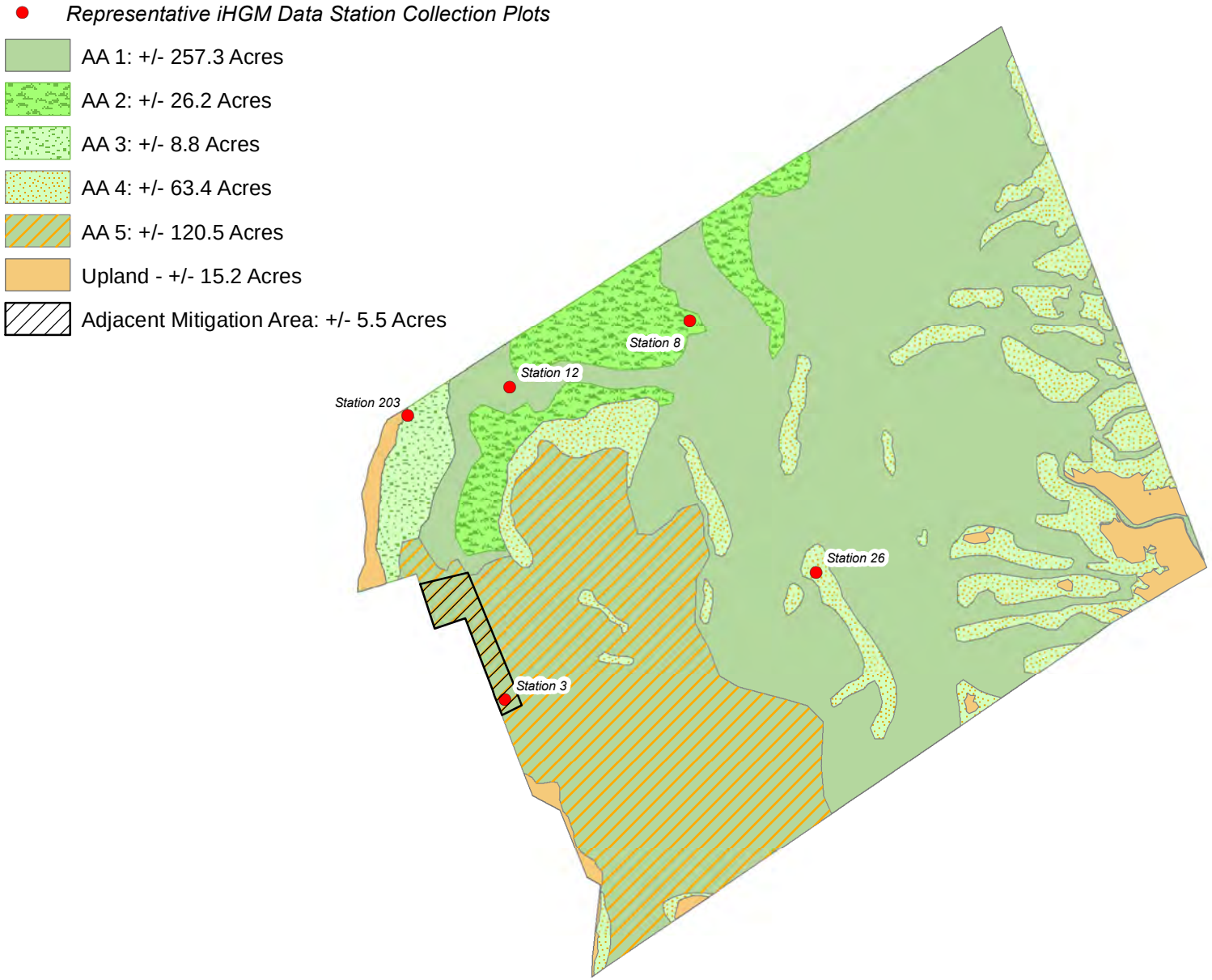
0 0.5 1 2 3 4 5 Miles

This map was generated by Advanced Ecology, LTD. using GIS (Geographical Information System) software. No claims are made to the accuracy or completeness of the data depicted in this map or to the map's suitability for a particular use. The information depicted may contain inaccuracies and is provided "as is".

Drawn By: Dan Johnson
Date: April 3, 2014

ADVANCED ECOLOGY

Figure 2
Representative iHGM Data Station Collection Locations
Lost Creek Brake Tract, Newton County, Texas



N
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0 800 1,600 3,200 4,800 6,400 8,000 Feet

This map was generated by Advanced Ecology, LTD. using GIS (Geographical Information System) software. No claims are made to the accuracy or completeness of the data depicted in this map or to the map's suitability for a particular use. The information depicted may contain inaccuracies and is provided "as is".

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Appendix B

SWG Riverine Forested iHGM Figures

Figure 1. iHGM Analysis of Plot Level Data gathered at Station 12 by AEL staff on March 26, 2014 on the Lost Creek Brake Tract, Newton County, Texas representing the 257.3 acre Assessment Area 1

I. Plot Level Data Gathered at Station 12 – 10th Acre Plot, DBH measured to a 1 inch class

Species	Tree Count	DBH of Trees (≥3") within the plot
bald cypress	11	7,8,17,19,11,10,3,7,7,18,12
red maple	9	4,3,5,4,4,4,3,6,3
green ash	1	3
water tupelo	17	5,6,3,16,10,11,4,8,4,11,16,14,13,6,27,5,8

Midstory Coverage – 80%
Herbaceous Coverage – 30%
Detritus Coverage – 100%
Pieces of Coarse Woody Debris – 11

II. Analysis of Station 12 Plot Level Data

Species	Trees/Acre	Basal Area/Acre	% Composition
bald cypress	110.0	85.0	20.4
red maple	90.0	8.3	16.7
green ash	10.0	0.5	1.9
water tupelo	330.0	212.3	61.1
Total	**540.0**	**306.1**	**100.0**

Woody Coverage of Plot – 100%
Composition of Desirable Species – 37%
Composition of Exotic Species – 0%
Number of Spp. Representing > 5% BA Composition – 3

III. Input of Results of Analysis into SWG Riverine Forested iHGM model

Variable	Baseline Subindex Value
Vdur	1.00
Vfreq	1.00
Vtopo	1.00
Vcwd	1.00
Vwood	1.00
Vtree	0.50
Vrich	0.60
Vbasal	1.00
Vdensity	0.40
Vmid	1.00
Vherb	1.00
Vdetritus	1.00
Vredox	1.00
Vsorp	1.00
Vconnect	1.00

Corresponding FCIs	
TSSW	1.00
MPAC	0.80
RSEC	1.00

Resulting FCUs	
TSSW	257.3
MPAC	205.8
RSEC	257.3

Figure 2. iHGM Analysis of Plot Level Data gathered at Station 8 by AEL staff on March 26, 2014 on the Lost Creek Brake Tract, Newton County, Texas representing the 26.2 acre Assessment Area 2

I. Plot Level Data Gathered at Station 8 – 10th Acre Plot, DBH measured to a 1 inch class

Species	Tree Count	DBH of Trees (≥3") within the plot
bald cypress	1	6
red maple	11	4,4,6,6,3,6,7,3,7,4,3
laurel oak	5	11,7,10,6, 19
evergreen bayberry	3	4,4,3
sweetgum	3	5,8,3
water tupelo	25	3,5,5,12,3,8,3,4,5,29,3,4,4,3,3,3,7,12,14,8,4,7,3,4,8

Midstory Coverage – 75%
Herbaceous Coverage – 60%
Detritus Coverage – 100%
Pieces of Coarse Woody Debris – 7

II. Analysis of Station 8 Plot Level Data

Species	Trees/Acre	Basal Area/Acre	% Composition
red maple	110.0	15.3	22.9
cypress	10.0	2.0	2.1
laurel oak	50.0	36.4	10.4
evergreen bayberry	30.0	2.2	6.3
sweetgum	30.0	5.3	6.3
water tupelo	250.0	100.5	52.1
Total	**480.0**	**161.7**	**100.0**

Woody Coverage of Plot – 100%
Composition of Desirable Species – 35%
Composition of Exotic Species – 0%
Number of Spp. Representing > 5% BA Composition – 5

III. Input of Results of Analysis into SWG Riverine Forested iHGM model

Variable	Baseline Subindex Value
Vdur	1.00
Vfreq	1.00
Vtopo	1.00
Vcwd	0.50
Vwood	1.00
Vtree	0.50
Vrich	1.00
Vbasal	1.00
Vdensity	0.60
Vmid	1.00
Vherb	0.30
Vdetritus	1.00
Vredox	1.00
Vsorp	1.00
Vconnect	1.00

Corresponding FCIs	
TSSW	0.91
MPAC	0.74
RSEC	0.97

Resulting FCUs	
TSSW	23.9
MPAC	19.4
RSEC	25.3

Figure 3. iHGM Analysis of Plot Level Data gathered at Station 203 by AEL staff on April 14, 2014 on the Lost Creek Brake Tract, Newton County, Texas representing the 8.8 acre Assessment Area 3

I. Plot Level Data Gathered at Station 203 – 10th Acre Plot, DBH measured to a 1 inch class

Species	Tree Count	DBH of Trees (≥3") within the plot
red maple	4	4,5,9,11
water oak	2	3,4
laurel oak	1	3
water tupelo	7	15,10,8,8,16,15,19
sweetgum	1	6
swamp cyrilla	9	4,4,3,3,5,5,4,3,4

Midstory Coverage – 90%
Detritus Coverage – 100%
Herbaceous Coverage – 45%
Pieces of Coarse Woody Debris – 7

II. Analysis of Station 203 Plot Level Data

Species	Trees/Acre	Basal Area/Acre	% Composition
red maple	40.0	13.3	16.7
water oak	20.0	1.4	8.3
laurel oak	10.0	0.5	4.2
tupelo	70.0	70.6	29.2
sweetgum	10.0	2.0	4.2
swamp cyrilla	90.0	7.7	37.5
Total	**240.0**	**95.4**	**100.0**

Woody Coverage of Plot – 100%
Composition of Exotic Species – 0%
Composition of Desirable Species – 29%
Number of Spp. Representing > 5% BA Composition – 4

III. Input of Results of Analysis into SWG Riverine Forested iHGM model

Variable	Baseline Subindex Value
Vdur	1.00
Vfreq	1.00
Vtopo	1.00
Vcwd	0.50
Vwood	1.00
Vtree	0.50
Vrich	0.80
Vbasal	0.80
Vdensity	1.00
Vmid	1.00
Vherb	0.50
Vdetritus	1.00
Vredox	1.00
Vsorp	1.00
Vconnect	1.00

Corresponding FCIs	
TSSW	0.91
MPAC	0.74
RSEC	0.97

Resulting FCUs	
TSSW	8.0
MPAC	6.5
RSEC	8.5

Figure 4. iHGM Analysis of Plot Level Data gathered at Station 26 by AEL staff on March 26, 2014 on the Lost Creek Brake Tract, Newton County, Texas representing the 63.4 acre Assessment Area 4

I. Plot Level Data Gathered at Station 26– 10th Acre Plot, DBH measured to a 1 inch class

Species	Tree Count	DBH of Trees (≥3") within the plot
overcup oak	1	13
laurel oak	1	3
sweetgum	13	10,6,3,5,3,4,4,3,27,22,4,4,3
tallow	14	3,3,4,4,5,3,6,5,5,3,3,8,7,8

Midstory Coverage – 70%
Herbaceous Coverage – 70%
Detritus Coverage – 100%
Pieces of Coarse Woody Debris – >7

II. Analysis of Station 26 Plot Level Data

Species	Trees/Acre	Basal Area/Acre	% Composition
overcup oak	10.0	9.2	3.4
laurel oak	10.0	0.5	3.4
sweetgum	130.0	80.4	44.8
tallow	140.0	19.9	48.3
Total	**290.0**	**110.0**	**100.0**

Woody Coverage of Plot – 100%
Composition of Desirable Species – 6.9%
Composition of Exotic Species – 48.3%
Number of Spp. Representing > 5% BA Composition – 2

III. Input of Results of Analysis into SWG Riverine Forested iHGM model

Variable	Baseline Subindex Value
Vdur	1.00
Vfreq	1.00
Vtopo	1.00
Vcwd	1.00
Vwood	1.00
Vtree	0.30
Vrich	0.40
Vbasal	1.00
Vdensity	0.60
Vmid	1.00
Vherb	0.30
Vdetritus	1.00
Vredox	1.00
Vsorp	1.00
Vconnect	1.00

Corresponding FCIs	
TSSW	1.00
MPAC	0.69
RSEC	1.00

Resulting FCUs	
TSSW	63.4
MPAC	43.8
RSEC	63.4

Figure 5. iHGM Analysis of Plot Level Data gathered at Station 3 by AEL staff on March 26, 2014 on the Lost Creek Brake Tract, Newton County, Texas representing the 120.5 acre Assessment Area 5

I. Plot Level Data Gathered at Station 3– 10th Acre Plot, DBH measured to a 1 inch class

Species	Tree Count	DBH of Trees (≥3") within the plot
bald cypress	8	11,22,4,6,28,6,5,6
water tupelo	46	5,23,4,7,9,3,3,56,6,4,40,17,5,4,4,3,3,4, 11,5,7,3,5,4,3,3,3,9,3,3,21,6,4,10,10,4, 10,6,6,13,5,16,8,3,13,8

Midstory Coverage – 50%
Herbaceous Coverage – 2%
Detritus Coverage – 100%
Pieces of Coarse Woody Debris – >7

II. Analysis of Station 3 Plot Level Data

Species	Trees/Acre	Basal Area/Acre	% Composition
bald cypress	80.0	83.9	14.8
water tupelo	460.0	430.6	85.2
Total	**540.0**	**514.4**	**100.0**

Woody Coverage of Plot – 100%
Composition of Desirable Species – 15%
Composition of Exotic Species – 0%
Number of Spp. Representing > 5% BA Composition – 2

III. Input of Results of Analysis into SWG Riverine Forested iHGM model

Variable	Baseline Subindex Value
Vdur	1.00
Vfreq	1.00
Vtopo	1.00
Vcwd	1.00
Vwood	1.00
Vtree	0.30
Vrich	0.40
Vbasal	1.00
Vdensity	0.40
Vmid	0.75
Vherb	0.30
Vdetritus	1.00
Vredox	1.00
Vsorp	1.00
Vconnect	1.00

Corresponding FCIs	
TSSW	1.00
MPAC	0.65
RSEC	1.00

Resulting FCUs	
TSSW	120.5
MPAC	78.8
RSEC	120.5

Appendix C

Site Photos

Representative Photographs of AA 1 –
Lost Creek Brake Tract, Newton County, Texas

Representative Photographs of AA 2 – March 26, 2014
Lost Creek Brake Tract, Newton County, Texas

Representative Photographs of AA 3 – March 27, 2014
Lost Creek Brake Tract, Newton County, Texas

Representative Photographs of AA 4 – March 27, 2014
Lost Creek Brake Tract, Newton County, Texas

Representative Photographs of AA 5 – March 27, 2014
Lost Creek Brake Tract, Newton County, Texas